

Reg. No.....

Name.....

26U4222

B A, B SC, B COM DEGREE END SEMESTER EXAMINATION – MARCH 2026

UGP (HONS.) SEMESTER 4: DISCIPLINE SPECIFIC COURSE

COURSE: 24UPHYDSC205: INTRODUCTION TO SPECTROSCOPY

Time : 1.5 Hours

Max. Marks: 50

PART A

(Short Answers) 2 marks each -Answer any 10 questions

1. Discuss the key concepts of vector atom model (CO 1, U)
 2. What is Bohr radius? Give its value (CO 1, U)
 3. Explain what are the different types of luminescence spectra observed in a molecule (CO 2, U)
 4. Analyse which is more intense stokes or anti-stokes lines? Explain why. (CO 2, An)
 5. Describe the behaviour of a spinning nucleus when placed in an external magnetic field (B_0) (CO3, U)
 6. Explain the origin of sodium doublet structure. (CO 1, A)
 7. What is Bohr magnetron. Give a mathematical expression for the Bohr magnetron. (CO 1, U)
 8. Discuss the Bron – Oppenheimer approximation in the context of electronic Spectroscopy (CO 2, U)
 9. Which is bigger, Bohr magnetron or Nuclear magnetron? Give reason. (CO3, A)
 10. Discuss briefly LS and j-j coupling (CO 1, A)
 11. Assume you keep equal volumes of water and a solid iron block in microwave oven for 2 minutes. Which one will heat up fast? Validate your answer. (C O 2, A)
 12. Even though a neutron is electrically neutral, it has a magnetic moment. Explain why? (CO 3, A)
- (2 x 10 = 20)**

PART B

(Short Essays or Problems) 5 marks each - Answer any 6 questions

13. Derive the relation between the orbital magnetic moment and the orbital angular momentum for an electron revolving in a circular orbit. (CO1, A)

14. Discuss normal Zeeman effect. Give the quantum theory of normal Zeeman effect. (CO1, U)
15. Explain Lande g factor. Calculate the Lande g factor for an electron p and d orbits. (CO1, A)
16. Discuss Raman scattering. Give the quantum theory of Raman Scattering (CO 2, U)
17. Discuss the mutual exclusion principle in Raman and IR spectroscopy. Explain it with carbon dioxide molecule (CO2, U)
18. The First line of CO spectra is observed at 3.84235 cm^{-1} . If the reduced mass of CO molecule is $11.38365 \times 10^{-27} \text{ kg}$, calculate the bond length of CO molecule. Given $h = 6.626 \times 10^{-34} \text{ kgm}^2\text{s}^{-1}$ and $c = 2.99 \times 10^8 \text{ ms}^{-1}$. (CO2, A)
19. Compare and contrast between ESR and NMR spectroscopy. Also, discuss the relaxation process in ESR excitation. (CO 3, An)
20. Explain the theory of NMR resonance Spectroscopy. Also discuss the reason why even-even nuclei do not exhibit NMR response (CO 3, U)

(5 x 6 = 30)