



Reg. No. : .....

Name : .....

**Sixth Semester B.Sc. Degree (C.B.C.S.S. – Supplementary/ One Time  
 Mercy Chance) Examination, April 2024  
 (2014 to 2018 Admissions)  
 CORE COURSE IN PHYSICS  
 6B 13 PHY : Quantum Mechanics**

Time : 3 Hours

Max. Marks : 40

*Instruction : Write answers in English only.*

## SECTION – A

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

1. Write the expression for energy of a harmonic oscillator.
2. Write down the expression for energy operator.
3. Write down the time independent Schrodinger equation.
4. What is Compton effect ?

(4×1=4)

## SECTION – B

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

5. What is the significance of Franck Hertz Experiment ?
6. Write the position-momentum uncertainty relation and the energy-time uncertainty relation.
7. What do you mean by eigen values and eigen functions ?
8. What are the conditions that a wave function must satisfy to be acceptable ?
9. What are free particles ? Write its box normalized wave function.
10. Explain the postulates of Bohr with regard to Hydrogen atom.

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11. Using the idea of standing wave of an electron in the orbit, obtain Bohr's quantization rule.
12. Write any two quantum numbers and their permissible values.
13. What do you mean by tunnel effect ?
14. State and explain Exclusion principle.

(7×2=14)

## SECTION – C

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

15. Explain the phenomenon of Photoelectric effect.
16. Determine the de Broglie wavelength of an electron that has been accelerated through a potential difference of 100 V.
17. When two observables are said to be compatible ? State the theorems that indicate the connection between compatible observables and commuting operators.
18. Explain briefly the Zeeman effect.
19. A 1 eV electron got trapped inside the surface of a metal. If the potential barrier is 4.0 eV and the width of the barrier is  $2\text{\AA}$ , calculate the probability of its transmission.
20. Using the rule of quantization, obtain the expression for energy of a particle in a box.

(4×3=12)

## SECTION – D

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

21. Obtain the expressions for lengths of semi major axis of  $n^{\text{th}}$  orbit of an electron orbit of Hydrogen atom.
22. Write down the Schrodinger equation of a linear harmonic oscillator and obtain its energy eigen values.
23. Derive the Schrodinger equation of the Hydrogen atom in spherical polar coordinates. Write the equations for  $R$ ,  $\Theta$  and  $\Phi$  using separation of variables.
24. State and explain the postulates of quantum mechanics.

(2×5=10)