

## **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 ( $\phi^4$ ) 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"