Date: 18-11-2024   Dept. No.   Max. : 100 Marks
Time: 09:00 am-12:00 pm

SECTION A

Answer ANY FOUR of the following   **4 x 10 = 40 marks**

1. Explain the limitations of classical physics in describing black body radiation and how Planck's quantum hypothesis resolved this issue.
2. Describe the photoelectric effect and its significance in supporting the quantum theory of light.
3. Discuss De Broglie's hypothesis of matter waves and explain its verification through the Davisson and Germer experiment.
4. Derive the time-dependent Schrödinger equation and explain its physical significance in wave mechanics.
5. Describe the postulates of quantum mechanics and explain the role of Hermitian operators in determining observable quantities.
6. Discuss the concept of four-dimensional Euclidean space-time and its importance in relativistic kinematics.
7. Describe the Lorentz transformation equations and their implications for length contraction and time dilation.
8. Discuss the gravitational red shift and bending of light near massive objects. How do these phenomena provide evidence for general relativity?

SECTION B

Answer ANY THREE of the following   **3 x 20 = 60 Marks**

9. Discuss the contributions of the G.P. Thompson experiment and electron microscopy in demonstrating the wave nature of particles.
10. Explain Ehrenfest's theorems and discuss their importance in connecting quantum mechanics with classical mechanics.
11. Discuss the solution for a one-dimensional simple harmonic oscillator and derive the energy eigenvalues.
12. Explain the Michelson-Morley experiment and its significance in disproving the existence of the ether.
13. Explain the mass-energy equivalence and derive the famous equation $E = mc^2$. Discuss its implications for modern physics.
14. Discuss the variation of mass with velocity in special relativity and explain how it affects the momentum and energy of a moving object.

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