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.
M.Sc. - END SEMESTER EXAMINATIONS NOVEMBER - 2022
SEMESTER - II

**20PPHCT2005 - Quantum Mechanics - II**

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

## Section A

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

1. Deduce an expression for scattering length for S-wave.
2. Discuss Born approximation and obtain an expression for scattering cross-section.
3. Derive an expression for transition probability per unit time based on time dependent Perturbation theory.
4. Discuss selection rules for dipole and forbidden transitions.
5. Use Dirac's equation to show that electron is endowed with a spin ½.
6. Explain various properties of gamma matrices.
7. Elaborate Feynman's theory of positron.
8. Define annihilation, creation and number operators based on second quantization. Obtain expressions for them.

## Section B

### Part A

Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. Apply the method of partial wave analysis to deduce an expression for the differential cross-section for elastic scattering by spherically symmetric potential.
10. Deduce an expression for magnetic moment of electron due to spin.
11. Prove the relativistic invariance of the Dirac equation under Lorentz transformation.
12. Discuss the theory of second quantization of Klein Gordan equation and obtain an expression for Dirac field.

### Part B

Compulsory question $(1 \times 10 = 10$ Marks)

13. Apply time dependent perturbation theory to semi classical theory of radiation and prove that transition probabilities of absorption and emission between any pair of states are the same.

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