

2000-2001

SEMESTER SYSTEM (SYLLABUS)

M.Sc., Physics, M.Sc., Material Science, M.Sc., Space Physics
and M.Sc., (Tech.) Electronics.

(With Effective from 2000 - 2001 Admitted Batch)

II SEMESTER

SSP - S204

P204. NUCLEAR 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 (H.A. Enge Chapter 1) 5 Hrs.

NUCLEAR FORCES: The deuteron: Introduction, experimental data, simple theory of the deuteron, root mean square radius, spin dependence of nuclear forces, tensor forces, scattering cross-sections, qualitative discussion of neutron-proton and proton-proton scattering, exchange forces, characteristics of nuclear forces, meson theory of nuclear forces (Yukawa's potential) H.A. Enge Chapter 2, 3. 10 Hrs.

NUCLEAR MODELS: Liquid drop model: introduction, Weissacker's semi-empirical mass formula, mass-parabolas. Nuclear shell model: magic numbers, prediction of angular momenta for ground states, Schmidt's lines, concept of isospin, Collective model: rotational and vibrational states. H.A. Enge Chapter 6. 10 Hrs.

UNIT - II.

ALPHA DECAY: Stability of heavy nuclei against breakup, the Geiger-Nuttall law, Gamow's theory of α - decay (barrier penetration) H.A. Enge Chapter 10. 5 Hrs.

BETA - DECAY: Beta ray spectra, neutrino hypothesis, simple theory of β - decay (Fermi's theory of β - decay), Curie plots, comparative half-lives, selection rules, parity violation in β - decay, Electron capture. H.A. Enge Chapter 11. 5 Hrs.

GAMMA DECAY: Multipole moments, selection rules, angular correlation, internal conversion, measurement of life times of excited states, Mossbauer effect. H.A. Enge Chapter 9. 5 Hrs.

NUCLEAR REACTIONS: Introduction, reaction dynamics, the Q - equation, neutron spectroscopy, different types of nuclear reactions. H.A. Enge Chapter 13. 5 Hrs.

NUCLEAR ENERGY: The fission process, stability against spontaneous fission, neutrons released in fission process, delayed neutrons, fission reactor operating with natural uranium (neutron cycle and four factor formula), Nuclear fusion, carbon-nitrogen cycle, prospect of continued fusion energy H.A. Enge Chapter 14. 5 Hrs.

REFERENCES:

- Introduction to Nuclear Physics, Harald A Enge, Addison - Wesley Pub. Co. (1983)
- The Atomic Nucleus, R.D. Evans, Tata Mc.Graw Hill Co.
- Nuclear Physics, Irving Kaplan, Addison - Wesley Publishing.
- Nuclear Physics, D C Tayal, Himalaya Publishing, Bombay.
- Quarks and Particles, E. Segre, Benjamin Inc. (1965).
- Concepts of Nuclear Physics, Bernard L. Cohen, Tata McGraw Hill Co. (1987)