

Department of Physics

Programme Outcome:

Course-Outcome of Physics Undergraduate Program.

The basic laws of physics, their corollaries, and comprehension of how they can be applied to explain specific natural phenomena as described in the mission statement of the physics undergraduate program. 2. Mathematical Physics: Students will express proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics. 3. Use of critical thinking, hypothesis building, and application of the scientific method to physics concepts, theoretical models and calculations, and laboratory experimentation. 4. Problem solving skills and relevant mathematical methods to approach, conceptualize, and achieve analytical or numerical solutions to physics problems. 5. Laboratory skills and exposure to a variety of important experiments at appropriate levels that illustrate phenomena discussed in the lecture classes. Instrumentation and experimental techniques; methods for quantitative analysis of data and measurement uncertainty. 6. General knowledge of the development of physics and the nature of scientific inquiry, particularly the progression from classical physics to the modern physics ideas of quantum mechanics, statistical mechanics, and relativity. 7. Contemporary areas of physics inquiry as introduced in interdisciplinary elective courses. 8. Written and oral communication skills for dissemination of scientific results in report, article, or oral presentation formats; standard citation methods; ethics in science and scholarship and its importance to scientific inquiry and professionalism.

Programme Outcomes

At the completion of under graduate programme, the student will be able to imbibe the following programme outcomes.

- Create logical reasoning and critical thinking through the knowledge that they acquired in classrooms, laboratory etc. and apply them in real-life situations.
- Internalize the significance of various academic as well as extracurricular activities that will enable them to become skilled professionals.
- Grow into accountable and empowered individuals who will emerge as scientists, entrepreneurs etc., and be employed in various governmental and non-governmental sectors.

- Attain expertise in communication skills, acquire moral and social values that keep one creative and compassionate human in all walks of life and turn out to be responsible citizens
- Build up self-esteem and ability to engage in independent and life-long learning in the context of an ever-changing world and competence to face challenges.
- Recognize the current local and global issues of environmental contexts and involves in activities that promote sustainable and green living

B.Sc. Physics (Honours) Programme Specific Outcomes

- Develop deep understanding of the various subjects of physics.
- Enhance practical and mathematical skills and competencies to conduct scientific experiments.
- Create analytical thinking and interpret the inferences from verbal, mathematical and graphical data.
- Develop problem solving skills and formulate questions from theoretical understanding of the subject.
- Equipped with knowledge to participate in the design and development of electronic systems.
- Ability to perform various task using their creativity, intellectual capacity, innovative thoughts and enthusiasm with precision and responsibility.
- Skill to organize events and transfer knowledge through fruitful communications and interact effectively with people from sundry backgrounds.
- Ascertain their area of interest in academic and R&D and get prepared for competitive exams.

SEMESTER I

CORET01: MATHEMATICAL PHYSICS

This paper helps in the following ways

Students will express proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics. This course enables the students to gain knowledge in differential equations which are essential to solve advanced problems in physics.

At the end of the course, students will be able to

Recapitulation of vectors, Vector Differentiation, Vector Integration, Orthogonal Curvilinear Coordinates

Introduction to Probability

formulate and solve the ordinary differential equations in physics;

describe the special polynomials and their properties;

Lagrange Multipliers.

Get acquainted with different coordinate systems and their applications in various kinds of problems in physics.

Attain knowledge on the importance of care to be taken while doing experiment and distinguish different types of errors that can involve in the experiment.

CORET02: MECHANICS

Fundamental of Dynamics & Rotational dynamics

Fluid Motion

Gravitational Field

Understand superposition of waves.

Define simple harmonic motion and deduce total energy of SHM.

Analyze the theory of various oscillations and resonance.

Study the elastic behaviour and working of torsional pendulum

Study of bending behaviour beams and analyse the expression for young's modulus

Understand the surface tension and viscosity of fluid

State and prove parallel and perpendicular axes theorems.

Basic understanding of Special Theory of Relativity & Lorentz Transformation

SEMESTER II

CORET03: ELECTRICITY & MAGNETISM

This course apprises the students regarding the concepts of electrostatics, electrodynamics and Maxwell equations and enables their use in various situations.

At the end of the course, students will be able to

- Study the electric field using coulombs inverse square law in electrostatics of current
- Analyse the relations between B, H and M
- Understand the faradays laws of electromagnetic induction by rayleigh's method
- Analyse the value of Maxwell equation- boundary conditions
- Explain the concept of Coulomb's and Gauss' laws and their applications; diagnose the electric circuits;
- compare and relate electricity and magnetism
- interpret the concepts of magnetic induction and classify magnetic materials; and
- Find out the unknown value of resistance, capacitance and inductance.
- Construct, understand and analyze various electronic circuits.
- Analyze and describe the working of fundamental electrical circuits.

