

Third Semester M. Sc. (Part-II) Examination

PHYSICS

Paper - 3 PHY 3

(Atomic and Molecular Physics)

P. Pages : 3

Time : Three Hours]

[Max. Marks : 80

- Note :** (1) All questions are compulsory and carry equal marks.
(2) Draw neat and labelled diagram wherever necessary.

1. (A) Explain the concepts in vector atom model :—
(i) Space quantization.
(ii) Spin of electron. 6
(B) Explain the significance of important quantum numbers encountered in vector atom model. 10

OR

- (P) Describe the principle and theory of Stern-Garlach experiment with necessary diagram and explain its results. 10
(Q) State and explain Pauli's exclusion principle. 6
2. (A) Explain normal and anomalous Zeeman effect. 5

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- (B) Describe experimental method to study the Zeeman effect in laboratory. 8
- (C) Find the value of g when $l = 1$, $s = 1/2$ and $j = 1/2$. 3

OR

- (P) Discuss Debye's theory to explain Normal Zeeman effect. 6
- (Q) Explain anomalous Zeeman effect in sodium D_1 and D_2 lines. 7
- (R) Find the value of g when $l = 1$, $s = 1/2$ and $j = 3/2$. 3
3. (A) Explain Paschen-Back effect. 4
- (B) Explain L.S coupling in case of two valence electron atom. 8
- (C) Explain the phenomenon of Electron Spin Resonance. 4

OR

- (P) Define linear and quadratic Stark effect. 4
- (Q) Explain J-J coupling in case of two valence electron atom. 8
- (R) Explain Nuclear magnetic Resonance phenomenon. 4

4. (A) Discuss the classification of molecular or band spectra. 6
- (B) Explain the rotational energy levels and spectrum of rigid diatomic molecule by quantum mechanical theory. 10

OR

- (P) Describe different types of molecules. 6
- (Q) Discuss the energy levels and spectra of diatomic molecule as a non-rigid rotator. Discuss Isotopic shift in pure rotational spectra. 10
5. (A) Discuss the case of diatomic molecule as a simple harmonic oscillator. 6
- (B) Find the energy levels and explain the spectrum in case of diatomic molecule when treated as simple harmonic oscillator. 6
- (C) Explain the significance of Morse potential energy curve. 4

OR

- (P) Describe the diatomic molecule as rigid rotator and harmonic oscillator. 6
- (Q) Describe PQR branches in molecular spectra. 6
- (R) Explain Raman spectra in case of diatomic molecule. 4

