Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NPHC510	Nuclear and Particle Physics	3	0	0	3

Course Objective
Thecourseestablishesafoundationofnuclearscienceandtechnologywithinthephysicsstudentsandhelpsthemtoprepareforhigherstudiesand research in the relevant fields.
Learning Outcomes
1. After attending the course, the students will be acquainted with various important aspects of nuclear science. 2. The students will be familiar with the nuclear systematic, stability, two nucleon problems, detector sand accelerators, nuclear reactions and elementary particles. 3. The students will develop a skill to be a successful researcher in the field of nuclear physics.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Nuclear global properties: the N-Z chart, nuclear masses, densities, radii, spin, parities, electric and magnetic moment	7	This unit covers the external and internal properties of nucleus.
2	Two Nucleon Problems: Nature of nuclear forces, Meson theory of nuclear forces, Deuteron problem, Nucleon-Nucleon scattering, scattering length, coherent and incoherent scattering, effective range theory.	5	This unit will help the students to get knowledge about different types of nuclear potentials and strong and short range attractive forces between nucleons.
3	Energetics and stability against particle emission: Gamow's theory of Alpha decay, Fermi theory of Beta decay, Double beta decay, Gamma decay, Weisskopf Units, Internal conversion. Nuclear isomerism, Nuclear Resonance Fluorescence	8	Students will understand the mechanism behind different types of nuclear decay and the irrelated reactions.
4	Nuclear Reactions: Conservation laws, Classification, Compound Nucleus theory, Continuum and Statistical theories, Cross-sections, Breit-Wigner formula, Direct Reactions, Fusion and Fission, Nuclear Reactions in Cosmos and High Energy Collisions	9	To know the conservation laws of different nuclear reactions and understand the mechanism of nuclear reactions through compound nucleus theory, fission, fusion and heavy ion collision.
5	Elementary particles: Leptons, Mesons and Baryons, Concept of antiparticle, discrete symmetries and conservation laws, weak interactions (nuclear and particle decays, neutrinos etc.), Isospin and strangeness, Gellmann-Nishijima formula, quark model, colour, resonances, SU(3) classification, flavour of standard model.	6	This unit will help in classifying the elementary particles and to know about their characteristics. Students will know about the four fund amental forces of Universe, Quark Model and Standard Model.
6	Selected experimental techniques: Radioactive Ion Beam and evolution of nuclear properties, Ion Colliders, Ion-optical devices and associated detectors, Angular correlation studies; Lifetime measurements; Detection of gamma rays; Hp-Ge and other detectors; Gamma arrays.	7	Students will develop knowledge about the cutting-edge research in this field and the associated state-of-the-art detection system.
	Total	**42**	

Text Books:

1. Basic Ideas and concepts in Nuclear physics, An introductory approach; Heyde, K.,Institute of Physics Publishing 2004
2. Introductory Nuclear Physics; Krane Kenneth S. Edition, reprint. Publisher, Wiley India, 2008.
3. Nuclear Physics; Ghoshal, S.N.,S. Chand and Company 2000.

Reference Books:

1. IntroductoryNuclearPhysics;SamuelSMWong;PHILearning;2010.
2. Introduction to Nuclear reactions; Bertulani, C.A. and Danielewicz, P, Institute of Physics Publishing 2004
3. Symmetry Principles Particle Physics; WMGibson andBRPollard;CambridgeUniversityPress;2010.
4. Symmetry Principles in Particle Physics; JMEmmerson;Oxford UniversityPress;1972.
5. Introduction of Elementary Particles; Griffith. D, John Wiley 2000.
6. Nuclear and Particle Physics; Burchamand Jobes;Longman PublishingGroup;1994.