



M 8173

Reg. No. :

Name :

VI Semester B.Sc. Degree. (CCSS-Reg./Supple./Improv.)
Examination, May 2015
CORE COURSE IN PHYSICS
6B13 PHY : Quantum Mechanics
(2010 and '11 Admn.)

Time: 3 Hours

Max. Weightage : 30

SECTION – A

(Each bunch carries a weightage of 1).

1. i) The waves associated with electrons is
 - a) longitudinal waves
 - b) matter waves
 - c) transverse waves
 - d) compton waves
- ii) According to Schrodinger, a particle is equivalent to
 - a) a single wave
 - b) a wave-packet
 - c) light wave
 - d) cannot behave as wave
- iii) The uncertainty relation cannot hold for the following pairs
 - a) position and momentum
 - b) energy and time
 - c) linear momentum and angle
 - d) angular momentum and angle
- iv) The energy operator is
 - a) $\frac{h}{i} \frac{\partial}{\partial t}$
 - b) $\frac{-\hbar^2}{2m} \nabla^2 + V$
 - c) $\frac{-\hbar}{i} \frac{\partial}{\partial t}$
 - d) $i\hbar \frac{\partial}{\partial t}$

P.T.O.



2. i) For normalised wave function, the value of $\int_{-\infty}^{+\infty} \psi_m^* \psi_m d\bar{v}$ is _____
- ii) The zero point energy of harmonic oscillator is given by _____
- iii) The existence of de-Broglie wavelength was confirmed by _____ experiment.
- iv) The eigen values of a particle in one-dimensional box of length 'L' is _____

(2×1=2)

SECTION – B

(Answer any six. Each question carries a weightage of 1).

3. What is Planck's quantum hypothesis ?
4. Elucidate any 2 inadequacies of quantum theory.
5. Write Einstein's photoelectric equation in terms of wavelength λ .
6. State the principle of superposition of waves.
7. State Heisenberg's uncertainty principle.
8. What are eigen functions and eigen values ?
9. What is a Hermitian operator ?
10. Write the differential equation of a simple harmonic oscillator.

(6×1=6)

SECTION – C

(Answer any nine; each question carries a weightage of 2).

11. Distinguish between phase velocity and group velocity.
12. Give the physical interpretation of wave function.
13. Define probability current density.
14. Prove that $[x, p_y] = 0$.
15. The energy of a linear harmonic oscillator in third excited state is 0% c V. Find the frequency of vibration.



16. Give the significance of zero point energy of a harmonic oscillator.
17. Prove the kinetic energy operator from momentum operator.
18. Prove that any two eigen functions of a Hermitian operator that belong to different eigen values are orthogonal to each other.
19. The radius of a hydrogen atom is 5.3×10^{-11} m. Find the minimum energy an electron can have in this atom using uncertainty principle.
20. What do you mean by normalised and orthogonal wave-functions ?
21. Explain Einstein's photoelectric equation.
22. X-rays of wavelength 0.085 \AA are scattered by carbon. At what angle will Compton scattered photons have a wavelength of 0.090 \AA ?

(9×2=18)

SECTION – D

(Answer any one; each question carries a weightage of 4).

23. Describe Stern and Gerlach experiment. What are the conclusions drawn from it ?
24. Derive time-independent Schrodinger equation. Explain the stationary states.

(1×4=4)