

SYLLABUS

Paper C: Nuclear and Particle Physics

(60 Hrs.)

- Unit-I:** Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge, Binding energy, angular momentum, magnetic moment and electric multiple moments of the nucleus. Wave mechanical properties of nucleus, Average Binding energy and its variation with mass number. Properties of nuclear force and saturation, Nonexistence of in the nucleus and neutron-proton model, Assumption of liquid drop model, semiempirical mass formula, conditions of nuclear stability, Fermi gas model, Nuclear Shell Model, Experimental evidence of magic numbers and its explanation.
- Unit-II:** Radioactivity, Modes of decay, and successive radioactivity. Alpha emission, electron emission, positron emission, electron capture, gamma-ray emission, internal conversion, Qualitative discussion of alpha, beta and gamma-ray spectra. Geiger-Nuttal rule, Neutrino hypothesis of beta decay. Evidence of existence of neutrino. Qualitative discussion of alpha and beta decay theories. Nuclear Reactions, Reaction cross section, conservation laws, Kinematics of nuclear reaction. Q-value and its physical significance, compound nucleus, possible reaction with high energy particles.
- Unit-III:** Energy loss due to ionization (Bethe Block formula), Energy loss of electrons, Bremsstrahlung, Multiple Coulomb scattering, Gamma-ray through matter, pair production, radiation loss by fast electrons. radiation length, electron-positrons annihilation, Cyclotron, Betatron, qualitative discussion of Synchrotron, Collider machines and Linear accelerator.
- Unit-IV:** Ionisation chamber, proportional counter, G.M. Counter, Scintillation counter, Solid State detectors. Sub-atomic particles and their masses, lifetimes, decay modes, classification of these particles, types of interactions. Conservation laws and quantum numbers, concepts of isospin, strangeness, charge conjugation, antiparticles, introduction to quarks and qualitative discussion of the quark model.
- Unit-V:** Spread over entire syllabus of unit I to IV as above.