

THIRD SEMESTER

MPYC-301 (ADVANCED QUANTUM MECHANICS & QUANTUM FIELD THEORY)

Marks-100

Unit-I

Relativistic Quantum Mechanics:

Klein-Gordon equation and its drawbacks, need for Dirac equation, Properties of Dirac matrices, Non-relativistic reduction of Dirac equation, magnetic moment, Darwins term, Spin-Orbit coupling, Poincare transformation, Lorentz group, Covariant form of Dirac equation, Bilinear covariants, Gordon decomposition.(12)

Unit-II

Free particle solution of Dirac equation, Projection operators for energy and spin, Physical interpretation of free particle solution, Zitterbewegung, Hole theory, Charge conjugation, space reflection and time reversal symmetries of Dirac equation. Continuous systems and fields. Transition from discrete to continuous systems, Lagrangian and Hamiltonian Formulations, Noether's theorem.(13)

Unit-III

Quantization of free fields:

Second quantization, Equal Time Commutators, Normal Ordering, covariant quantization of electromagnetic field, Quantization of scalar, e.m, and Dirac fields, Propagators for scalar, spinor and vector fields(15)

Books:

1. Advanced Quantum Mechanics - J.J. Sakurai
2. Relativistic Quantum Mechanics - J.D. Bjorken and S.D. Drell Relativistic Quantum Fields - J.D. Bjorken and S.D. Drell Quantum Field Theory - F. Mandl and G. Shaw

Reference books:

1. Quantum Field Theory - C. Itzykson and J. Zuber Quantum Field Theory - M. E. Peskin and D. V. Schroeder
2. Quantum Field Theory - L. H. Ryder
3. Quantum Field Theory - S. Weinberg