CORET04: WAVES & OPTICS

Distinguish the basic phenomena like interference, diffraction and polarization that occur in nature.

Understand the basic theories and applications of these phenomena.

Study the light propagation in optical fibres and acquaint with different kinds of optical fibres and its applications.

Understand the natural behaviour of aberration in lens

- Study the theory and experiment of interference using air wedge, newtons rings and michelson interferometer

- Study the theory and experimental past of diffraction by fresnels and fraunhoffer methods

- Study the theories for production of polarization of light

Analyse waves and oscillations

- Study the basic properties and production of ultrasonics by different methods

SEMESTER III

CORET05: MATHEMATICAL PHYSICS-II

This course enables the students to gain knowledge in differential equations which are essential to solve advanced problems in physics, to understand special functions in mathematical methods

At the end of the course, students will be able to

Analyze Fourier Series

formulate and solve the partial differential equations in physics;

describe the special polynomials and their properties;

apply special functions to describe physical systems;

Variational Calculus & Analytical Dynamics

CORET06: THERMAL PHYSICS

This course enables students to understand the fundamentals of heat & thermodynamics and the concepts of entropy and enthalpy. It helps students to gain knowledge in kinetic theory and transport phenomena. To know the basic concepts in classical thermodynamics and to learn the thermodynamic aspects of various processes and reactions.

At the end of the course, students will be able to explain the basic concepts of thermodynamics and applications of first law of thermodynamics;

- apply first and second laws of thermodynamics and derive thermodynamic relations;

implement laws of thermodynamics to elucidate simple thermodynamic systems;

- Understand the fundamentals of Heat transport, Kinetic theory of gas and law of thermodynamics and entropy
- Analyses of zeroth law of thermodynamics and entropy
- Understanding the low temperature physics
- Analyses thermal conductivity

CORET07 - DIGITAL SYSTEMS AND APPLICATIONS

Understand the fundamentals of codes and number system

- Understand the binary arithmetic, logics and boolean functions
- Understand the functions and working of flipflop circuits register s and counters
- Perform the procedures into applications
- Understand the applications into memory circuits

Simplify circuits and Boolean expressions using the Boolean laws.

Design different registers and counters.

Design basic combinational and sequential logic circuits.

Simplify Boolean algebra expressions using Karnaugh maps.

The students will

- i. get a thorough knowledge of Digital electronics be able to design simple logic circuits
- ii. Acquire knowledge in using different types of measuring instruments used in the electronics laboratory.

SEC: BASIC INSTRUMENTATION SKILLS

Understand the fundamentals of codes and number system

- Understand the binary arithmetic , logics and boolean functions
- Understand the functions and working of flipflop circuits register s and counters
- Perform the procedures into applications
- Understand the applicattions into memory circuits

SEMESTER IV

CORET08 MATHEMATICAL PHYSICS III

This course enables the students to gain knowledge in Complex Integral, Matrices and Boundary Value Problem which are essential to solve advanced problems in physics.

At the end of the course, students will be able to

Recognize the importance of mathematical modeling and computing, and the role of approximation and mathematical approaches to describe the physical systems;

formulate and solve the partial differential equations in physics;

describe the special polynomials and their properties;

apply special functions to describe physical systems;

classify the types of matrices and determine Eigenvalues and Eigenvectors; and explain the Fourier and Laplace transforms and their uses.

CORET09: ELEMENTS OF MODERN PHYSICS

After successful completion of the course, the student is expected to:

- To become familiar with Blackbody radiation, Ultraviolet catastrophe, Photo-electric effect and Compton Effect and hence be aware how quantum theory emerged.
- Have gained a clear knowledge about wave properties of particles, De Broglie waves and its implications on the uncertainty principle.
- Study the Bohr Atom model in detail and understand about atomic excitations
- Discuss and establish the dual nature of matter;
- Describe different atom models.
- Explain the inadequacies of classical physics and experimental evidences for quantum theory.
- Understand the basic principle of laser and characteristics, types of lasers, basic working principle of Laser and familiarize applications of lasers in different fields.

This course also enables students to know about the properties of Nuclear Physics. It helps students to know about the basics of elementary particles. At the end of the course, students will be able to:

- explain the stability of the nucleus and the signatures of nuclear models;
- classify various types of nuclear decay processes;
- illustrate the key features of nuclear fission and fusion and their applications; and categorize the elementary particles and their symmetries.

CORET10: ANALOG SYSTEMS AND APPLICATIONS

Provides the student with the fundamental skills to understand the basic of semiconductor components like diode, transistor, FET, MOSFET and operational amplifier.

Build foundation to understand the role of electronic components such as resistors, capacitors, inductors, ordinary diode, zener diode etc. in a circuit when connected individually or in combination. Equipped with knowledge to participate in the design and development of electronic systems.

