MODERN PHYSICS

1.1 Course Number: PY112
1.2 Contact Hours: 2-1-0 Credits: 8
1.3 Semester-offered: 1st Year- Even
1.4 Prerequisite: Class 12th level Physics and Mathematics
1.5 Syllabus Committee Member: Dr. A. Shukla (C), Dr. A. Sharma, Dr. V. Amoli

2. **Objective:**

This course is intended as a modern physics course to strengthen basic modern physics concepts required for engineering students. Basic elements of modern physics based on quantum physics and relevant information on atomic structure and spectra, are included in the syllabus. Students taking this course should enter in higher standards of engineering program with a solid conceptual understanding of the fundamental physical laws, how these laws can be applied to solve many problems, and how physics is relevant to the world around them. The course helps in developing the understanding required for a broad range of engineering applications and examples. In this regard, attempts will be made to answer questions such as: What holds molecules together, how electrons move, tunnel through barriers, and how microscopic world is connected to macroscopic phenomenon through quantum mechanics.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Basics elements of Modern Physics	Failure of classical physics: Black body radiation; Photoelectric effect; Compton effect. de Broglie waves, Wave particle Duality, Davisson- Germer experiment (electron diffraction experiment), Matter waves, Particle and wave packets, Uncertainty principle.	7
2		Wave function, Schrodinger's time independent equation and its Applications- Particle trapped in a 1-D box and 3-D box. Expectation values, Potential barrier and Quantum tunneling effect.	7
3	Applications of Modern Physics	Atomic & Molecular Spectra: Hydrogen atom (radial equation), Brief idea of Atomic and molecular spectra (rotational, vibrational and rotational-vibrational spectra of diatomic molecules), Introduction to Laser, laser systems (He-Ne and Ruby Lasers) and applications	7

4		Introduction to Solid State Physics & Devices: Band theory of Solids Conductors, insulators and semi-conductors; Hall effect; Intrinsic and Extrinsic semiconductors; Temperature variation of Fermi energy, p-n junction and Transistor; Introduction to Superconductivity and types of superconductors	7
		Total	**28**

4. Readings

4.1 Textbooks:

1. Concepts of Modern Physics A. Beiser
2. Modern Physics by P.A. Tipler and R.A. Liewellyn.
3. Physics for Scientists and Engineers Raymond A. Serway and John W. Jewett
4. Physics: Principles with Applications Douglas C. Giancoli

4.2 Reference books:

1. Modern Physics: for Scientist and Engineers by John Morrison, Publisher: Academic Press; 1st edition.

2. University Physics with Modern Physics by Hugh D. Young, Roger A. Freedman and Lewis Ford.

3. Solid State Physics, Solid State Device and Electronics by C M Kachhava, New Age International, 2003.

5 Outcome of the Course:

This course is designed so that the students learn basic and essential concepts of Modern Physics with some of its main applications, which may be further useful for higher learning in different branches of engineering and develop analytical and problem solving skills for variety of problems. On completion of this course, the students will be able to develop understanding for variety of areas in the physics including quantum physics, atomic and molecular spectroscopy and solid-state physics/devices. Furthermore, this course will further help students to understand the fundamental physics behind the emerging areas of physics such as lasers and superconductors.