Programme Outcome

Bachelor of Science

- Understanding of basic scientific principles
- Develop an ability to analyze and think about the scientific events around the world and the ability to explain everything scientifically
- Capacity building to handle every situation in a scientific way
- Contribute to society through scientific ideas

Programme Specific Outcome (PSO)
&
Course Outcome

DEPARTMENT OF PHYSICS

PROGRAMME OUTCOMES, PROGRAM SPECIFIC OUTCOMES, COURSEOUTCOMES

Course Outcomes: Physics

Physics is the heart of science. It not only aims to explain the endless mysteries of the Universe but also helps to understand the theories of other branches of science like Chemistry or Biological Sciences at the deepest level. The arena of Physics is all pervading. It covers the stars and Galaxies at one end of the scale and the world of sub-atomic particles on the other. Study of Physics instills in us the habit of reasoning, to look for the cause and effect relations, to seek the logical explanation of every phenomenon, not only in nature but also in our life and society. It helps developing a scientific culture and wipes out misconceptions and superstitions, which is so essential in our society. The knowledge of Physics in essential for inventing, developing, manufacturing or repairing modern machines and instruments and hence forms an indispensable part of the training of the professionals who aspire to build a career in these areas. Even for a layman, a preliminary idea of this subject helps in understanding the working principles of the commonly used machines/gadgets at the basic level and hence facilitates a safe and better handing of such machines.

Job opportunities after completing this course include research work in Institutes within the country and abroad, teaching career in universities, colleges and schools, going for higher studies like M.Sc, B.Tech, Integrated M.Tech and Integrated Ph.D programs. Master degree and Ph.D programs in various allied branches become open for the students of this course. These include Electronics, Computer Science, Oceanography, Atmospheric Science, Environmental Science and so on. Students may even seek administrative jobs like I.A.S, I.P.S. etc., by appearing in the appropriate competitive examinations.

Program Specific Outcomes: Physics

Semester I	**1.1 Mathematical Physics - I** The section recapitulates the basic concepts of Calculus, learnt by the students at the +2 level. Mathematical object like **Vectors** and **Matrices**are introducedand their properties are discussed. In the corresponding Practical Course, the programming language '**Python**' and the graph-plotting software '**Gnuplot**' is introduced.
	1.2 Mechanics Mechanics is the most fundamental branch of Physics. It lays the foundation stone through teaching the students the basic laws of Particle Dynamics, Rigid-body Dynamics and Fluid Dynamics.

Semester II	**2.1 Electricity and Magnetism** The Electrostatic and the Magneto-static field are introduced and their properties are discussed. The inter-relation between electric and magnetic field is also studied and **Maxwell's Equations**, which form the basis of the theory of electro-magnetism are introduced.
	2.2 Waves and Optics The properties of **Simple Harmonic Motion** and wave motions are discussed. The properties of Light, in which its wave nature is manifested, are discussed. Thus, the fact that light is a wave motion is established

Semester III	**3.1 Mathematical Physics – II** **Fourier Series** and **Fourier Transform** are introduced. Methods of solving **Ordinary** and **Partial Differential Equations** are taught. The students are introduced to the theory of **Probability**, which forms the basis of Statistical Mechanics to be introduced later. In the corresponding Practical Course, The different modules in Python language are introduced and methods of Numerical Integration, Interpolation
	3.2 Thermal Physics The **Laws of Thermodynamics** and their applications to study thermal properties of various systems are discussed. The kinetic molecular models of ideal and real gases are introduced and it is demonstrated how to derive various properties of gases on the basis of such models. The theory of heat conduction is also developed.
	3.3 Modern Physics The Foundation of **Quantum Mechanics** as the basic theory of ModernPhysicsis laid down. The basics of Nuclear Physics are discussed. The principles of LASER production are discussed.
	SEC A-2 : Renewable Energy and Energy Harvesting In the present days of energy crisis, harvesting different renewable sources of energy is of utmost importance. This course introduces the different conventional and alternate sources of energy
Semester IV	**4.1 Mathematical Physics – III** The Calculus of Complex Numbers is developed.The 'Calculus of Variation' is introduced and the **Lagrangian** and the **Hamiltonian Formulation** of Classical Mechanics is developed as examples of this technique. The **Special Theory of Relativity** is introduced, which shows how the results of Newtonian Mechanics are to be modified for fast moving particles. In the corresponding Practical Course, one learns to evaluate Improper Integrals, to solve Ordinary and Partial Differential Equations, to study the properties of
	4.2 Analog Electronics The modern age is the age of electronics in general and semiconductor electronics in particular. The present section discusses the properties and applications of semiconductor devices like **P-N Diodes**, **Bipolar Junction Transistors**and **Field Effect Transistors**.**Amplifiers, Feedback Amplifiers** and **Operational Amplifiers**(with its variousapplications) are studied. **Multivibrators** and**Oscillators** of various types are discussed.

	4.3 Quantum Mechanics Quantum Mechanics is the basic theory for the sub-atomic world. In this course, students learn Quantum Mechanics as a problem solving methodology with applications in Atomic Physics.
	SEC B-2 : Electrical Circuits and Network Skills Describes the structures and functioning of some basic electrical instruments like **Generators, Transformer** and **Motors**.
Semester V	**5.1 Electromagnetic Theory** Visible light, microwave, radio wave, etc., are all forms of Electromagnetic wave. The properties of such waves can all be explained in terms of Maxwell's Electromagnetic Theory. The purpose of the present section is to develop the theory for propagation of EM wave in bounded and unbounded media.
	5.2 Statistical Physics The purpose of this section is to explain the properties of a macroscopic object in terms of a statistical description of its microscopic constituents. All the three distribution functions (MB, FD and BE) are derived and their application in appropriate systems are studied.
	DSE A1 (a) : Advanced Mathematical Method Introduces and studies the properties of mathematical objects like **Groups, Fields, Vector spaces,** and **Tensors**. While studying this section, students become acquainted with the concepts of Abstract Algebra, which are essential parts of the language of advanced Theoretical Physics.
	DSE B1 (b) : Nuclear and Particle Physics Nuclear Physics and the Physics of sub-atomic particles provide insight into the structure of all matters. The study of the Elementary Particles and the Fundamental Interactions paves the way towards the frontiers of modern Physics for the students.
Semester VI	**6.1 Digital Systems and Applications** Digital Electronics lies at the root of the majority of electronic gadgets and machines, in the current age. The present course helps the students to understand the working principles of the basic digital circuits, e.g. **the dataprocessing circuits, sequential circuits, counters** and **registers**. This is the age of computers. The present course provides insight into the basic structure of a
	6.2 Solid State Physics Among the three stats of matter, the gaseous state is discussed in the previous sections and the liquid state is relatively less understood. The present course discusses various properties of the solid state, e.g. the **specific heat**, the **dielectric constant**, the **magnetic susceptibility**, etc., of a solid, in terms of a microscopic theory.

	DSE A2(b) : Advanced Classical Dynamics The Lagrangian and the Hamiltonian formalism of Classical Mechanics is developed and some advanced topics like the rigid-body rotation, the small oscillation problem, etc., are discussed within these frameworks. The basic techniques of describing **Non-linear Dynamical Systems** are taught, which throws light on the path to reach the frontiers of research in this field.
	DSE B2(b) : Advanced Statistical Mechanics The Classical Statistical Mechanics is revisited. The **Density MatrixFormulation** of Quantum Statistical Mechanics is introduced. Ideal Bose and Fermi systems are discussed. Non-equilibrium Statistical Mechanics is introduced, which may lead the students to the research horizon in this field.