M.Sc. DEGREE EXAMINATION,NOVEMBER 2019
I Year II Semester
Quantum Mechanics - II

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. Define scattering amplitude.
2. Define phase shift of the l-th partial wave.
3. What do you mean by adiabatic perturbation?
4. What are density operator and density matrix?
5. Write the names of two particles obeying Dirac equation.
6. What do you mean by Lorentz covariance of an equation.
7. What is pair creation and pair annihilation?
8. Draw the Feynman diagram for Compton effect and electron – electron scattering.
9. Discuss how a four vector transforms under a Lorentz transformation.
10. Write down the Lagrangian density associated with Klein-Gordon field.
11. Define differential and total cross sections.
12. Mention any two remarks of Klein-Gordon equation.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Find the differential cross section using partial wave analysis.
14. The perturbation ( ) at $V_t =$ e , 0 < a <<1 is switched on at t $= -\infty$ and the initial state of the system is pi . Determine the probability amplitude of finding the system in the fth state at time t.
15. Obtain Klein–Gordon relativistic equation for a free particle.
16. Discuss the adiabatic approximation in detail.
17. Write the Hamiltonian of electromagnetic field in terms of creation and annihilation operators.
18. What is Fermi-Golden rule? Explain transition to continuum states.
19. Write down the expression for the scattering amplitude in first Born approximation and express the scattering cross section in the approximation.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Explain the method of partial wave analysis to calculate the phase shifts and scattering amplitude
21. Develop a perturbation theory applicable for harmonic perturbation.
22. Determine the energy values of a Dirac particle in a coulomb potential.
23. Discuss about the relativisitc invariance of the Dirac equation.
24. Obtain the classical field equation in terms of Lagrangian density.

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