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SUBJECT CODE NO: - BB-2520
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. (CBCGS) (Pattern 2022) T.Y SEM VI
Examination November / December 2025
Physics-XXII Atomic and Molecular Physics

[Time:1:30Hours]**[Max. Marks:40]**

Please check whether you have got the right question paper.

N. B

- 1) All questions are compulsory.
- 2) All questions carry equal marks.

Q1 solve any one**10**

- A) Represent with the help of diagram series spectrum of H-atom in the light of Bohr's theory.
- B) Derive an expression based on vibration and rotation spectrum of a diatomic molecule.

Q2 solve any one**10**

- A) Explain Pauli Exclusion Principle and its applications
- B) Explain any two applications of Raman effect.

Q3**10**

- A) Explain in detail Rutherford nuclear atom model.
- B) The molecule of HCl shows a strong absorption line of wavelength 3.456 microns. Assuming origin of line due to the vibration, calculate force constant of HCl bond.

OR

- A) Explain j-j coupling scheme
- B) A sample was excited by the 4358 AU line of mercury. A Raman line was observed at 4447 AU. Calculate the Raman shift in per cm.

Q4 Multiple Choice questions**10**

- 1) The formula for empirical atomic model has given by-----
 - a) E. Rutherford
 - b) Niels Bohr
 - c) J.J. Thomson
 - d) None of these
- 2) According to Boh's theory, the spectral lines of hydrogen atom arise due to
 - a) Excitation of the atom.
 - b) Electron transitions between discrete energy levels
 - c) collision with other atoms.
 - d) presence of magnetic fields
- 3) In the Normal Zeeman Effect, the spectral lines are split into how many components?
 - a) 2
 - b) 3
 - c) 4
 - d) 5

- 4) The Stark effect refers to the splitting or shifting of spectral lines in an atom due to the presence of...
- a) magnetic field
 - b) Electric field
 - c) Gravitational field
 - d) Temperature gradient
- 5) The energy levels of quantum harmonic Oscillator are:
- a) Continuous
 - b) Discrete and equally spaced.
 - c) Discrete but not equally spaced
 - d) only on the ground state is quantized
- 6) Which of the following transitions is Typically observed in the UV region for diatomic molecules?
- a) vibrational transitions
 - b) Rotational transitions
 - c) Electronic transitions
 - d) Translational transitions
- 7) The shift in frequency for Raman scattering is typically of the order of:
- a) 1MHz
 - b) 10MHz
 - c) 10cm^{-1}
 - d) 1000cm^{-1}
- 8) In ESR, the splitting of energy levels due to an external magnetic field is called:
- a) Zeeman splitting
 - b) Hyperfine splitting
 - c) Stark Splitting
 - d) Doppler Splitting
- 9) Nuclear Magnetic Resonance (NMR) Spectroscopy is primarily used to study.
- a) The rotational motions of molecules
 - b) The electronic spectra of molecules
 - c) the nuclear spin states in molecules
 - d) The vibrational frequencies of molecules
- 10) Bohr's model was able to explain the Spectral lines of which elements?
- a) Hydrogen
 - b) Helium
 - c) Oxygen
 - d) Neon

