(i) **Printed Pages : 3** **Roll No. .....**

(ii) **Questions : 7** **Sub. Code : 0349**

Exam. Code : 0004

B.A./B.Sc. (General) 4th Semester

1059

PHYSICS

Paper : C Quantum Physics–II

Time Allowed : Three Hours] **[Maximum Marks : 22**

Note :— (1) Attempt **five** questions in all selecting **two** questions each from sections **A** and **B**. Section **C** is compulsory.

(2) Use of non-programme calculator or log table is allowed.

SECTION—A

1. (a) Give brief description of Stern-Gerlach experiment. Derive expression for displacement of silver atom. 3

   (b) What is Larmor precession and derive an expression for Larmor frequency. 1.5

2. (a) Explain hyperfine structure and derive expression for energy of spin orbit interaction with total nuclear spin. 3

   (b) What is Lande's g-factor ? Calculate Lande's g-factor for p-electrons. 1.5

3. (a) What is Pachen Back effect ? Explain this effect in weak and strong magnetic field. 3

(b) A 5000 A° line exhibits a normal Zeeman splitting of 1.1×10^{-3} A°. Find the magnetic field. 1.5

SECTION–B

4. (a) Discuss L-S coupling and J-J coupling schemes ; which scheme holds for lighter atoms ? 3

   (b) Prove that total wavefunction of identical fermions is antisymmetric. 1.5

5. (a) Discuss the method to produce X-rays and state important properties of X-rays. 3

   (b) Which element has Kα line of wavelength 1.785 A°. Given = R 109737 cm^{-1} 1.5

6. (a) Explain vibrational-rotational spectra in diatomic molecule and draw energy levels. 3

   (b) What is Raman effect ? What are the stoke's and antistoke's lines in Raman effect ? 1.5

SECTION—C

7. Attempt any eight parts :

   (i) What is difference between Zeeman Effect and Stark Effect ?

   (ii) Is $^2P_{5/2}$ a possible term ? Why ?

   (iii) Two bosons can exist in the same quantum state but two fermions cannot exist in the same quantum state. Explain why.

   (iv) What are the selection rules for X-ray spectra ?

(v) Why should target in X-ray tube have high atomic number, high melting point and large thermal conductivity ?

(vi) Why do molecules show band spectra rather than line spectra ?

(vii) Why does symmetric orbital wave function lead to the bindir ي in H_2 molecules ?

(viii) What are equivalent electrons ?

(ix) What is anomalous Zeeman effect ?

(x) What is Stark effect ? $0.5 \times 8 = 4$