

# Department of Physics

## Program Specific Outcomes (PSO)

### B.Sc. (Physics):

- PSO1: Students completing this course will have understanding of matter through courses like solid state physics, atomic and molecular physics, nuclear physics etc.
- PSO2: Students will acquire introductory knowledge of theoretical course like mathematical methods of physics, classical and quantum mechanics.
- PSO3: Skills of computer programming in C language will be developed.
- PSO4: Technical skills will be inculcated through project course.
- PSO5: Able to solve problems in physics.

### M.Sc. (Physics):

- PSO1: Students pursuing this course will develop thorough knowledge of fundamental laws of nature through various branches of Physics like classical and quantum mechanics, electrodynamics, statistical physics etc.
- PSO2: Students will also develop practice of using different mathematical methods required in science .
- PSO3: Problem solving skills are also developed.
- PSO4: Knowledge of electronic devices and its day-to-day applications are also developed.
- PSO5: Understanding of different experimental and analytical techniques like microscopy, spectroscopy, X-ray diffraction will be developed.

## Course Outcomes (CO)

### F.Y. B.Sc. Physics

#### Term I:

##### PHY111: Mechanics

- CO1: Demonstrate an understanding of Newton's Laws and its applications in simple system.
- CO2 : Understanding of basic concepts of energy, work and power.
- CO3 : Understanding of physical properties like elasticity, viscosity, surface tension.
- CO4: Use of Bernoulli's theorem in real life

##### PHY112: Physics principles and applications

- CO1: Understanding of electromagnetic spectrum and waves.
- CO2: Understanding of structure of atom and hydrogen atom spectrum.
- CO3: Understand the atomic excitation and laser principles.
- CO4: to demonstrate quantitative problem solving skills in all the topics covered.

#### Term II:

##### PHY121: Heat and Thermodynamics

- CO1: Understanding of concepts of thermodynamics and equation of state
- CO2: Applications of Laws of thermodynamics for a process
- CO3: Understanding of refrigerators, heat pumps and thermometers
- CO4: Knowledge of entropy and latent heat

##### PHY122: Electromagnetics

- CO1: Understanding of electric force field and potential for stationary charges
- CO2: Knowledge of Coulombs, Gauss , Biot-Savart and Amperes law
- CO3: Understanding of magnetization of materials
- CO4: To develop problem solving skills

##### PHY123: Physics Practical

- CO1: Acquire technical and manipulative skills in using laboratory equipments, tools and materials.  
CO2: Understanding of lab procedures including safety and scientific techniques.  
CO3: Skill development in collaborative learning and teamwork in lab setting.

## **S.Y. B.Sc. Physics**

### **Term I:**

#### **PHY211: Mathematical Methods in Physics**

- CO1: Understanding of complex Algebra  
CO2: Understanding of partial differentiation and its use in physics.  
CO3: Understanding of vector algebra and singular points of physics

#### **PHY212: Electronics/ Instrumentations**

- CO1: Understanding of Laws of electrical circuits.  
CO2: Understanding of solid state semiconductor devices like transistors, OPAMP  
CO3: Understanding of Boolean Algebra and logic circuits

### **Term II:**

#### **PHY221: Oscillations, Waves and sound**

- CO1: Understanding of equation of motion in different types of oscillations  
CO2: Understanding of basic concepts of energy exchange in oscillations  
CO3: Understanding of Doppler effect and its applications in real life

#### **PHY222: Optics**

- CO1: Acquire basic concepts of wave-optics  
CO2: Understanding of optical phenomenon such as interference, diffraction, polarization, birefringence etc.  
CO3: Learn optical instruments like microscopes and IP's

#### **PHY223: Physics Practical**

- CO1: Design experiments to test hypothesis and /or determination of unknown quantities  
CO2: To develop skill of data analysis, plotting graphs and drawing conclusions  
CO3: Investigate theoretical background of an experiment

## **T.Y. B. Sc. Physics**

### **Term I:**

#### **PH331: Mathematical methods of Physics**

- CO1: Introduced to curvilinear coordinate system.  
CO2: Solve of Legendre, Hermite and Bessel differential equations.  
CO3: Introduced to special theory of relativity.

