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

(ii) Questions : 7 Sub. Code : 0 3 4 7

Exam. Code : 0 0 0 4

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

1046

PHYSICS

Paper : C–Quantum Physics–II

Time Allowed : Three Hours] [Maximum Marks : 22

Note :– (1) Attempt **five** questions in all, selecting **two** questions from each of Sections A and B. Section C is compulsory.

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

SECTION–A

I. (a) Show that the average life time of an atom in the excited state is inversely proportional to transition probability. What are strongly allowed and weakly allowed transitions ? 2

(b) What is Anomalous Zeeman Effect ? Discuss its theory by taking the case of sodium lines. 2

II. (a) Give brief description of Stern - Gerlach experiment. What conclusions do you draw from it ? 2.5

(b) Calculate Lande's g factor for s-electron and $^2P_{3/2}$ state. 1.5

III. (a) What is fine structure of atomic spectra ? How is it explained ? Illustrate with an example of hydrogen spectral line. 2.5

(b) Calculate the two possible orientations of spin angular momentum S with respect to magnetic field direction. 1.5

SECTION–B

IV. (a) What are symmetric and antisymmetric wavefunctions ? Show that the total wavefunction of fermions is antisymmetric. 2.5

(b) What is LS coupling ? Draw a fully labelled energy level diagram showing the levels of 4s, 3d configuration. 1.5

V. (a) State and explain Mosley's law. Derive it from Bohr's theory. 2.5

(b) What is Auger effect and explain its achievement in explaining photoelectric effect using X-Ray. 1.5

VI. (a) How classical and quantum mechanical theories explain Raman effect ? 3

(b) The force constant k of the bond in CO is 187 N/m. Find the frequency of vibration of the CO molecule and the spacing between its vibrational energy levels. 1

SECTION–C (Compulsory)

VII. Attempt any **six** parts :

(i) What are bonding and antibonding states of molecules ?

(ii) Draw four graphs to show that in case of continuous spectrum of X-rays, $\lambda_{min} \propto 1/V$.

(iii) What are the selection rules for observing spectra of many electron system ?

(iv) How spin-orbit coupling linked with fine structure ?

(v) What was the necessity of introducing the concept of electron spin ?

(vi) Explain the meaning of Larmor precession and Larmor frequency.

(vii) Calculate the values of *l*, s and j and L, S and J for a 'd' electron in an electron atomic system. $1 \times 6 = 6$