

Course Title	NUCLEAR PHYSICS
Course Code	MPHY-434
Credit Hours	CH3
Pre- requisites	MPHY-332
Learning outcomes	To describes the fundamental principles and concepts of nuclear physics.
Contents	Properties of Nucleus: Basic Properties of Nucleus, nuclear size, mass, radius, binding energy and semi-empirical mass formula, applications of semi-empirical mass formula, nuclear spin, magnetic dipole moment, electric quadrupole moment, parity, Nuclear Force, nature of nuclear force between nucleons, the deuteron, properties of the nuclear force. Radioactive Decays: basic alpha decay processes, quantum theory of alpha decay and explanation of observed phenomena, angular momentum and parity in alpha decay, measurement of β-ray energies, Fermi theory of β-decay, angular momentum and parity selection rules, neutrino hypothesis, double beta decay, parity violation in beta decay, theory of gamma decay, multipolarity of gamma-rays, angular momentum and parity selection rules. Nuclear Models and Reactions: Nuclear shell model, Nuclear Reactions, types of nuclear reactions and conservation laws, Coulomb scattering, nuclear scattering, Q-value of nuclear reaction, threshold energy, cross section from nuclear reactions, compound nucleus theory of nuclear reactions, direct reactions, Nuclear fission, description of fission reaction, mass distribution of fission fragments, average number of neutrons released, fission cross-section, chain reaction, controlled fission reactions, fission reactors. Nuclear fusion, basic fusion processes, energy released in nuclear fusion, solar fusion, p-p cycle, CNO cycle, controlled nuclear fusion, D-D and D-T reactions.
Teaching-learning Strategies	Classroom teaching / Lecturing
Assignments- Types and Number	Problem sheet: 3-4
Assessment and Examinations	Mid-Term Assessment: 35% Formative Assessment: (25%): It includes classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc. Final Term Assessment: 40%
Text Books	1. Introductory Nuclear Physics by K. Krane, Wiley (1980) 2. Nuclear and Particle Physics by Burcham, E. E. and Jobes, M., Longman (1995) 3. Nuclear and Particle Physics by Martin, R. B., John Wiley (2006) 4. Nuclear Physics by I. Kaplan, Addison-Wesley (1980). 5. Nuclear Physics in a nutshell, by C.A. Bertulani, Princeton, (2007). 6. Nuclear Physics by A. Kamal, Springer, (2014) 7. Foundations of Nuclear and Particle Physics, Donnelly and Formaggio, Cambridge (2017) 8. Nuclear Physics: Principles and Applications by J. Lilley, John Wiley (2013).