

## Physics

**Course Title:** Physics

**Course No.:** PHY113

**Nature of the Course:** Theory + Lab

**Semester:** I

**Full Marks:** 60 + 20 + 20

**Pass Marks:** 24 + 8 + 8

**Credit Hour:** 3

**Course Description:** This course covers the fundamentals of physics including oscillations, electromagnetic theory, and basics of quantum mechanics, band theory, semiconductors and universal logic gates and finally physics of manufacturing integrated circuits.

**Course Objectives:** The main objective of this course is to provide knowledge in physics and apply this knowledge for computer science and information technology.

### Course Contents:

#### Unit 1: Rotational Dynamics and Oscillatory Motion (5 Hrs.)

Moment of inertia and torque, Rotational kinetic energy, Conservation of angular momentum, Oscillation of spring: frequency, period, amplitude, phase angle and energy

#### Unit 2: Electric and Magnetic Field (5 Hrs.)

Electric and magnetic field and potential, Force on current carrying wire, magnetic dipole moment, Force on a moving charge, Hall effect, Electromagnetic waves

#### Unit 3: Fundamentals of Atomic Theory (8 Hrs.)

Blackbody radiation, Bohr atom, Spectrum of Hydrogen, Franck-Hertz experiment, de Broglie's hypothesis and its experimental verification, Uncertainty principle and its origin, matter waves and the uncertainty principle, group velocity.

#### Unit 4: Methods of Quantum Mechanics (5 Hrs.)

Schrodinger theory of quantum mechanics and its application, Outline of the solution of Schrodinger equation for H-atom, space quantization and spin, Atomic wave functions

#### Unit 5: Fundamentals of Solid State Physics (6 Hrs.)

Crystal structure, Crystal bonding, Classical and quantum mechanical free electron model, Bloch theorem, Kronig-Penny model, Tight-binding approximation, conductors, insulators and semiconductors, effective mass and holes.

#### Unit 6: Semiconductor and Semiconductor devices (8 Hrs.)

Intrinsic and extrinsic semiconductors, Electrical conductivity of semiconductors, Photoconductivity, Metal-metal junction: The contact potential, The semiconductor diode, Bipolar junction transistor (BJT), Field effect transistor (FET).

#### Unit 7: Universal Gates and Physics of Integrated Circuits (8 Hrs.)

Universal gates, RTL and TTL gates, Memory circuits, Clock circuits, Semiconductor purification: Zone refining, Single crystal growth, Processes of IC production, Electronic component fabrication on a chip.

**Laboratory Works:**

Students should be able to perform at least one experiment from units 1, 2 and 5, 6, 7. The details of the experiment will be provided in the manual.

**Text Books:**

1. Garcia Narciso, Damask Arthur, Physics for Computer Science Students, Springer-Verlag

**Reference Books:**

1. Heliday David, Resnick Robert and Walker Gearl, Fundamentals of Physics, 9<sup>th</sup> ed., John-Wiley and Sons, Inc.
2. Francis W. Sears, Hugh D. Young, Roger Freedman, Mark Zemansky, University Physics, Volume 1 & 2, 14<sup>th</sup> ed., Pearson Publication
3. Knight Randall D., Physics for Scientists and Engineers: A Strategic Approach, 3<sup>rd</sup> ed., Pearson Publication