Course Objectives:

The course introduces the different scattering process, symmetries of high energy particles. It also details the standard theoretical models employed in particle physics.

UNIT 1: Scattering Processes

Relativistic kinematics, phase space, Mandelstam variables, Feynman rules, lifetimes and cross-sections, Golden rule; scattering of a spinless charged particle by electromagnetic field, scattering of electrons by electromagnetic field,e−μ scattering, Moller scattering, electron-proton scattering and form factors, higher order corrections, vacuum polarization, charge renormalization, Lamb shift,g−2

UNIT 2: Symmetries and Quarks

Discrete symmetries, isospin-SU(2), G-parity, SU(3)-classification of mesons and baryons, mass formula, magnetic moments, motivation for colour as an internal symmetry.

UNIT 3: Parton Model and QCD

Deep inelastic scattering (DIS) of electrons on nucleons, structure functions and scale invariance, Bjorken scaling, parton model; quantum chromodynamics:Lagrangian, symmetries.

Beta-decay, μ-decay, parity violation,V−A theory of weak interactions, conserved vector current (CVC) hypothesis.

UNIT 4: Standard Model and Neutrino Physics


Neutrino Physics: neutrino oscillations.

Reference Books:

**Course Outcomes:**
After the completion of the course student is expected to:

CO1: Be familiar with main theoretical concepts and experimental techniques used in elementary particle physics
CO2: Be able to make quantitative estimates of cross-sections etc. of basic elementary particle processes
CO3: Have a basic understanding of the Standard Model and of theoretical methods employed in particle physics

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