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

Code No. : 20447 E **Sub. Code : CMPH 52**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023.

Fifth Semester

Physics – Core

SPECTROSCOPY

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Absorbance is

(a) $A = I_0 / I$ (b) $A = e^{-I_0 / I}$

(c) $A = \log(I_0 / I)$ (d) $A = e^{-\Delta E / KT}$

2. Fundamental unit of angular momentum is

(a) m^2 / s (b) $kg.m^2$

(c) $gm.m^2 / s$ (d) $kg.m^2 / s$

3. The number of fundamental vibrations of a non-linear molecule with N-atoms is

(a) N (b) $3N$

(c) $3N - 5$ (d) $3N - 6$

4. The number of fundamental vibrations of a linear molecule is

(a) N (b) $3N$

(c) $3N - 5$ (d) $3N - 6$

5. Source of exciting radiation in modern Raman spectrometers is

(a) Globar (b) Microwave

(c) Laser (d) Mercury arc lamp

6. Raman shift is associated with molecular

(a) Vibrations only

(b) Rotations only

(c) Both vibrations and rotations

(d) Electronic transitions

7. Electronic spectra are produced by

(a) Molecular of permanent dipole moment

(b) Molecular having change of dipole moment

(c) Molecular of permanent polarisability

(d) All the above

8. Transition between ground state and excited electronic states are vertical

(a) Frank-Condon principle

(b) Born-oppenheimer approximation

(c) Fermi golden rule

(d) All the above

9. Prisms and lenses in IR spectrometers are made of

(a) NaCl (b) Br

(c) Both (a) and (b) (d) None

10. The output of single beam IR spectrometer is

(a) d.c. (b) a.c.

(c) Pressure variation (d) Saw tooth wave

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Define : Spectroscopy. State the properties of e.m. radiation.

Or

(b) Explain the term : laser as a spectroscopic source.

12. (a) Write an essay on IR spectroscopy.

Or

(b) Give the theory of vibrating rotator spectrum of carbon monoxide.

13. (a) Define : Scattering of light. Explain the term : Rayleigh scattering.

Or

(b) State the advantages and limitations of Raman spectroscopy.

14. (a) Write short note on Lamber Beer law.

Or

(b) Write a short note on : dissociation energy and dissociation products.

15. (a) Write a short note on different spectroscopic methods.

Or

(b) Write a short note on : Prism monochromator.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Discuss emission spectra and absorption spectra.

Or

(b) Discuss rotational spectrum of asymmetric top molecules.

17. (a) Observe an expression for vibrational energy of diatomic molecule regarding it as harmonic oscillator.

Or

(b) Observe an expression for vibrational energy of diatomic molecule regarding it as anharmonic oscillator.

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

Or

(b) Describe the molecular structure determination from IR and Raman spectroscopy.

19. (a) Discuss Born-oppenheimer approximation and its applications.

Or

(b) Discuss the appearance and explanation of pre dissociation.

20. (a) Discuss the theory and types of monochromators.

Or

(b) Describe the various sources used in IR spectrometer.

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