

M. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2026**SEMESTER 4 : PHYSICS****COURSE : 24P4PHYT13 : ATOMIC AND MOLECULAR PHYSICS***(For Regular 2024 Admission)*

Time : Three Hours

Max. Weights: 30

PART A**Answer any 8 questions****Weight: 1**

1. Comment on the influence of nuclear spin on the IR spectra of molecules. (An)
2. What is the effect of centre of symmetry on the spacing of rotational Raman lines? (An)
3. What is the effect of quadruple interaction in Mossbauer Effect? (An)
4. Distinguish between progressions and sequences in electronic spectra. (An)
5. List the factors affecting the width of spectral lines (U)
6. Explain gyro magnetic ratio. (R)
7. How does intensity of spectral lines vary in rotational spectra? (A)
8. Sketch and explain Morse curve. (I)
9. Explain inverse Raman Effect? (R)
10. What is meant by spin lattice relaxation? (U)

(1 x 8 = 8)**PART B****Answer any 6 questions****Weights: 2**

11. An NMR signal for a compound is found to be 180 Hz downward from TMS peak using a spectrometer operating at 60 MHz. Calculate its chemical shift in ppm. (A)
12. Obtain doublet separation in D state due to spin-orbit interaction. (A)
13. Figure the normal vibrations of H₂O and CO₂ molecules. (R)
14. The exciting line in an experiment is 4358A^o and the Raman line is observed at 4567A^o. Find the stoke's and antistokes wavelengths for the same substance when the exciting line wavelength is 4047A^o (A)
15. Explain the relaxation process in NMR. What are the applications of NMR? (An)
16. With the help of a diagram explain Fortrat parabola. (A)
17. The ground state of chlorine is ²P_{3/2}. (a) Find its magnetic moment.(b) In to how many sub states will the ground state split in a weak magnetic field? (A)
18. The fundamental band of HCl is centered at 2886cm⁻¹. Assuming the internuclear distance to be 1.276A^o, calculate the wave number of first two lines in each of the P and R branches of the spectrum. (A)

(2 x 6 = 12)**PART C****Answer any 2 questions****Weights: 5**

19. Explain Bloch equations and obtain their steady state solutions. (A)
20. Explain Zeeman Effect and Stark Effect. Obtain stark splitting in one electron system. (U)
21. Give the theory of Raman Effect. Explain how Raman spectrum gives information on molecular structure. What are the advantages of using lasers in the study of Raman effect? (An)

22. Explain how the study of vibrational spectrum of a diatomic molecule enables to determine the anharmonicity constant and equilibrium frequency of vibration. (A)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
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Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;