(6 pages) Reg. No. : .....

Code No. : 20307 E **Sub. Code : AMPH 61**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023.

Sixth Semester

Physics – Core

QUANTUM MECHANICS

(For those who joined in July 2020 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer:

1. The momentum of a particle is equal to the product of
   (a) Mass, weight
   (b) Mass, velocity
   (c) Mass, acceleration
   (d) Mass, force

2. A black surface absorbs _____ as compared to a white surface, under identical conditions?
   (a) Same heat (b) Negligible heat
   (c) More heat (d) Lesser heat

3. What happens to the wavelength of a photon after it collides with an electron?
   (a) Increases (b) Decreases
   (c) Remains the same (d) Infinite

4. The energy of the particle is proportional to
   (a) n (b) n^{-1}
   (c) n^2 (d) n

5. The uncertainty principle applies to
   (a) Macroscopic particles
   (b) Microscopic particles
   (c) Gases
   (d) None of the above

6. Uncertainty principle can be easily understood with the help of
   (a) Dalton's effect (b) Crompton' s effect
   (c) Electrons effect (d) Rhombic effect

7. In general the solution of the Schrodinger wave equation is
   (a) Real (b) Imaginary
   (c) Complex (d) None of the above

8. The ground state energy of an electron confined to a box 1 $\mathring{A}$ wide is
   (a) 6.016×10^{-20} (b) 2.016×10^{-8}
   (c) 5.02×10^{-18} (d) 6.016×10^{-8}

9. In simple harmonic oscillation, what is the phase difference between velocity and acceleration?
   (a) 0 (b) π
   (c) $\pi/2$ (d) $\pi/4$

10. For a particle inside a box, the potential is maximum at X = _____.
    (a) L (b) 2 L
    (c) L/2 (d) 3L

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is meant by black body radiation? Describe the photo electric effect.

    Or

    (b) Explain in details about the Plank's quantum theory.

12. (a) Describe the motion of a free wave packet.

    Or

    (b) Write short notes on phase and group velocity?

13. (a) Explain the elementary proof of Heisenberg's uncertainty relation.

    Or

    (b) Explain in elementary proof of the Heisenberg's uncertainty relation between energy and time.

14. (a) Derive the expression for Schrödinger's one dimensional time-dependent wave equation.

    Or

    (b) What are the postulates of quantum mechanics?

15. (a) Explain in detail about simple harmonic oscillator.

    Or

    (b) What is Schrödinger wave equation for particle in a rectangular three dimensional box?

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss about the Bohr's quantization of angular momentum and its application to the hydrogen atom.

Or

(b) Discuss about the failure of classical physics and to explain energy distribution in the spectrum of a black.

17. (a) State and explain wave particle duality?

Or

(b) Explain the interference of electrons.

18. (a) Explain the illustration of Heisenberg's uncertainty principle by thought experiments.

Or

(b) State Uncertainty principle and describe the consequences of the uncertainty relation?

19. (a) What are the physical interpretation of the wave function ψ ?

Or

(b) Describe the Eigen value and Eigen value equation.

20. (a) Explain the particle in a one dimensional box.

Or

(b) Explain in about Reflection at a sleep potential and the transmission across a potential barrier.

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