Time : Three hours   Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1.   (a)   Construct Green's function for an outgoing wave in scattering problem.

Or

     (b)   Write a short note on low energy scattering.

2.   (a)   Give the time dependent perturbation for a harmonic perturbation.

Or

     (b)   Write a short note on sudden approximation.

3.   (a)   Derive an expression for the magnetic moment of an electron due to spin.

Or

     (b)   Obtain the Dirac's equation for a free particle and find its solution.

4. (a) Explain the covariant formulation of Dirac's equation.

Or

(b) Obtain the plane wave solutions of the Dirac's equation for the free particle.

5. (a) Discuss the covariance of commutation relations for the Klein -Gordon field.

Or

(b) How does quantization of Dirac field cause problems? And how did Dirac solve them?

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. What is Born approximation? And state the condition for its validity. Give the interpretation of phase shift and deduce optical theorem.

7. Discuss the first order time dependent perturbation theory and derive the Fermi - Golden rule for the transition rate from a given initial state to a final state of continuum.

8. Give a simple derivation of Klein - Gordon equation. What type of particles obey this equation? Discuss the difficulties associated with the interpretation of this equation and how they have been overcome.

9. Show that Dirac's equation is invariant under Lorentz transformation.

10. Explain the meaning of second quantization. Discuss the second quantization of non - relativistic Schrödinger's field.