Part A: Introduction				
Program: **Degree Course**		Class: **B.Sc.**	Semester: **Sixth**	Session:**2024-2025**
1	Course Code	**PSE – 06T**		
2	Course Title	**Nuclear & Particle Physics**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	NO		
5	Course Learning Outcomes (CLO)	**After completion of the course students will be able to –** • Understand Nuclear Force and Nuclear Models • Analyze the semi empirical mass formula and its applications using liquid drop model and shell model • Understand the concept of Nuclear Decay Processes • Interpret the Classification of nuclear reactions Understand the Classification of elementary Particles and their Quantum Numbers		
6	**Credit Value**	**Theory : 3**		
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks :40**	

Part B: Content of the Course

Total Hours: 45

Unit	Topic	Number of Hours
I	**General Properties of Nuclei**: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.	12
II	**Nuclear Models**: Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic umbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.	11
III	**Radioactivity decay**: (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, (b) Beta-decay: energy kinematics for Beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. **Nuclear Reactions:** Types of Reactions, Conservation Laws, kinematics of reactions-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).	11
IV	**Nuclear Detector:** Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation 32 Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si & Ge) for charge particle and photon detection (concept of charge carrier and mobility).	11

	Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.	