

Roll No.

(05/16-I)

5258

B. Sc. EXAMINATION

(Sixth Semester)

PHYSICS

Paper-XI (PH-602)

Atomic & Molecular Spectroscopy

Time : Three Hours

Maximum Marks : 80

Note : Q. No. 1 Section I is compulsory. For Section II to V, attempt *one* question out *two* question set from each Section

Section I

- 1. (a) Give the postulates of Bohr's theory of Hydrogen atom. 2
- (b) What is Raman Effect ? 2
- (c) What is meant by J-J coupling ? 2

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- (d) Under what conditions normal and anomalous Zeeman effects are observed in an atomic system ? 2

Section II

- 2. Give an account of Bohr-Sommerfeld model of elliptical electron orbit of an atom. Show that total energy of an electron moving in Semmerfeld's orbit of the same quantum number is equal and identical with that of corresponding Bohr orbit. 8
- 3. (a) Explain various Quantum numbers associated with Vector-Atom model. 4
- (b) Write a short note on emission and absorption spectra. 4

Section III

- 4. (a) On the basis of classical model, obtain as expression for quantum defect in penetrating orbit of alkali elements. 5
- (b) What are penetrating and non-penetrating orbits ? 3

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2

5. Describe the general features of spectra of alkali atoms. Explain, how the doublet fine structure is explained on the basis of Vector-Atom model. 8

Section IV

6. (a) Derive an expression for interaction energy in case of L-S coupling. 6
 (b) What are the values of S, L and J for $1P_1, 1S_0, 2P_2, 3D_2$. 2
9. (a) What is Russel-Saunders (L-S) coupling? Find the spectral terms arising due to *p-d* configuration. 5
 (b) What are the factors responsible for hyperfine structure of spectral lines? 3

Section V

8. (a) What is Stark effect? Explain the splitting of spectral lines under the effect of weak electric field in case of H-atom. 5

- (b) Calculate the value of Lande g-factor for the doublet terms : $2P_{3/2}$ and $2F_{7/2}$. 3
9. (a) Derive the expression for energy shift in Paschen-Back effect for one valence electron system. 5
 (b) Explain vibrational spectra of diatomic molecule in brief. 3

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