ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER	**PHYSICS**	TIME: 3 HRS./WEEK
PH 4403 (3)	**MODERN PHYSICS**	MAX. MARKS: 100
w.e.f.20AH	**SYLLABUS**	

COURSE OBJECTIVES:

- *Gain insight into the nucleus of the atom and various concepts principles, and measurements regarding radioactive radiations.*
- *Acquire wider knowledge of nuclear structure, nuclear detectors, accelerators and gives a practical outlook regarding nuclear reactors, nuclear power plants and accelerators.*
- *Progress to higher studies in nuclear physics.*
- *Gain insight into classical and quantum aspects in the behavior of particles and dualistic nature of matter and light.*
- *Develop an awareness of spectra of different elements and their fine structures and an analytical study of different spectroscopic observation.*

COURSE OUTCOMES:

- *To know the concept of quantum theory of light and to recognize the x-ray diffraction and Bragg's law.*
- *To have an idea of Thomson and Rutherford atomic model and Bohr's atom model.*
- *The student will learn the concept of photoelectric effect, Compton effect, Raman effect.*

UNIT – I: ATOMIC AND MOLECULAR PHYSICS:

Introduction –Drawbacks of Bohr's atomic model- Somerfield's elliptical orbits-relativistic correction (no derivation). Vector atom model and Stern-Gerlach experiment - quantum numbers associated with it. L-S and j-j coupling schemes. Zeeman Effect and its experimental arrangement.

Raman Effect, hypothesis, Stokes and Anti Stokes lines. Quantum theory of Raman Effect. Experimental arrangement – Applications of Raman effect.

UNIT – II: MATTER WAVES & UNCERTAINTY PRINCIPLE:

Matter waves, de Broglie's hypothesis - wavelength of matter waves, Properties of matter waves - Davisson and Germer experiment – Phase and group velocities. Heisenberg's uncertainty principle for position and momentum (x and p), & energy and time (E and t). Experimental verification - Complementarity principle of Bohr.

UNIT – III: QUANTUM (WAVE) MECHANICS:

Basic postulates of quantum mechanics-Schrodinger time independent and time dependent wave equations-derivations. Physical interpretation of wave function. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

UNIT – IV: GENERAL PROPERTIES OF NUCLEI:

Basic ideas of nucleus -size, mass, charge density (matter energy), binding energy, angular momentum, parity, magnetic moment, electric moments. Liquid drop model and Shell model (qualitative aspects only) - Magic numbers.

RADIOACTIVITY DECAY: Alpha decay: Basics of α-decay processes. Theory of α-decay, Gamow's theory, Geiger Nuttal law. β-decay, Energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis.

UNIT – V: DETECTORS AND ACCELERATORS: Ionization chamber - GM counter – proportional counter – cloud chamber – Bubble chamber - scintillation counter – solid state detector – need for accelerators – Linear accelerators – Van de Graff generator -The Lawrence cyclotron – synchro cyclotron – synchrotron - Betatron– problems.

REFERENCE BOOKS:

1. Nuclear Physics and introduction by S.B. Patel (Wiley Eastern Ltd., Delhi)1992
2. Nuclear Physics by D.C. Tayal (Himalaya Pub. House, Bombay)1993
3. Concepts of Nuclear Physics by Bernard L Cohen (Tata McGraw Hill, Delhi)1988
4. Modern Physics by R. Murugeshan (S. Chand & Co., Delhi)1998
5. Unified Physics – Vol. 4 - S.L. Gupta and Sanjeev Gupta (Jai Prakash Nath & Co., Meerut) 1992 (Prescribed)
6. Quantum Mechanics by Gupta, Kumar and Sharma (Jai Prakash Nath & Co, Meerut) 1985
7. Introduction to Quantum Mechanics Agarwal and Jain (Pragati Prakashan Pub., Delhi) 1998.
8. Atomic Physics by J.B. Rajam (S. Chanda & Co. Delhi) 1980.

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