#### **PH332: Classical Electrodynamics:**

- CO1: Understand fundamentals of Electrostatics.  
CO2: Understand fundamentals of Magnetostatics.  
CO3: Understand fundamentals of Electrodynamics.

#### **PH333: Classical Mechanics:**

- CO1: Understanding of mechanics of system of particles and scattering of particles.  
CO2: Understanding of Motion of object in central force field.  
CO3: To set up Lagrangian and Hamiltonian formulation.

#### **PH334: Atomic and Molecular Physics:**

- CO1: Understanding of atomic structure and spectra.  
CO2: study of one and two electron systems.  
CO3: Introduction to various spectroscopies.

#### **PH335: Computational Physics:**

- CO1: Develop skills of C-language programming for solving physics problems.

**PH336: Astronomy and Astrophysics:**

CO1: Basic knowledge of astronomical bodies like star systems, galaxies, dark matter.

CO2: Study of astronomical instruments.

**PH347: Laboratory course I**

CO1: Handling of optical and measuring instruments

CO2: Learn to verify basic constants in physics

CO3: To verify laws of physics experimentally

**Term II :****PH341: Solid State Physics:**

CO1: Understanding of crystal structure and types of Bravais lattices.

CO2: Study of X-ray diffraction technique.

CO3: Introduced to band theory of metals.

CO4: Study of magnetic properties of solids.

**PH342: Quantum Mechanics:**

CO1: Introduction to modern physics and development of quantum mechanics.

CO2: Setting up Schrodinger's steady state equation.

CO3: Problems like potential well, potential barrier, step, hydrogen atom

CO4: Introduction to operators.

**PH343: Thermodynamics and statistical physics:**

CO1: Introduction of Kinetic theory of gases.

CO2: Importance of Maxwell's relation

CO3: Knowledge of Random walk problem.

CO4: Types of ensembles.

CO5: Introduction to Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.

**PH344: Nuclear Physics:**

CO1: Understand properties of nucleus.

CO2: Study of Radioactivity.

CO3: Knowledge of types of nuclear forces and nuclear reactions.

CO4: Knowledge of types of particle accelerators.

**PH345: Electronics:**

CO1: To know basic components like diode and its types, BJT, FET

CO2: Study of amplifiers and its types.

CO3: Introduction to power supplies.

CO4: Details of Digital electronics.

**PH346: Microcontroller:**

CO1: Understand the Architecture of 8051.

CO2: Develop skill of assembly language programming.

CO3: Methods of serial communication and Interfacing.

**PH348: Laboratory course II**

CO1: C-programming Skills

CO2: Knowledge of microcontroller programming

**PH349: Laboratory course III (Project)**

CO1: To develop skills of independent working

CO2: Learn Literature survey

CO3: Designing of physics/electronics experiments

CO4: To Develop writing and presentation skills

**M. Sc. (Physics)****Semester I:****PHYUT501: Classical Mechanics:**

- CO1: Set up Lagrangian and Hamiltonian formulation.
- CO2: Introduction to Canonical transformations and Poissons brackets.
- CO3: Basics of Non-inertial frame of reference.
- CO4: Information of Central force field problems.

**PHYUT502: Electronics:**

- CO1: Study of special function IC's like 555, 556, 565, OPAMP.
- CO2: Study of types of power supplies.
- CO3: Understanding of Digital Electronics, Use of K-Map.
- CO4: To know basics of analog to digital and digital to analog converter types.

**PHYUT503: Mathematical methods of physics:**

- CO1: Get familiar with Matrix Algebra.
- CO2: Introduction to operators.
- CO3: Uses of Special functions like Legendre, Bessel.
- CO4: Uses of Fourier series, Fourier and Laplace transforms.

**PHYUT504: Atoms and Molecules:**

- CO1: To know basics of Atomic structure and atomic spectra.
- CO2: Understanding of molecular spectra.
- CO3: To get familiar with ESR, NMR and X-ray diffraction techniques.

**PHYUT505: Experimental Techniques I:**

- CO1: Introduction to vacuum physics.
- CO2: Study of various types of vacuum pumps.
- CO3: Study of vacuum measuring gauges.

