MP-07
NUCLEAR PHYSICS & PARTICLE PHYSICS
(Questions will be set from each unit/section with internal choice)

Units	Topics
I	**Basic Properties of Nuclei:** Methods for determination of nuclear size and their interpretations (experimental details not required) Binding energy curve for nuclei and its consequences Numerical problems) Nuclear spin. Magnetic and quadrupole moments of nuclei (with experimental determination) Schimidit's lines. Semiemprical mass formula and its application to mass parabolas. Mirror nuclei and isotopic spin formalism.
II	**Nuclear Force and Two Body Problem:** Basic properties of deuteron, its binding energy, size, spin, magnetic and quadrupole moments. Existence of excited states of deuteron (solution of spherically symmetric square well potential for higher angular momentum states), n-p scattering at low energies with specific square well potential results of low energy n-p and p-p scattering. Their spin dependence and scattering length. Qualitative discussion of the effective range theory. Theory of n-p and p-p scattering (excluding mathematical derivation. Results of the theory to be assumed). Various types of two body nuclear forces, Elementary idea of Yukawa theory of nuclear forces.
III	**Nuclear Models and Nuclear Reactions:** Liquid drop model and fission, Asymmetryc in fission and spontaneous fission. Nuclear shell model. Spin orbit coupling, Magnetic and quadrupole moments and the nuclear shell structure of elementary idea of collective model of the nucleus. Conservation loss of nuclear reactions Q value and threshold energy of a nuclear reaction. Nuclear reaction cross section and level width, Bohr compound nucleus theory of nuclear reaction. Deuteron stripping reaction. Briet-Wegner single level formula.
IV	**Nuclear Decay:** Decay and nature of Beta ray spectrum. Nentrino hypothesis. Fermi theory of Beta decay allowed and forbidden transitions parity violation in Beta decay. Concept of helicity. Multipole transition and selection rules for the decay of the nuclei selection rules (results without mathematical derivation). Internal conversion coefficients Isomeric nuclei. Angular correlation of successive decay.
V	**Elements of Particle Physics** **Elementary Particles:** classification and their interaction, concept of quantum number Isospin hypercharge, strangeness, Leptons and Baryon numbers. Invariance, concept variation laws and selection rules in relation to particle production and decay of charge conjugation, parity invariance and time reversal with simple application in particle physics, Elementary idea SU(2) and SU (3) Results of group theory be assumed. Gelleman Okebo mass formula (without derivation) and its application to mass spectra of particles qualitative idea of quark Lepton family and quatum chromodynamics.