

**ADVANCED QUANTUM THEORY****Unit – I**

Klein-Gordan Equation: Negative energy, Probability density and energy levels in H-atom, Dirac equation, Free particle Dirac Equation, Covariant Formulation, Lorentz Covariance of Dirac equation, Bilinear co-variants and transformation properties, algebra of Dirac  $\gamma$ -matrices, plane wave solutions, negative energy states and Dirac hole theory. Spin of Dirac electron.

**Unit – II**

Dirac Equation in an electromagnetic field and non-relativistic correspondence, Orthonormality and Completeness relation for spinors, H-atom in Dirac theory.

**Path integral Quantization:** Propagator in Path integral approach, free particle propagator, equivalence of path integral method to Schrödinger equation, propagator for Harmonic Oscillator.

**Unit – III**

Field Theory: Lagrangian formulation of system with infinity degrees of freedom, Real scalar field, Variational Principle and Noether's Theorem, Energy momentum Tensor, Angular momentum Tensor, Complex scalar field, Dirac field and electromagnetic field

**Texts and References:**

1. J.D. Bjorken and D.S. Drell, McGraw-Hill: Relativistic Quantum Mechanics (Vol. - I) (Vol. - II)
2. L.H. Ryder, Cambridge University Press: Quantum Field Theory
3. B.K. Agarwal : Quantum Mechanics and Field Theory
4. L. Schiff, McGraw-Hill: - Quantum Mechanics
5. R.P. Feynman and A.R. Hibbs, Dover Publications Inc: Quantum Mechanics and Path integral
6. C. Itzykson and J.B. Zuber, McGraw-Hill : Quantum Field Theory