

Roll No. ....

(07/22-11)

**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

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### 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  $4560 \text{ \AA}$  and the Stokes line is at  $5520 \text{ \AA}$ . Calculate the wavelength of antistokes line. 4

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