Quantum Field Theory - Video course

COURSE OUTLINE

This is an advanced elective course for the students at the M.Sc level who are interested to pursue their carrier in Theoretical High Energy Physics, Theoretical Condensed Matter Physics or Experimental High Energy Physics.

The course aims to introduce basic concepts in Quantum Field Theory which will enable the students to compute tree level scattering cross sections and also to give elementary idea on renormalization.

COURSE DETAIL

Topics	No. of Lectures (1 hr each)
Canonical Quantization: General Formulation. Conjugate Momentum and Quantization. Neutral Scalar Field. Commutation Relations, Normal Ordering, Bose Symmetry, Fock Space. Charged Scalar Field. U(1) Invariance, Charge Conservation, Particles and Antiparticles. Time Ordered Product, Feynman Propagator for Scalar Fields, Bose-Einstein Distribution, Propagators at Finite Temperature.	8
Dirac Field: The Dirac Equation, Relativistic Covariance. Anti-Commutators. Quantization of the Dirac Field, Electrons and Positrons. Connection between Spin and Statistics. Discrete Symmetries, Parity, Charge Conjugation, Time Reversal, CPT Theorem.	6
Gauge Field: Gauge Invariance and Gauge Fixing. Quantization of the Electromagnetic Field, Propagator, Vacuum Fluctuations.	6
Interacting Theory and Elementary Processes: Wick's Theorem. Feynman Rules and Feynman Diagrams for Spinor Electrodynamics, Lowest Order Cross-Section for Electron-Electron, Electron-Positron and Electron-Photon Scattering.	15
Elementary Ideas on Radiative Corrections and Renormalization.	5

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Physics

Pre-requisites:

Classical Mechanics, Quantum Mechanics, Classical Electrodynamics and Classical Field Theory.

Coordinators:

Dr. Prasanta Tripathy
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References:

1. Quantum Field Theory, C. Itzykson and J. B. Zuber, McGraw-Hill Book Co, 1985.
2. Quantum Field Theory, L. H. Ryder, Cambridge University Press, 2008.
3. Field Theory, A Modern Primer, P. Ramond, Benjamin, 1980.
4. The Quantum Theory of Fields, Vol I, S. Weinberg, Cambridge University Press, 1996.
5. Introduction to The Theory of Quantum Fields, N. N. Bogoliubov and D. V. Shirkov, Interscience, 1960.
6. An Introduction to Quantum Field Theory, M. E. Peskin and D. V. Schroeder, Westview Press, 1995.