DEPARTMENT OF PHYSICS
COURSE OUTCOMES

CORE 1 MATHEMATICAL PHYSICS -1

Revise the knowledge of calculus, vectors, vector calculus, probability and probability distributions. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering. Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries. Learn the Dirac delta function its properties, which have applications in various branches of Physics, especially quantum mechanics. In the laboratory course, learn the fundamentals of the C and C++ programming languages and their applications in solving simple physical problems involving interpolations, differentiations, integrations, differential equations as well as finding the roots of equations.

Training in calculus will prepare the student to solve various mathematical problems. It helps them to develop an understanding of how to formulate a physics problem and solve given mathematical equation risen out of it.

CORE 2 MECHANICS

Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. Write the expression for the moment of inertia. Understand the phenomena of collisions and idea about center of mass and laboratory frames and their correlation. Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity. Understand simple principles of fluid flow and the equations governing fluid dynamics. Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation. Appreciate the nuances of Special Theory of Relativity (STR). In the laboratory course, the student shall perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.

Learn basics of the kinematics and dynamics linear and rotational motion. Learn the concepts of elastic in constant of solids and viscosity of fluids . Develop skills to understand and solve the equations of Newtonian Gravity and central force problem. Acquire basic knowledge of oscillation. Learn about inertial and non-inertial systems and essentials of special theory of relativity

CORE 3 ELECTRICITY AND MAGNETISM

Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges. Apply Gauss's law of electrostatics to solve a variety of problems. Describe the magnetic field produced by magnetic dipoles and electric currents. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric. Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction. Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor. In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism such as Lenz's law, Faraday's law and learn about the construction. Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

This course will help in understanding basic concepts of electricity and magnetism and their applications. Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

CORE 4: WAVES AND OPTICS

Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems. Apply basic knowledge of principles and theories about the behavior of light and the physical environment to conduct experiments. Understand the principle of superposition of waves, so thus describe the formation of standing waves.

Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings, experiment, Fresnel Bi-prism etc.

This course in basics of optics will enable the student to understand various optics phenomena, principles, workings and applications optical instruments.

CORE - 5: MATHEMATICAL PHYSICS-II

Learn the Fourier analysis of periodic functions and their applications in physical problems such as vibrating strings etc. Learn about the special functions, such as the Hermite polynomial, the Legendre polynomial, the Laguerre polynomial and Bessel functions and their differential equations and their applications in various physical problems such as in quantum mechanics which they will learn in future courses in detail. Learn the beta, gamma and the error functions and their applications in doing Apply the Scilab software in curve fittings, in solving system of linear equations, generating and plotting special functions such as Legendre polynomial and Bessel functions, solving first and second order ordinary and partial differential equations..

Training in mathematical tools like calculus, integration, series solution approach ,special function will prepare the student to solve ODE, PDE's which model physical phenomena. He / she shall develop an understanding of how to model a given physical phenomena such as pendulum motion, rocket motion, stretched string, etc., into set of ODE's, PDE's and solve them. These skills will help in understanding the behavior of the modeled system/s.

CORE-6 THERMAL PHYSICS

This basic course in thermodynamics will enable the student to understand various thermo dynamical concepts, principles.

CORE- 7 DIGITAL SYSTEMS AND APPLICATIONS

Acquire skills to understanding the functioning and operation of CRO to measure physical quantities in electrical and electronic circuits. Learn the basics of IC and digital circuits, and difference between analog and digital circuits. Various logic GATES and their realization using diodes and transmitters. Learn fundamental of Boolean algebra and their role in constructing digital circuits. Learn about combinatorial and sequential systems by building block circuits to construct multivibrators and counters. Understand basics of microprocessor and assembly language programming.

CORE 8 MATHEMATICAL PHYSICS-III

Knowledge of various mathematical tools like complex analysis, integral transform will equip the student with reference to solve a given ODE, PDE.

These skills will help in understanding the behavior of the modeled system/s.

CORE -9 ELEMENTS OF MODERN PHYSICS

Comprehend the failure of classical physics and need for quantum physics. Grasp the basic foundation of various experiments establishing the quantum physics by doing the experiments in laboratory and interpreting them. Formulate the basic theoretical problems in one, two and three dimensional physics and solve them. Learning to apply the basic skills developed in quantum physics to various problems in

I. Nuclear Physics.
II. Atomic Physics.
III. Laser Physics.

CORE 10 ANALOG SYSTEMS AND APPLICATIONS

Learn basic concepts of semiconductor diodes and their applications to rectifiers. Learn about junction transistor and their applications. Learn about different types of amplifiers including operational amplifier. (Op-Amp) and their applications. Learn about sinusoidal oscillators of various types and A/D conversion.

CORE 11 QUANTUM MECHANICS AND APPLICATIONS

This course shall develop an understanding of how to model a given problem such as particle in a box, hydrogen atom, hydrogen atom in electric fields. Many electron atoms, L-S and J-J couplings. These skills will help in understanding the different Quantum Systems in atomic and nuclear physics.

CORE-12: SOLID STATE PHYSICS

Learn basics of crystal structure and physics of lattice dynamics Learn the physics of different types of material like magnetic materials, dielectric materials, metals and their properties. Understand the physics of insulators, semiconductor and conductors with special emphasis on the elementary band theory of semiconductors. Comprehend the basic theory of superconductors. Type I and II superconductors, their properties and physical concept of BCS theory.

CORE -13: ELECTROMAGNETIC THEORY

Comprehend the role of Maxwell's equation in unifying electricity and magnetism.

Derive expression for

(i) Energy density

(ii) Momentum density

(iii) Angular momentum density of the electromagnetic field

Learn the implications of Gauge invariance in EM theory in solving the wave equations and develop the skills to actually solve the wave equation in various media like

(i) Vacuum

(ii) Dielectric medium

(iii) Conducting medium

Derive and understand associated with the properties, EM wave passing through the interface between two media like

(i) Reflection

(ii) Refraction

(iii) Transmission

(iv) EM waves

Learn the basic physics associated with the polarization of electromagnetic waves by doing various experiments for:

(i) Plane polarized light

(ii) Circularly polarized light

(iii) Circularly polarized light

Learn the application of EM theory to

(i) Wave guides of various types

(ii) Optical fibers in theory and experiment

CORE – 14 STATISTICAL MECHANICS

Learn the basic concepts and definition of physical quantities in classical statistics and classical distribution law. Learn the application of classical statistics to theory of radiation. Comprehend the failure of classical statistics and need for quantum statistics. Learn the application of quantum statistics to derive and understand.

1. Bose Einstein statistics and its applications to radiation.
2. Ferm -Dirac statistic and its applications to quantum systems.