



K19U 0135

Reg. No. :

Name :

VI Semester B.Sc. Degree (CBCSS-Reg./Supple./Improv.)

Examination, April 2019

(2014 Admission Onwards)

CORE COURSE IN PHYSICS

6B13 PHY : Quantum Mechanics

Time : 3 Hours

Max. Marks : 40

SECTION – A

(Answer **all**. Very short answer type. **Each** question carries **one** mark.)

1. The Paschen series is the transition between the levels of _____
2. The momentum of matter wave is given by _____
3. The solution of Schrodinger equation of a free particle is _____
4. One dimensional harmonic oscillator has _____ degrees of freedom.

SECTION – B

(Answer **any seven**. Short answer type. **Each** question carries **two** marks.)

5. What is Compton Effect ?
6. List out any four inadequacies of quantum theory.
7. Consider the standing wave of an electron in an orbit and Bohr's quantization rule.
8. Prove the non-existence of electrons inside the nucleus on the basis of uncertainty principle.
9. What are Eigen functions and Eigen values of an operator ?
10. What is box normalization ? Explain with example.
11. Why does the spin of an electron play an important role in the structure of energy levels of a many electron atom but not in hydrogen atom ?
12. Explain de Broglie hypothesis. Why the wave nature of matter is not apparent in our daily observations ?

P.T.O.



13. Bring out the conclusions of Stern Gerlach experiment.
14. Briefly explain the mechanism by which photoelectrons are emitted.

SECTION - C

(Answer **any four**. Short essay/problem type. **Each** question carries **three** marks.)

15. Find the energy of an harmonic oscillator using quantization rule.
16. An X-ray photon of wavelength 0.3\AA is scattered through an angle 45° by a loosely bound electron. Find the wavelength of the scattered electron.
17. Find the Eigen functions and nature of Eigen values of the given operator.

$$\frac{d^2}{dx^2} + \frac{2d}{x dx}$$

18. A harmonic oscillator moves in a potential $V(x) = \frac{1}{2}kx^2 + cx$. Find the energy Eigen values.
19. 1 g marble is constrained to roll inside a tube of length 1 cm, the tube is capped on both sides. Modeling this as square well potential, determine the values of quantum numbers of the marbles. If the initial energy is 1.06 mJ, calculate the next excitation energy of marble.
20. Normalize the wave function $\Psi(x) = e^{-\frac{x}{a}}$.

SECTION - D

(Answer **any two**. Long essay type. **Each** question carries **five** marks.)

21. Explain the significance of Ehrenfest's theorem.
22. A) Explain the postulates of Bohr with regard to hydrogen atom.
B) Explain the photoelectric effect and also the concept of Einstein with regard to it.
23. Explain the different postulates of quantum mechanics in detail.
24. Solve the Schrodinger equation for linear harmonic oscillator using Schrodinger method.