COURSE 10: MODERN PHYSICS

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The course on Modern Physics aims to provide students with an understanding of the principles of modern physics and their applications in various fields.

LEARNING OUTCOMES:

On successful completion of this course, the students will be able to:

1. Understand the principles of atomic structure and spectroscopy.
2. Understand the principles of molecular structure and spectroscopy
3. Develop critical understanding of concept of Matter waves and Uncertainty principle.
4. Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
5. Increase the awareness and appreciation of superconductors and their practical applications

UNIT-I: Introduction to Atomic Structure and Spectroscopy:

Bohr's model of the hydrogen atom -Derivation for radius, energy and wave number - Hydrogen spectrum, Vector atom model – Stern and Gerlach experiment, Quantum numbers associated with it, Coupling schemes, Spectral terms and spectral notations, Selection rules. Zeeman effect, Experimental arrangement to study Zeeman effect.

UNIT-II: Molecular Structure and Spectroscopy

Molecular rotational and vibrational spectra, electronic energy levels and electronic transitions, Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect. Spectroscopic techniques: IR, UV-Visible, and Raman spectroscopy

UNIT-III: Matter waves & Uncertainty Principle:

Matter waves, de Broglie's hypothesis, Properties of matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle for position and momentum & energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit) and photons (Gamma ray microscope).

UNIT-IV: Quantum 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 (one-dimensional potential box of infinite height (Infinite Potential Well)

UNIT-V: Superconductivity:

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect, London's Equation and Penetration Depth, Isotope effect, Type I and Type II superconductors, BCS theory, high Tc super conductors, Applications of superconductors

REFERENCE BOOKS

1. BSc Physics, Vol.4, Telugu Akademy, Hyderabad
2. Atomic Physics by J.B. Rajam; S.Chand& Co.,
3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
5. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
6. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
7. K.K.Chattopadhyay&A.N.Banerjee, Introd.to Nanoscience and Technology(PHI Learning Priv. Limited).
8. Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
9. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath and J Murday-Universities Press-IIM