

Reg. No. :

Name :

15

VI Semester B.Sc. Degree (CBCSS – Supple./Improv.)
Examination, April 2022
(2016-2018 Admissions)
CORE COURSE IN PHYSICS
6B13PHY : Quantum Mechanics

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. The ground state energy of a particle in a square well potential is
2. Bohr's quantization rule is
3. States of motion corresponding to the same energy are called
4. Give the time independent Schrodinger equation

SECTION – B

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

5. What is delta normalization ? Explain with example.
6. A particle in a box must have a certain minimum amount of energy. Comment.
7. Determine the de Broglie wavelength of an electron that has been accelerated through a potential difference of 100 V.
8. List out any four inadequacies of quantum theory.
9. Distinguish between phase velocity and group velocity.
10. Find the angular momentum of an electron having orbital quantum number 2.
11. What is meant by Correspondence principle ?

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12. Give the Planck's quantum hypothesis for the explanation of black body radiation.
13. Normalize the wave function $\psi(x) = \exp(-x/a)$.
14. Explain uncertainty principle.

SECTION – C

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

15. Explain how barrier tunneling accounts for α -decay by certain nuclei.
16. From a sodium surface, light of wavelength 3125 Å and 3650 Å causes emission of electrons whose maximum kinetic energy is 2.128 eV and 1.595 eV, respectively. Estimate Planck's constant and work function of sodium.
17. Briefly explain the mechanism of photoelectrons emitted from a metal surface.
18. An electron has speed of 500 m/s with an accuracy of 0.004 %. Calculate the certainty with which we can locate the position of the electron.
19. Obtain the energy Eigenvalues and Eigenfunctions for a particle trapped in the potential well $V(x) = 0$ for $0 \leq x \leq a$ and $V(x) = \infty$: otherwise.
20. Explain Davisson and Germer experiment with proper diagram.

SECTION – D

Answer **any two**. Long Essay type. **Each** question carries **five** marks :

21. What is a wave function? Derive Schrodinger's time independent equation.
22. A) Write the time independent Schrodinger equation for the hydrogen atom in spherical polar co-ordinates and separate it into three differential equations for the three parts of the total wave function.
 B) Solve the azimuthal wave function and show that the magnetic quantum number m must be zero or a positive or a negative integer.
23. Explain the different postulates of quantum mechanics in detail.
24. A) Explain the postulates of Bohr with regard to hydrogen atom.
 B) Explain the concept of elliptic orbits of hydrogen atom using Sommerfeld quantization rule.