Roll No. .....

(07/22-II)

5258

B. Sc. EXAMINATION

(Sixth Semester)

PHYSICS

Paper XI (PH-602)

Atomic and Molecular Spectroscopy

Time : Three Hours *Maximum Marks :* 40

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) What is Bohr magneton ? Calculate its value. 2

   (b) Explain the penetrating and non-penetrating orbits for alkali elements. 2

   (c) Give important applications of Raman effect. 2

(d) Calculate the Lande's g factor and total magnetic moment for the term $^2D_{3/2}$. 2

Unit I

2. (a) Discuss the effect of nuclear motion on the spectrum of hydrogen like atom. 5

(b) Prove that velocity of hydrogen atom in first Bohr orbit is close to 1/137 times the velocity of light. 3

3. (a) What do you understand by space quantization ? Explain the significance of quantum numbers. How are they related ? 4

(b) An electron is made to collide with a hydrogen atom in its ground state and excites it to $n = 3$. Find the energy gained by hydrogen atom. 4

Unit II

4. (a) Discuss the theory of spin orbit interaction and derive an expression for spin orbit interaction energy for single valence electron. 5

(b) What is the significance of Larmor's precession theorem in atomic structure ? 3

5. (a) Discuss the following :

(i) Quantum states of atomic electron

(ii) Term value

(iii) Multiplicity of terms. 5

(b) Find the values of S, L and J for the terms $^1P_1$, $^3S_1$, $^3P_2$ and $^3D_2$. 3

Unit III

6. Discuss the coupling scheme for two valence electron atoms. Find out the spectral terms arising due to S-P and D-d configuration in L-S coupling. 8

7. (a) What is Pauli's principle ? Calculate the possible states for p electronic configuration. 4

(b) Obtain the spectrum terms of two equivalent electrons. 4

Unit IV

8. (a) What is Zeeman effect ? Explain splitting of D_1 and D_2 lines of sodium in weak magnetic field. 4

   (b) Distinguish between anomalous Zeeman effect and Paschen back effect. 4

9. (a) Explain quantisation of vibrational and rotational energies of a molecule. 4

   (b) The exciting line in an experiment is 4560 Å and the stokes line is at 5520 Å. Calculate the wavelength of antistokes line. 4