

FPYC-902: NUCLEAR AND PARTICLE PHYSICS

Marks-100

Unit-I

General nuclear properties: Radius, mass, binding energy, nucleon separation energy, angular momentum, parity, electromagnetic moments, excited states.

Two Nucleon Problem:

Central and noncentral forces, deuteron and its magnetic moment and quadrupole moment; Force dependent on isospin, exchange force, charge independence and charge symmetry of nuclear force, mirror nuclei. Nuclear models:

Liquid drop model, fission, magic numbers, shell model, analysis of shell model predictions, beta stability line, collective rotations & vibrations, Nuclear Structure: Form factor and charge distribution of the nucleus, Hofstadter form factor. (15)

Unit-II

Nuclear reaction:

Energetics of nuclear reaction, conservation laws, classification of nuclear reaction, radio active decay, radio active decay law, production and decay of radioactivity, radioactive dating, alpha decay: Gamow theory and branching ratios, beta decay: energetic angular momentum and parity selection rules, compound nucleus theory, resonance scattering, Breit- Wigner formula, Fermi's theory of beta decay, Selection rules for allowed transition, parity violation. (10)

Unit-III

Particle Physics:

The Standard model of particle physics, particle classification, fermions and bosons, lepton flavors, quark flavors, electromagnetic, weak and strong processes, Spin and parity determination, Isospin, strangeness, hypercharge, and baryon number, lepton number, Gell-Mann-Nishijima Scheme, Quarks in hadrons: Meson and baryon octet, Elementary ideas of SU(3) symmetry, charmonium, charmed mesons and B mesons, Quark spin and colour(15)

BOOKS:

1. Nuclear physics, Satyaprakash.
2. Nuclear and Particle Physics, Mital, Verma, Gupta.
3. Nuclear Physics, Dr. S. N. GHOSAL.
4. Atomic and Nuclear physics, Shatendra Sharma.