Roll.No. | 22UPHCT6012

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS) (Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc.Physics - END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER -VI

22UPHCT6012 - Relativity and Quantum Mechanics

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Derive the expression for time dilation using Lorentz transformation.
2. Explain the null result of the Michelson–Morley experiment and its significance.
3. State and explain Heisenberg's Uncertainty Principle with one illustration.
4. Describe the Davisson and Germer experiment and explain how it confirmed the wave nature of electrons.
5. Write the time-independent Schrödinger wave equation and explain the significance of each term.
6. What is a Hermitian operator? Explain why the eigenvalues of Hermitian operators are always real.
7. Obtain the expression for the energy levels of a particle in a one-dimensional box.
8. Outline the steps involved in solving the barrier penetration (tunnelling) problem using Schrödinger's equation.

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. Derive the Lorentz transformation equations from the postulates of special relativity and explain their significance.
10. Describe the Davisson and Germer experiment in detail and show how it verified the wave nature of electrons using de Broglie's hypothesis.
11. Derive the time-dependent Schrödinger wave equation and reduce it to the time-independent form. Discuss the physical significance of the wave function.
12. Explain commutating and non-commutating operators with examples. Show that position and momentum operators do not commute by computing their commutator.
13. Solve the Schrödinger equation for a particle in a one-dimensional box and obtain the allowed energy levels and eigenfunctions.

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