18BSP505					Nuclear and Particle Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	0	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To introduce properties of nuclei and details of popular nuclear models.
- To derive and discuss properties of nuclear decays and nuclear reactions in brief.
- To familiarize with the fundamental forces and the dynamics of elementary particles under these forces.
- To overview basic relativistic quantum mechanics and quantum electrodynamics for particle physics.

UNIT 1 PROPERTIES OF THE NUCLEUS **14 Hrs.**

Nuclear Sizes and Densities, Nuclear Masses and Abundances, Binding Energy, Nuclear mass, Semi empirical formula, valley of stability, Drip Lines, Nuclear Forces. Nucleon mean potential, approximation by specific solvable potentials, single particle energy levels, magic number, The Liquid Drop Model, The Shell Model, Predictions of the Shell Model, The Collective Model.

UNIT 2 RADIOACTIVITY AND NUCLEAR REACTIONS **16 Hrs.**

Gamow theory and branching ratios. Beta decay: energetics, angular momentum and parity selection rules, Elementary ideas of Fermi theory. Fermi and Gamow - Teller transition probabilities, Kurie plot and mass of a neutrino. Gamma decay: energetics, Mossbauer effect, angular momentum and parity selection rules, Detectors and Accelerators, Nuclear reactions, Nuclear Fission, Fusion.

UNIT 3 ELEMENTARY PARTICLES AND INTERACTIONS **14 Hrs.**

Nucleon Forces, Isospin, Pions, Leptons, Strangeness, Families of Elementary Particles, classification of particles: leptons and quarks and gauge bosons. Quark model: meson and baryon, Structure of protons and neutrons, Observed Interactions and Conservation Laws.

UNIT 4 BASIC INTRODUCTION TO PARTICLE PHYSICS **16 Hrs.**

Introduction, Evidence for Partons, Unitary Symmetry and Quarks, Extensions of SU(3)—More Quarks, Color and the Color Interaction, Introduction to Gauge Theories, Quantum Chromodynamics, Electroweak Theory, Grand Unification and the Fundamental Interactions.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Describe basic properties of nuclei, nuclear interactions, nuclear structure and reactions.

CO2 – Identify the strengths and limitations of various nuclear models.

CO3 – Relate theoretical predictions and measurements of Quantum mechanical reasoning in classification of processes in subatomic world.

CO4 – Apply the knowledge of basic laws of conservation and momentum in the determination of particle properties and properties of processes in the subatomic world.

CO5 - Work on elementary problem solving in nuclear and particle physics, and relating theoretical predictions and measurement results.

CO6 – Demonstrate the ability to critically evaluate the results in nuclear and particle physics.

TEXT/REFERENCE BOOKS

1. Nuclear Physics by V. Devanathan. Narosa Publishing House, Delhi.
2. Nuclear Structure Vol. 1 & 2., Aaghe Bohr & Ben R. Mottelson, World Scientific.
3. Fundamentals In Nuclear Physics, Jean-Louis Basdevant, James Rich, Michel Spiro, Springer.
4. Introductory Nuclear Physics, Samuel S. M. Wong, Wiley-Vch.
5. Source Book on Atomic Energy, Samuel Glasstone, Litton Educational Publishing.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: <Details>	<> Marks
Part B/Question: <Details>	<> Marks