VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination,
April 2021
(2014 – 2018 Admissions)
CORE COURSE IN PHYSICS
6B13 PHY : Quantum Mechanics

Time : 3 Hours

Max. Marks : 40

**Instructions :**
1) Write answers in **English only**.
2) Section – **A** : Answer **all** questions (Very short answer type. **Each** question carries **1** mark.)
3) Section – **B** : Answer **any seven** questions (Short answer type. **Each** question carries **2** marks.)
4) Section – **C** : Answer **any four** questions (Short essay/ problem type. **Each** question carries **3** marks.)
5) Section – **D** : Answer **any two** questions (Long essay type. **Each** question carries **5** marks.)

## SECTION – A

1. State Bohr's Correspondence principle.

2. Write the Time independent Schrodinger equation.

3. Give Planck's radiation formula.

4. Define gyromagnetic ratio. (4×1=4)

## SECTION – B

5. Give the limitations of Classical Physics.

6. Explain Compton effect.

7. State and explain uncertainty principle.

P.T.O.

8. Briefly explain the orthogonality and normalization condition of wave function.

9. Explain significance of Stern-Gerlach experiment.

10. State Wilson-Sommerfeld quantisation rule.

11. State Ehrenfest's theorem.

12. What are the basic properties of stationary states ?

13. Explain tunnel effect.

14. Explain Pauli's exclusion principle.

15. Explain probability density.

16. What are the eigen functions and eigen values of an operator ?

17. Explain space quantisation.

18. What are the admissibility conditions on the wave functions ?          $(7 \times 2=14)$

SECTION – C

19. A sample of certain element is placed in a 0.3 T magnetic field and suitably excited. How far apart are the Zeeman components of the 450 nm spectral line of this element ?

20. Find the expectation value of the position of a particle trapped in a box L wide.

21. Calculate the de Broglie wavelength of an electron having a kinetic energy of 1000 eV. Compare the result with the wavelength of X-rays having the same energy.

22. An electron has a speed of 500 m/s with an accuracy of 0.004%. Calculate the uncertainty with which we can locate the position of the electron.

23. X-rays of wavelength 1.4 Å are scattered from a block of carbon. What will be the wavelength of scattered X-rays at (i) 180° (ii) 90° ?

24. Can we measure kinetic and potential energies of a particle simultaneously with arbitrary precision ?

25. What is the work function of a metal if the threshold wavelength for it is 580 nm ? If light of 475 nm wavelength falls on the metal, what is its stopping potential ?

26. An eigen function of the operator $\dfrac{d^2}{dx^2}$ is $\psi = e^{2x}$. Find the corresponding eigen value.                                                                                 $(4 \times 3=12)$

SECTION – D

27. Obtain wave equation for linear harmonic oscillator. Find out the eigen values and eigen functions. Draw energy levels with wave function and probability density.

28. a) How Planck theoretically explained black body radiation problem ?

    b) How did Einstein explain photoelectric effect using Quantum theory ?

29. Discuss Bohr atom model, derive expression for energy levels and explain hydrogen spectrum.

30. State the important postulates of Quantum mechanics and justify each.

31. Derive Schrodinger equation for hydrogen atom in spherical polar co-ordinates and solve for the possible stationary states.

32. With necessary theory and diagram, explain the interaction of atoms with magnetic field in Zeeman effect.                                                              $(2 \times 5=10)$

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