

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

B.Sc. (CHCS) 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.

- Absorbance is
 - $A = I_0 / I$
 - $A = e^{-L \cdot I}$
 - $A = \log(I_0 / I)$
 - $A = e^{-\Delta E / kT}$
- Fundamental unit of angular momentum is
 - m^2 / s
 - $kg \cdot m^2$
 - $gm \cdot m^2 / s$
 - $kg \cdot m^2 / s$

- The number of fundamental vibrations of a non-linear molecule with N-atoms is
 - N
 - 3N
 - 3N - 5
 - 3N - 6
- The number of fundamental vibrations of a linear molecule is
 - N
 - 3N
 - 3N - 5
 - 3N - 6
- Source of exciting radiation in modern Raman spectrometers is
 - Globar
 - Microwave
 - Laser
 - Mercury arc lamp
- Raman shift is associated with molecular
 - Vibrations only
 - Rotations only
 - Both vibrations and rotations
 - Electronic transitions
- Electronic spectra are produced by
 - Molecular of permanent dipole moment
 - Molecular having change of dipole moment
 - Molecular of permanent polarisability
 - All the above

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- Transition between ground state and excited electronic states are vertical
 - Frank-Condon principle
 - Born-oppenheimer approximation
 - Fermi golden rule
 - All the above
- Prisms and lenses in IR spectrometers are made of
 - NaCl
 - Br
 - Both (a) and (b)
 - None
- The output of single beam IR spectrometer is
 - d.c.
 - a.c.
 - Pressure variation
 - Saw tooth wave

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

- Define : Spectroscopy. State the properties of e.m. radiation.

Or

 - Explain the term : laser as a spectroscopic source.

- Write an essay on IR spectroscopy.

Or

 - Give the theory of vibrating rotator spectrum of carbon monoxide.
- Define : Scattering of light. Explain the term : Rayleigh scattering.

Or

 - State the advantages and limitations of Raman spectroscopy.
- Write short note on Lambert Beer law.

Or

 - Write a short note on : dissociation energy and dissociation products.
- Write a short note on different spectroscopic methods.

Or

 - Write a short note on : Prism monochromator.

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[P.T.O.]

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) Write an expression for vibrational energy of diatomic molecule regarding it as harmonic oscillator.

Or

- (b) Write 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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