**PHYUP506: Physics Lab I**

- CO1: Understanding of optical instruments
- CO2: Introduced to magnetism related experiments
- CO3: develop experimental skills

## **Semester II:**

**PHYUT601: Electrodynamics:**

- CO1: Understand principles of multipole expansions and time varying fields.
- CO2: Derivations of Energy, force and momentum relations for electromagnetic wave.
- CO3: Introduction of inhomogenous wave equations and relativistic mechanics.

**PHYUT602: Solid State Physics:**

- CO1: Understand band theory of solids.
- CO2: Know about Diamagnetism and paramagnetism in solids.
- CO3: Know about Ferromagnetism, anti-ferromagnetism and ferrimagnetism in solids.

**PHYUT603: Quantum Mechanics I:**

- CO1: Representation of state of system.
- CO2: Using Dirac and Delta notations.
- CO3: Concept of Angular Momentum.
- CO4: Introduction to types of approximation methods

**PHYUT604: Lasers:**

- CO1: To understand principles of Interaction of radiation with matter, Einstein's coefficients.
- CO2: To know basics of two, three and four level laser systems.
- CO3: Study of various laser systems like He-Ne, N<sub>2</sub>, CO<sub>2</sub>, Nd:YAG, Ruby, Excimer, Dye lasers.
- CO4: To know applications of lasers.

**PHYUT605: Experimental Techniques II:**

- CO1: Get information of radiation sources, detectors and sensors.
- CO2: Practice of Structural characterization and thermal analysis.
- CO3: Practice of Morphological and Magnetic characterization.
- CO4: Practice of Spectroscopic analysis.

### **PHYUP606: Physics lab II (Electronics)**

CO1: Design skills of electronic circuits

CO2: Handling of electronic instruments

CO3: understanding of basic concepts of electronic devices

### **Semester III:**

#### **PHYUT701: Statistical Mechanics:**

CO1: Understanding of statistical description and thermodynamics of particles.

CO2: To get knowledge of classical statistical mechanics.

CO3: Applications of statistical mechanics and quantum distribution functions.

CO4: To understand basics of Ideal Bose and Fermi systems.

#### **PHYUT702: Physics of Semiconductor devices:**

CO1: Understand Properties of semiconductors.

CO2: Working principles and construction of pn junction diode.

CO3: Working principles and construction of junction transistor and field-effect devices.

CO4: Working principles and construction of Metal and MIS devices.

#### **PHYUT703: Communication Electronics:**

CO1: To get knowledge of digital communication.

CO2: To know basics of Broadband communication systems.

CO3: Technology used in telephone and facsimile systems.

CO4: Basics of satellite communication.

#### **PHYUT704: Electronic Instrumentation I:**

CO1: Introduction to measurement systems.

CO2: To get information of transducers and its types.

CO3: To understand principles of signal conditioning and data acquisition systems and data converters.

CO4: Knowledge of Indicators, display systems and recorders.

#### **PHYDP705: Special lab I**

CO1: Understanding of sensors

CO2: Knowledge of communication circuits

CO3: Designing of instrumentation circuits

#### **PHYUP706: Physics lab III (Computational physics)**

CO1: Understanding of computational methods

CO2: Knowledge of C-language

CO3: Development of programming skills

### **Semester IV:**

#### **PHYUT801: Nuclear physics:**

CO1: To understand general properties and concepts of nuclei.

CO2: To know about radiation detectors and nuclear models.

CO3: To understand basics of reaction dynamics, nuclear reactors and accelerators.

CO4: knowledge of nuclear interactions and particle physics.

#### **PHYUT802: Material science:**

CO1: Understand properties of materials and defects in solids.

CO2: Basics of solid solutions and diffusion in solids.

CO3: To know metallurgical thermodynamics.

CO4: To get knowledge of phase diagrams.

#### **PHYUT803: Microwave Physics and applications:**

CO1: Discussion of Passive elements of microwave systems.

CO2: To know impedance matching, wave-guides and its components.

CO3: Discussion of active elements of microwave systems.

CO4: To get familiar with Microwave other devices and measurements.

**PHYUT804: Electronic Instrumentation II:**

CO1: Introduction to process control.

CO2: Basics of discrete state process control.

CO3: Understanding the controller principles and types.

CO4: Introduction to modeling, simulation and Matlab programming.

**PHYDP805: Special lab II**

CO1: Understanding of sensors

CO2: Knowledge of MATLAB programming

CO3: Use of MATLAB for electronics and physics simulations