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 - APRIL 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. Define inertial and non-inertial frames of reference with examples.
2. Define phase velocity and group velocity. Derive their mathematical expressions.
3. What are the necessary conditions for a wave function to be well-behaved?
4. Describe the basic postulates of wave mechanics.
5. Discuss the qualitative treatment of the barrier penetration problem.
6. Derive the Lorentz transformation equations and explain their significance.
7. Illustrate the uncertainty principle using the electron diffraction experiment and discuss its implications.
8. Explain why a differential wave equation is needed to describe quantum systems.

Section C

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

9. Explain the Michelson-Morley experiment and discuss how its negative results led to the development of the theory of relativity.
10. Describe Davisson and Germer's experiment and explain how it confirms the wave nature of electrons.
11. Derive the time-dependent Schrodinger wave equation and explain its significance.
12. (a) Define operators in quantum mechanics and explain the difference between commutating and non-commutating operators with examples.
    (b) What is a commutator? Derive the commutator relation for position $(\hat{x})$ and momentum $(\hat{p})$ operators.
13. Apply Schrodinger wave equation for particle in a box and discuss the solution outcomes.

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