Exam.Code:0003
Sub. Code: 0249

2012
B.A./B.Sc. (General) Third Semester
Physics
Paper – C: Quantum Physics – I

Time allowed: 3 Hours | Max. Marks: 44

NOTE: *Attempt five questions in all, including Question No. 7 (Unit-III) which is compulsory and selecting two questions each from Unit I - II. Use of non- programmable calculator is allowed.*

x-x-x

Unit -1

1. (a) Establish De-Broglie wave relation. Describe Davisson-Germer experiment for the diffraction of electrons. What role did it play in the verification of De-Broglie Hypothesis? 6
   (b) What is the condition for orthogonal and normalized wave function? 3
2. (a) Discuss Planck's hypothesis for a Black Body Radiation and derive Planck's formula in terms of wavelength λ correspond to wavelength interval λ and $\lambda+d\lambda$ 6
   (b)A certain spectral line has wavelength 4000 Å. Calculate the frequency and energy in eV of the photon associated with it? 3

3. (a) State and derive Ehrenfest theorem. 6
   (b) What is electron microscope? Also state the principal of electron microscope? 3

Unit-2

4. (a) Derive steady state Schrodinger wave equation. 6
   (b) Show that the state of a Hydrogen atom for a given value of n has n^2 fold degeneracy. 3
5. (a) Write down Schrodinger equation for an electron of hydrogen atom. Obtain the three independent differential equations for Schrodinger wave equation in spherical polar coordinates. 6
   (b) On what factor potential of Hydrogen atom depends? 3

6. (a) What is tunnelling through a barrier? Calculate the reflection coefficient of a particle through a one dimensional potential barrier for energy less than step height. 6
   (b) How do you explain the zero point energy of Harmonic Oscillator? 3

P.T.O.

Unit-3

7. Attempt any eight parts

a) Explain the term Pair Production.

b) Define threshold frequency for photoelectric effect?

c) What is the physical significance of wave function?

d) A proton and a deutron having same energy penetrate a given rectangular barrier. Which particle has a greater depth of penetration?

e) Calculate the De Broglie wavelength for an electron which has been accelerated through a potential difference of 60 V.

f) What are photons? State their properties.

g) What is tunnel effect? How tunnel effects explain alpha decay?

h) Calculate the commutator for position and momentum operator [x,Px].

i) Out of visible light and gamma rays, which can easily show Compton effect and why?

j) What is the difference between quantum mechanical angular momentum and angular momentum from Bohr's theory ? 1*8=8

x-x-x