M. Sc. II Year		MPH-C401			Semester-IV
		PHYSICS OF NUCLEI & PARTICLES			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

NUCLEAR INTERACTION AND NUCLEAR REACTIONS

Nucleon: nucleon interaction, Exchange forces and tensor forces, Meson theory of nuclear forces, Nucleon-nucleon scattering, Effective range theory- Spin dependence of nuclear forces, Charge independence and charge symmetry of nuclear forces, Iosospin formalism ,Yukawa interaction.

Direct and compound nuclear reaction mechanisms, Cross sections in terms of partial wave amplitudes, Compound nucleus, Scattering matrix, Reciprocity theorem, Breit-Wigner formula. **(12 Lectures)**

UNIT-II

NUCLEAR MODELS

Liquid drop model, Bohr-Wheeler theory of fission, Experimental evidence for shell effects, Shell model, Spin-orbit coupling, Magic numbers, Angular momenta and parities of nuclear ground states, Qualitaive discussion and estimates of transition rates, Magnetic moments and Schmidt lines, Collective model.

(12 Lectures)

UNIT-III

NUCLEAR DECAY

Alpha decay, Beta-decay, Fermi theory of beta decay, Shape of the beta spectrum, Total decay rate, Angular momentum and parity selection rules, Comparative half lives, Allowed and forbidden transitions, Selection rules, Parity violation, Two component theory of neutrino decay, Multipole transitions in nuclei : Angular momentum and parity, Selection rules, Internal conversion, Nuclear isomerism. **(12 Lectures)**

UNIT-IV

ELEMENTARY PARTICLES

Types of interaction between elementary particles, Hadrons and leptons, Symmetry and conservation laws, Elementary ideas of CP and CPT invariance, Classification of hadrons, Lie algebra, SU(2), SU(3) multiplets, Quark Model, Gell-Mann, Okubo mass formula for octet and decuplet hadrons, Charm, Bottom and top quarks. **(12 Lectures)**

UNIT-V

NUCLEAR INSTRUMENTATION

Ionization chamber, Geiger-Muller counter, Scintillation counter, Semiconductor detecctor, Bubble chamber, Spark chamber, Nuclear Emulsions, Cerenkov Counters, Van De Graff accelerator, Cyclotron, Phase stability principle, Synchrotrons, Colliding beam, Betatron, Basic introduction to large hadron collider (LHC).

(12 Lectures)

Text Books / Reference Books

1. Nuclear Physics - I. Kalplan, Narosa, Madras
2. Atomic nucleus - R. D. Evans, McGraw Hill, N York
3. Concepts of Nuclear Physics - B.L. Cohen, MGH, Bombay, 1971
4. Nuclear Physics - R.R. Roy and B.P. Nigam, Wiley- Eastern Ltd., 1983
5. Introduction to Experiemntal Nuclear Physics - R.M. Singru, John Wiley & Sons
6. Atomic and Nuclear Physics vol.2 - Ghoshal,
7. Introduction to nuclearPhysics- H.A. Enge, Addison -wesley, 1975
8. Introduction to high energy Physics - P.H.Perkins, Addison-wesley, London, 1982
9. Quarks, Leptons - F. Halzen and A.D. Martin, John Wiley & sons, N York
10. Modern Elementary Particle Physics- G. Kare, Edition Wiseley