Course Code	Course Title	L	T	P	C
BPHY403L	Atomic and Nuclear Physics	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To understand the foundations of atomic and nuclear structure.
2. To gain knowledge about origins of various atomic spectra.
3. To know the science of X-rays and their practical applications.
4. Gain insight into radioactive nature of materials and energy production through nuclear processes.

Course Outcomes

1. Obtain knowledge about the origins of understanding the atoms.
2. Gain insights into various models that explained the atomic and nuclear structure.
3. Realize the importance of various experiments which led to proper knowledge of atoms and nucleus.
4. Employ the knowledge of X-rays in various practical domains.
5. Understand the properties of nucleus.
6. Realize the fundamentals and applications of radioactivity and nuclear energy.

Module:1	Atomic Structure	7 hours

Cathode rays and positive rays (Review) - Determination of electron charge - Structure of atom - Rutherford alpha particle scattering - Atomic spectra of Hydrogen atom - Rydberg constant - Bohr atom model - Atomic excitation - Frank Hertz experiment

Module:2	Atom Models and Many electron systems	6 hours

Sommerfeld model - Vector atom model - Quantum numbers – Pauli's exclusion principle - LS and JJ Coupling schemes - Lande g factor - Bohr magneton

Module:3	Atoms in Electric and Magnetic Fields	7 hours

Fine structure of spectral lines - Sodium D, Alkali and Helium - Zeeman and Anomalous Zeeman effect - Larmour theorem - Paschen Bach effect - Stark effect - Stern Gerlach experiment

Module:4	X-Ray Spectroscopy	6 hours

Nature of X-rays - Discrete and continuous X-ray spectra - Duane and Hunt's Rule - X-Ray Diffraction - Bragg's law - Simple crystal structure determination - X-ray emission spectra - Mosley's law and its applications - Uses of X-rays - Applications: Health and Materials

Module:5	Properties of Nuclei	6 hours

Nuclear Structure and composition - Isotopes, Isobars, Isotones - Nuclear Properties - size, mass, charge, spin, magnetic moment - Binding energy

Module:6	Nuclear Models	5 hours

Nuclear forces - Nuclear models - Liquid drop Model - Nuclear stability - Absence of electrons inside nucleus - Shell model - Magic Numbers

Module:7	Radioactivity	6 hours

Radioactivity - Half life - Qualitative understanding of alpha, beta and gamma decay - Radioactive dating – Applications - Nuclear Medicine - Radiation Dosage - Nuclear Energy Production (Fission and Fusion)		
Module:8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Arthur Beiser, Shobit Mahajan, S. Rai Choudhary, Concepts of Modern Physics, 2017, 7th Edition, Tata McGraw Hill, India.
2.	I. Kaplan, Nuclear Physics, 2012, Narosa Publishing Company, India.
Reference Books	
1.	R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics, 2019, 18th Edition, S. Chand Publishing, India.
2.	S. N. Ghoshal, Nuclear Physics, 2019, S. Chand Publishing, India.
3.	Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2008, 3rd Edition, Brooks Cole.
4.	K. Gopalakrishnan, Atomic and Nuclear Physics, 2012, 4th Edition, MacMillan,
5.	India.
6.	J. B. Rajam, Atomic Physics, 2010, S. Chand Publishing, India.
	Henry Semat and John Albright, Introduction to Atomic and Nuclear Physics, 1972, 5th Edition, Chapman & Hall.
Mode of Evaluation: CAT, Written Assignment, Quiz and FAT	

Recommended by Board of Studies	20-06-2023		
Approved by Academic Council	No. 70	Date	24-06-2023