**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 APRIL - 2022**
**SEMESTER - II**
**20PPHCT2005 - Quantum Mechanics - II**

**Total Duration : 3 Hrs.** **Total Marks : 60**

## Section A

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

1. Discuss a) Ramseur-Townsend effect
   b) Optical theorem in low energy scattering theory.
2. Explain the theory of adiabatic approximation in detail.
3. Show that the two components of positive and negative energy solutions describe the spin up and spin down states
4. Discuss Feynmans theory of pair production and annihilation.
5. Show that the creation and annihilation operators commute for any two **k** and **k'** but do not commute among themselves.
6. If the incident energy is small, the S-wave ($l$=0) only is effective. Establish this using effective range theory.
7. Construct density matrix for a spin $1/2$ system.
8. Derive klein-Gordon equation and explain its significance.

## Section B

### Part A

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

9. Apply time dependent perturbation theory to harmonic perturbation and derive expression for transition probability per unit time.
10. Obtain the plane wave solutions of Diracs equation and explain the significance of negative energy states.
11. Give the four contravariant Gamma matrices and list their important properties.
12. Discuss the second quantization of Klein-Gordon field and derive expression for creation and annihilation operators.

### Part B

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

13. Discuss Born approximation applied to scattering of high energy scattering.

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