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

Code No. : 30455 E **Sub. Code : CMPH 52**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2024.

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 molecule will be microwave active ————.

(a) C_6H_6 (b) N_2O

(c) CH_4 (d) C_2H_2

2. The par contains a spherical top and a symmetric top, among the following ————

(a) CH_4, CH_2Cl_2 (b) CH_2Cl_2, CH_3Cl

(c) CH_3Cl, CH_4 (d) CH_4, $C(CH_3)_4$

3. What is the relation between restoring force f to the displacement q in hooks law?

(a) $f = -kq$ (b) $f = kq$

(c) $f = kq^2$ (d) $f = -kq^2$

4. On which factors the vibrational stretching frequency of diatomic molecule depend

(a) Force constant (b) Atomic population

(c) Temperature (d) Magnetic field

5. Selection rule of the translational energy level in the Raman spectrum is ΔJ is equal to

(a) ± 1 (b) ± 2

(c) $+1$ (d) $+2$

6. Raman shift depens upon ————

(a) Incident wave length

(b) Incident intensity

(c) Resolving power of spectrograph used

(d) Molecular energy level of scatter

7. Radiation source not used for UV-visible spectroscopy is ————

(a) Xenon Arc lamp

(b) Mercury vapor lamp

(c) Tuneston lamp

(d) Nernst Glower lamp

8. Most widely used detector in UV spectroscopy is ———

(a) Bolometer

(b) Photomultiplier Tube (PMT)

(c) Holometer

(d) Pyroelectric Detector

9. For measuring chemical shift in NMR spectroscopy the chemical compound commonly used as reference is ———

(a) Tetramethyl island (b) Hydroquinone

(c) Benzene (d) Ethanol

10. The splitting of signal in NMR is due to ———

(a) Shielding effect

(b) Spin spin decoupling

(c) Deshielding effect

(d) Spin spin coupling

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) To discuss how to classify the molecule.

Or

(b) Explain theory of the origin of the pure rotational spectrum of molecule.

12. (a) Discuss the origin of P.Q.R. branches in the vibration rotation of diatomic molecule.

Or

(b) Explain theory of the origin of the vibration spectrum of a molecule.

13. (a) Discuss the Raman spectra of diatomic molecule.

Or

(b) To point out similarity and difference in infra-red and Raman spectra.

14. (a) Explain the principle of ultraviolet spectroscopy.

Or

(b) Write a short note on beer-lambert law.

15. (a) To give account the theory of NMR spectroscopy.

Or

(b) Describe the term magnetic resonance imaging.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 600 words.

16. (a) Give the detail account of principle, construction and working of microwave spectroscopy.

Or

(b) Derive an expression for energy of rotational state of non-rigid rotator and show how force constant of the molecule can be determine.

17. (a) Discuss how the study of vibration spectrum of diatomic molecule enables us to determine the anharmonicity constant and equilibrium frequency of vibration.

Or

(b) Explain the rotational-vibration spectra of diatomic molecule.

18. (a) Give the theory of Raman effect and describe an experiment arrangement for studying it.

Or

(b) Discuss the main feature of the vibration and rotation Raman spectra of diatomic molecule.

19. (a) Explain the analytical uses of UV spectroscopy.

Or

(b) Briefly explain the principle, construction and working of uv spectroscopy with suitable diagram.

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.

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