Sr. No. of Question Paper : 6868　　　　　**D**　　　　**Your Roll No................**

Unique Paper Code　　　: 222563

Name of the Course　　　: **B.Sc. (Physical Science)**

Name of the Paper　　　: Physics – V Quantum Mechanics & Atomic Physics (PHPT-505)

Semester　　　　　　　: V

Duration : 3 Hours　　　　　　　　　　　　　Maximum Marks : 75

Instructions for Candidates

1.　Write your Roll No. on the top immediately on receipt of this question paper.

2.　Attempt any **five** questions.

3.　**All** questions carry equal marks.

1.　(a)　Discuss how Classical Physics failed to account for the spectral distribution of energy density in the black-body radiation. How did Planck overcome the difficulty.　(9)

　　(b)　Derive the relationship between group and phase velocity.　(6)

2.　(a)　What is photoelectric effect ? Define threshold frequency and work function. Give an account of Einstein explanation of photoelectric effect on the basis of quantum theory.　(6,5)

　　(b)　Radiations of wavelength 5400 Å fall on a metal plate whose work function is 1.9eV. Find the kinetic energy of the emitted photoelectrons.　(4)

3.　(a)　What is a wave packet ?　(2)

　　(b)　Prove that the de-Broglie wave packet associated with a moving body travels with the same velocity as the body.　(6)

　　(c)　State Heisenberg uncertainty principle and derive it on the basis of wave packets.　(2,5)

4. (a) Obtain Schrodinger's time dependent form of wave equation for a particle in one dimension. (8)

   (b) Calculate the expectation value of the momentum of a particle trapped in a one-dimensional box of length L. (4)

   (c) What is tunnel effect ? (3)

5. (a) What is the physical significance of the magnetic orbital quantum number and magnetic spin quantum number ? (3,3)

   (b) What is Larmor's theorem ? Derive Larmor's frequency. (3,6)

6. (a) What is Gyromagnetic ratio for the orbital and spin motion of an electron in an atom ? (3)

   (b) Explain Stern- Gerlach experiment. What conclusions does it lead to ?
   (9,3)

7. (a) What is Anomalous Zeeman effect ? Explain with the help of diagram the transitions between 3d and 2p levels in a Normal Zeeman effect. (3,6)

   (b) Calculate the Lande g factor for the following states :

   (i) $3^2S_{1/2}$ (ii) $4^2P_{3/2}$ (3,3)

8. (a) Explain j-j coupling. (3)

   (b) Give all possible states under L-S coupling for two non-equivalent p electrons (2p-3p configuration). (5)

   (c) State Pauli's exclusion principle. Give electronic configurations for the following elements (i) Ag(Z=47) and (ii) Ni(Z=28). (3,2,2)

Some constants :

h = 6.626×10^{-34} Js

m_e = 9.1×10^{-31} Kg

(2500)