Syllabus 831 (D. Zeppenfeld)

Introduction

Klein Gordon equation

Lorentz group
- representation theory
- Lie groups, Lie algebras
- field transformations: Klein Gordon, Dirac, vector fields

Dirac equation. plane wave solutions

Lagrangian field theory
- equations of motion
- symmetries (Noether's theorem)
- gauge symmetries, gange fields

Canonical (second) quantization of spin $0, \frac{1}{2}, 1$ fields
- creation and annihilation operators
- Fock space
- propagators
- Gupta Bleuler quantization of photon

Path integrals
- 1 dimensional, 1 particle systems
- functionals, functional derivatives
- field theory systems

S-matrix, LSZ reduction formula

Perturbation theory
- Feynman rules for QED
- cross sections, decay rates
- radiative corrections

Second semester (832)
- Quantization of nonabelian gauge theories
- spontaneous symmetry breaking, Higgs mechanism
- Renormalization, renormalization group
- Anomalies
- Standard Model
- Model building
- Supersymmetry