

2009-10

SSP-S 228

**DEPARTMENT OF PHYSICS**

**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics

IISemester

(w.e.f 2009-10 batch)

**P204,SP204: NUCLEAR AND PARTICLE PHYSICS**

**UNIT - I**

**INTRODUCTION :**

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, Energy levels, mirror nuclei.

**NUCLEAR FORCES** : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, charge independence and charge symmetry of nuclear forces, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

**UNIT - II**

**NUCLEAR MODELS** : Liquid drop model:, Weissacker's semi-empirical mass formula, Mass - parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model., More-realistic models

**NUCLEAR DECAY** : Alpha decay process, Energy release in Beta-decay, Fermi's Theory of  $\beta$  - decay, selection rules, parity violation in  $\beta$  -decay, Detection and properties of neutrino, . Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

**NUCLEAR REACTIONS** : Types of reactions and conservation laws, the Q - equation, Optical model, heavy ion Reactions

**UNIT - III**

**NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

**ELEMENTARY PARTICLE PHYSICS:** Particle interactions and families, symmetries and conservation laws ( energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number( Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, SU(2), SU(3) multiplets, Quark model.

**UNIT - IV**

**DETECTING NUCLEAR RADIATION:** Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

**ACCELERATORS:** Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

**APPLICATIONS OF NUCLEAR PHYSICS:** Trace Element Analysis, Rutherford Back-scattering, Mass spectrometry with accelerators, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

**TEXT BOOKS :**

. "Introductory Nuclear Physics" Kenneth S. Krane

**Reference Books:**

1. "Introduction to Nuclear Physics " Harald A. Enge
2. "Concepts of Nuclear Physics " Bernard L. Cohen.
3. " Introduction to High Energy physics" D.H. Perkins
4. " Introduction to Elementary Particles" D. Griffiths

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