

Roll No.

(07/20-I)

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.

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|--------|------------------------------------------------|---|
| 1. (a) | What is Hyperfine Structure ? | 1 |
| (b) | State the values of m_l for $l = 4$. | 1 |
| (c) | Define Bohr Magneton. | 2 |
| (d) | What is Raman Shift ? | 2 |
| (e) | What is the origin of spin-orbit interaction ? | 2 |

Unit I

2. (a) State Bohr's postulates and deduce an expression for the allowed energy of the hydrogen atom. 4
- (b) Find the wavelength of the photon emitted when a H-atom goes from the $n = 10$ state to its ground state. 4
3. (a) Discuss Wilson-Sommerfeld quantization rule. 4
- (b) Explain Bohr's correspondence principle. 4

Unit II

4. (a) Derive an expression for Larmor's precession frequency. 4
- (b) Calculate the spin-orbit interaction splitting of a level corresponding to $n = 2$ and $l = 1$ of hydrogen atom. 4

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5. (a) Calculate the spin-orbit interaction energy for a single non-penetrating valence electron. 4
- (b) Describe the general features of spectra of alkali like atoms. 4

Unit III

6. (a) Derive the expression of interaction energy for LS coupling. 4
- (b) Find the values of L, S, J and the corresponding values of L, S, J for an atom having electronic configuration $1s^2 2s^2 p^1$. 4
7. (a) Discuss the origin of Hyperfine structure of spectral lines. 4
- (b) Differentiate equivalent and non-equivalent electrons. 4

Unit IV

8. (a) Describe an experimental set-up to study Zeeman Effect. 4
- (b) Explain Rotator Model of diatomic molecule. 4

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9. (a) Derive an expression for Lande's splitting
g-factor. 4
- (b) What are stokes and antistokes lines in
Raman Effect ? 4