Established Under Gujarat Private Universities Act No. 9 of 2016

Syllabus for Master of Science

Physics

Subject Code: 02PY0552

Subject Name: Nuclear Physics

M.Sc. Year-II, Sem.-IV

Objective: To get the exposure of Nuclear Physics and its applications in Nuclear Power reactors and in preparation of radioactive elements.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, post graduate will be able to

- Learn the analytical techniques for studying the Structural, Microstructural, Optical and Transport properties.
- Understand the most advanced imaging instruments and their workings.
- Apply knowledge of physics as a basic science in solving real life and scientific problems
- Apply knowledge of physics to become successful in national level examinations like NET, SLAT, GATE etc.
- Engage in research in the field of pure and applied physics and involve in life-long learning

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	0	0	4	50	30	20	25	25	150

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Contents:

Unit	Topics	Contact Hours
1	**Nuclear charge and composition** Distribution of Nuclear charge, Bainbridge and Jordan mass spectrograph, Neir mass spectrometer. Mass spectrometers, Theories of nuclear composition, Proton-electron theory, Proton- neutron theory, Neutron-positron theory, Anti-proton-neutron theory.	12
2	**Nuclear Forces and fundamental interactions** Theories of nuclear composition, Proton-electron theory, Proton- neutron theory, Neutron-positron theory, Anti-proton-neutron theory, Interaction of nucleons in nucleus, Deutron ground state and spin dependence of nuclear forces, Exchange forces, Majorna forces, Barlett forces, Heisenberg forces	12
3	**Nuclear Models** Nuclear Models – Elementary account of the liquid drop model, Bohr-Wheeler Theory of Fission, The Shell Model, Evidence for Shell Model – Explanation of magic numbers, Prediction of Shell Model , Collective Model, Electric Quadrupole Moment,	12
4	**Nuclear Reactors: (Design & applications)** Revision of general concepts of nuclear fusion and fission, Nuclear chain reaction, four , factor formula, critical size and mass, various geo, metries, general aspects of reactor ,design, classification of nuclear reactors, researc h & productions reactors – Graphite , moderated, swimming pool, light water moderated; Power reactors : heavy water,moderated, fast breeder.	12
5.	**Nuclear decays** Alpha decay – Gamow theory, Bita decay – Fermi theory, Curie plots, neutrino, parity conservation violation in β decay, Wu's experiment. γ decay – Multipole radiation, selection rules.	12

	Total Hours	**60**

References:

1. Nuclear Physics, D.C. Tayal, Himalaya Publication.
2. Concepts of Nuclear Physics, B.L. Cohen(1971),Tata McGraw-Hill.
3. Introduction to Nuclear Physics,Samuel S.M.Wong,Prentice-Hall.
4. Atomic Physics by J B Rajam

Nuclear Physics, S. N. Ghoshal. S Chand and Company Pvt. Ltd. 2016

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.