



K24P 1112

Reg. No. : .....

Name : .....

**Second Semester M.Sc. Degree (C.B.C.S.S. – OBE-Regular)**  
**Examination, April 2024**  
**(2023 Admission)**  
**PHYSICS**  
**MSPHY02C11/MSPHN02C11 : Spectroscopy**

Time : 3 Hours

Max. Marks : 60

**SECTION – A**

Answer **any 5, each** one carries **3** marks.

1. What can be observed while examining the spectra of alkali metal vapours ?
2. What are hot bands ?
3. The diatomic molecule can never have zero vibrational energy. Validate the statement.
4. Why anti-Stokes lines less intense than Stokes lines ?
5. Distinguish between spin lattice and spin-spin relaxations.
6. Though contributions to  $|\phi(0)|^2$  will only be from s-orbitals, the other orbitals do affect the value of isomer shift. How ? **(5×3=15)**

**SECTION – B**

Answer **any 3, each one** carries **6** marks.

7. Derive the Lande'  $g_j$ - factor formula for an atom with a single valence electron.
8. Calculate the Zeeman shift observed in the normal Zeeman effect when a spectral line of wavelength 5000 Å is subjected to the magnetic field of  $1.4 \text{ Wb/m}^2$  taking  $e/m = 1.76 \times 10^{11} \text{ C.kg}^{-1}$ .

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9. What is the change in the rotational constant B when hydrogen is replaced by deuterium in the hydrogen molecule ?
10. Draw the schematic diagram of Fortrat Parabola and explain it.
11. Define chemical shift in NMR spectra. Explain it with examples. **(3×6=18)**

**SECTION – C**

Answer **any 3, each** one carries **9** marks.

12. Define the Stark effect and explain the experimental setup used by Stark to study this phenomenon. Illustrate how the Zeeman effect is more useful than the Stark effect.
13. Prove that anharmonic oscillator behaves like a harmonic oscillator but with an oscillating frequency decreasing with increasing vibrational quantum number.
14. Explain Born-Oppenheimer approximation. Discuss the vibrational coarse structure of a diatomic molecule.
15. Describe the rotational fine structure of electronic vibrational spectra.
16. Give the basic principle of ESR spectroscopy. Write a note on ESR spectrometer. **(3×9=27)**