Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NPHD505	HIGH ENERGY PHYSICS	3	0	0	3

Prerequisite: Mathematical Physics, Quantum Mechanics, Electrodynamics, Statistical Mechanics

Course Objective

- To teach the students some high level physical concepts of sub-nuclear or particle physics;
- To specialize them for research on very advanced scientific problems of both experimental and theoretical physics in the area of fundamental nuclear particles and their interactions.

Learning Outcome

The course will let the students learn about fundamental particles, their interactions and conservations laws, quark model, different symmetries, Gauge theories, quantum electrodynamics and quantum chromodynamics.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Natural units; four fundamental interactions, leptons and hadrons, historical introduction to the elementary particles, Gell-Mann eightfold way	7	This unit will help students aware of elementary particles and its classification.
2	Quark model, Concept of colour, Bound states of quarks, Decays and conservation laws.	4	This topic will help students learn about various decays and conservation laws involving elementary particles.
3	Relativistic kinematics, Lorentz Covariance, Collisions.	5	This topic will help students understanding mechanism of particle colliders.
4	Symmetries and groups, SU(2) of Isospin, Flavour symmetries, SU(3) flavour group, construction of hadronic wave functions, Parity, Charge conjugation, CP violation, Weak Interactions.	10	This unit will help students various symmetries in terms of groups.
5	Gauge Theories, Lagrangians in relativistic field theory, Noether's theorem: symmetries and conservation laws, U(1) local gauge invariance and QED Lagrangian	6	In this unit, Students will about gauge theories and gauge interactions.
6	Non-Abelian Gauge Invariance, Yang-Mills Theory, Spontaneous Breaking of Gauge symmetry, Higgs Mechanism, Feynman diagrams and elementary particle dynamics	7	In this topic, students will learn about gauge invariance and Feynman diagrams of various fundamental interactions. .
7	Quantum Chromodynamics, The Standard Model, Grand Unification	3	This unit gives an overview of advanced topics like QCD and grand unification.
	Total	**42**	

Text Books:

1. Introduction to Elementary Particles, David J. Griffiths.
2. Introduction to High Energy Physics, Donald Perkins.
3. Quarks and Leptons: An Introductory Course in Modern Particle Physics, Francis Halzen and Alan Martin.

Reference Books:

1. Elementary Particle Physics, Stephen Gasiorowicz.
2. Relativistic Quantum Mechanics, James Bjorken and Sidney Drell.
3. Modern Elementary Particle Physics; Gordon Kane.
4. Gauge Theory of Elementary Particle Physics; T. P. Cheng and L. F. Lee, Oxford University Press 1984.