MSc DEGREE END SEMESTER EXAMINATION- MARCH 2025
SEMESTER 4 : PHYSICS
COURSE : **21P4PHYT13 ; ATOMIC AND MOLECULAR PHYSICS**
(For Regular - 2023 Admission and Supplementary 2022/2021 Admissions)

Duration : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   Weight: 1

1.	Explain Raman Effect	(U, CO 3)
2.	Explain the principle of NMR.	(U, CO 4)
3.	Explain the effect of anharmonicity on the vibrational spectra of molecules	(U, CO 2)
4.	What is the effect of nuclear spin on the intensity of atomic spectra?	(U, CO 1)
5.	Outline double resonance in ESR spectroscopy.	(An, CO 4)
6.	Explain X-Ray production in SEM	(An, CO 5)
7.	Obtain the Lande 'g' factor of *d* electron	(A, CO 1)
8.	What information can be derived from the position of band head in rotational fine structure of electronic vibration transitions?	(An, CO 3)
9.	Differentiante TEM and STEM	(A, CO 5)
10.	Comment on the rotational spectra of polyatomic linear molecules.	(A, CO 2)

(1 x 8 = 8)

PART B
Answer any 6 questions   Weights: 2

11.	Obtain doublet separation in D state due to spin-orbit interaction.	(A, CO 1)
12.	Explain the quantum theory of normal Zeeman Effect.	(R, CO 1)
13.	What are the applications of Mossbauer studies?	(U, CO 4)
14.	Find the bond length of N_2 molecule if the spacing between adjacent Raman lines is $7.99 cm^{-1}$.	(A, CO 3)
15.	The spectrum of molecule shows an intense absorption at $2886 cm^{-1}$ and a weak one at $5668 cm^{-1}$. Calculate the equilibrium oscillation frequency and the corresponding anharmonicity constant.	(A, CO 2)
16.	Explain any two non linear Raman effects.	(U, CO 3)
17.	Describe the different types of electron guns employed in SEM.	(A, CO 5)
18.	Calculate the frequency for proton resonance at 1.5T. Compare this with the vibrational frequency in H_2, being $4390 cm^{-1.}$	(A, CO 4)

(2 x 6 = 12)

PART C
Answer any 2 questions   Weights: 5

19.	With the help of a diagram explain Fortrat parabola. Also discuss on dissociation, dissociation energy and pre dissociation.	(A, CO 3)
20.	Explain the theory of linear stark effect in Hydrogen atom.	(U, CO 1)
21.	Describe the microwave spectra of a polyatomic linear molecule.	(A, CO 2)
22.	How does a Transmission Electron microscope function?	(E, CO 5)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	To apply the principles of atomic spectroscopy in the study of material science	A	4, 7, 11, 12, 20	11
CO 2	Analyse the microwave and infra red spectrum in the material science study	An	3, 10, 15, 21	9
CO 3	Analyse the given Raman & UV - Visible spectra in the material science study	An	1, 8, 14, 16, 19	11
CO 4	To understand about the NMR, ESR & Mossbauer technique of material identification	U	2, 5, 13, 18	6
CO 5	Understand about the advanced spectroscopic techniques	U	6, 9, 17, 22	9

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;