- explain the operation of electronic devices and their simple applications;
- Understand the basics of diode and working of rectifier circuits and characteristics
- Analyse the characteristics of transistor and transistor biasing circuits
- Perform the procedures for the working of single stage and multistage amplifier
- Analyse the relationship between amplifier and oscillators
- Understand the applications of op-amps inverting and non inverting modes.
- Understand the fundamental operation of various electronic components.

SEC: COMPUTATIONAL PHYSICS

Understand the basic concepts of fundamentals of operators and expressions

- Analyse the relationship between various statements
- Analyse the various types of function
- Perform the different types of arrays
- Understand the structure and unions

SEMESTER V

CORET11: QUANTUM MECHANICS AND APPLICATIONS

This course enable the Students to understand the concepts of inadequacies of classical physics, the fundamentals of quantum mechanics, and to learn the skills of quantum mechanics and its applications to free state and bound states.

At the end of the course, students will be able to

Appreciate the historical development and origin of quantum mechanics.
Understand the basic mathematical formulation of quantum mechanics.

Apply the Schrodinger equation for solving the problem of a particle in a box.
Distinguish between classical mechanics and quantum mechanics.

- describe the wave mechanical concepts of quantum systems; elucidate the basic formalism of quantum mechanics; and devise and explain exactly solvable quantum systems.
- To study the basic postulates of quantum mechanics
- To enable the students to solve the simple quantum mechanical models such as simple harmonic oscillator, particle in a 1D- box, rigid rotor, H atom etc.
- To understand the quantum mechanical aspect of angular momentum and spin.

This course also enables the students to understand the Atomic Physics in particular fine structure of atom, to have greater understanding of atomic spectrum with applied fields,

- to gain knowledge in Molecular spectroscopy and to understand the Raman spectroscopy
- explain basic atomic models and their related phenomena;
describe interaction of atoms with external fields, and spectrum of many electron atoms;

CORET12: SOLID STATE PHYSICS

This course deals with the basic concepts like crystal structures. It also deals with the theory of crystal binding and the theory of band structure and phonon. It also discuss the Physics of semiconductors and superconductivity.

At the end of the course, students will be able to

- determine the structure factors of fundamental crystal lattices;

- analyze the X-ray diffraction patterns of simple crystal structures;
 - classify the different crystal binding forces and explain the vibrations of lattice structures;
 - describe the quantum theories of energy bands and their consequences;
- classify the materials based on their electrical properties; and Classify materials as metals, semiconductors and insulators based on band theory.
- explain the basics of superconductivity based on experimental facts.
 - Describe material properties such as magnetism, dielectric properties, superconductivity and understand the theoretical framework of the same.
 - Solve problems and analyze experimental results.

DSE 2: ADVANCED DYNAMICS

- Understand the dynamics and gravitation
 - Study the behaviour of rigid body dynamics
 - Analyse the performance of hydrostatic and hydrodynamics
- Understand the basic significance of mechanics of a system of particles
Understand the basic understanding of Non linear dynamics & Chaos

DSE 3: NUCLEAR & PARTICLE PHYSICS

Understand the properties of positive rays, experimental proof by frank and hertz method

- Analyse the relationship between various types of couplings
- Understand the properties of x-ray s verification
- Analyse the ideas of basics of nucleus and their energy
- Perform the procedures for nuclear fission and fusion

SEMESTER VI

CORET13: Statistical Mechanics

Analyses thermal conductivity and black body radiation

- Understanding the statistical methods

CORET14: ELECTROMAGNETIC THEORY

1. Lay a sound theoretical foundation in electricity and electrodynamics.
2. Realize how the development of modern technological world rely on the field- electricity and electrodynamics.
3. Comprehend various phenomena and applications around them related to electric and magnetic field.
4. Understand the power of Maxwell's Equations and their various solutions to ponder into various topics that include Energy and Momentum of Electromagnetic Fields, Radiation
5. Sources and Antennas, Electrodynamics in Macroscopic Media, Wave Guides and Cavities.

DSE 3: Advanced Mathematical Physics II

DSE 4: Astronomy & Astrophysics

GENERAL PRACTICAL

- Study the basic ideas of the experiment
- study the basic working, conditions of the experiments
- Perform the procedure as the laboratory standards
- Understand the applications

PROJECT

- Understand the basic ideas about the project
- Understand the working procedure of the project
- Perform the procedure as the laboratory standards
- Understand the values obtained and its applications

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Grow into accountable and empowered individuals who will emerge as scientists, entrepreneurs etc., and be employed in various governmental and non-governmental sectors.

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B.Sc. Physics Model I Programme Specific Outcomes

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Skill to organize events and transfer knowledge through fruitful communications and interact effectively with people from sundry backgrounds.

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