

Quantum Field Theory 1 Syllabus.

- I. Interacting fields and Feynman diagrams
 - Canonical quantization of Klein-Gordon and Dirac fields
 - Perturbation theory and Feynman diagrams
 - S-matrix

- II. Functional methods
 - Path Integral in quantum mechanics
 - Generating functional
 - Functional quantization of fields

- III. Renormalization
 - Perturbation theory for scalar (ϕ^4) theory
 - Divergent Feynman diagrams
 - Dimensional regularization
 - Renormalization schemes

- IV. Renormalization Group equations
 - Wilsonian RG
 - Callan Symanzik equations
 - Running of coupling constants

Additional topics to be discussed if time permits

- V. Critical phenomena

- VI. Quantum Electrodynamics
 - Path integral with fermions
 - Vacuum polarization

- VII. Non-Abelian Gauge Field theory.
 - Quantum Chromo-Dynamics

- VIII. Symmetry and Symmetry breaking
 - Higgs mechanism
 - Superfluidity and Superconductivity

Prime book:

M.E. Peskin and D.V. Schroeder, "An Introduction to Quantum Field Theory"

Additional books:

S. Weinberg, "The Quantum Theory of Fields "

P. Ramond, "Field Theory : Modern Primer"

C. Itzykson and J-P. Zuber, "Quantum Field Theory"

L. Zinn-Justin, "Quantum Field Theory and Critical Phenomena"

J.J. Bjorken and S.D. Drell, "Relativistic Quantum Fields"