

**Name of the programme:** B.Sc. PHYSICS (Major) (CCF)

**Academic year of introduction:** 2023 – 2024

### **Programme Outcome (PO):**

The undergraduate (UG) course offered by the Department of Physics, St. Paul's Cathedral Mission College following the Credit Curriculum Framework (CCF) model under National Education Policy (NEP) is designed for eight semesters (four years) to provide a systematic understanding of core physics concepts, principles, and theories, along with their applications. The Learning Outcomes-based Curriculum Framework (LOCF) for a degree in B.Sc. Physics is intended to provide a comprehensive foundation to the subject, and to help students develop the ability to successfully continue with further studies and research in the subject. The framework is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge based society. It is further aimed to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills of students. The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Physics, as well develop scientific orientation, enquiring spirit, problem solving skills and values which foster rational and critical thinking. The present curriculum will not only advance their knowledge and understanding of the subject, but will also increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solution, improve practical skills, enhance communication skill, social interaction and increase awareness in environment related issues.

The course is a combination of general and advanced education, simultaneously introducing the concepts of breadth and depth in learning. The course structure has been prepared in such a way so as the students learn and understand how the various physical phenomena take place based on their already acquired knowledge. Solving problems based on realistic situation make them understand how various physical systems in everyday life works.

### **Programme Specific Outcomes (PSO):**

The programme specific outcome includes:

- Imparting in students detailed knowledge in diverse premises of physics that includes classical mechanics, thermal physics, acoustics, wave optics, advanced mathematical physics, electricity & magnetism, quantum mechanics, statistical mechanics, electromagnetic theory, electronics,

special theory of relativity and atomic physics, modern physics and modern communication electronics.

- Each of these theories are experimentally verified in a number of ways and found to be a sufficiently appropriate description of nature. Students get oriented along this line of thinking and earn enough proficiency to use Physical Principles/concepts to explain various phenomena.
- Developing proficiency in designing various electronic & electrical devices for domestic, engineering, medical and/or laboratory need
- Applying conceptual understanding of basic laws & principles of physics to analyze variety of physical phenomena of general real-world problems.
- Developing capabilities of oral and written scientific communication skill and scientific thinking to appreciate advancement of modern physics in diverse areas. Students learn the applications of computer programming language PYTHON in an elaborate manner.
- Knowledge gained through theoretical, computational and lab based experiments will generate technical personnel in various priority areas of research on basic, applied and interdisciplinary science.
- Physics uses mathematics as a medium to organize and formulate experimental results. Students gather handsome knowledge on mathematics required for formulating and solving problems.
- Students learn laboratory skills enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions.

**Name of the programme:** B.Sc. PHYSICS (Honours) (CCF)

**Academic year of introduction:** 2023-24

Semester	Course Code	Course Name	Course Outcome (CO)
<b>Semester I</b>	DSC1/ Minor-1: BASIC PHYSICS-I (Theory)	(A) Mathematical Physics (Theory)	<p>After completion of the course the students will learn some important mathematical tools required for pursuing higher study in Physics such as :</p> <ul style="list-style-type: none"> <li>• To acquire basic knowledge of calculus which are integral part of any branch of Physics.</li> <li>• Understand the Vector algebra, divergence, gradient and curl and their physical interpretation which are very important for theories of electricity and magnetism to be taught later.</li> <li>• Understand basics of differential equations and how to solve them. Solve simple problems with physics oriented application.</li> <li>• Acquire knowledge of different types of Curvilinear Coordinate systems</li> </ul>
		(B) Classical Mechanics (Theory)	<ul style="list-style-type: none"> <li>• How to use different co-ordinates systems appropriately to solve equations of motion of particles in various situations.</li> <li>• Recapitulate the importance of inertial frames while applying Newtonian mechanics and learn about dynamics in rotating frame of reference.</li> <li>• Dynamics of system of particles and conservation laws. The topic of central force is introduced and gravitation is discussed as a classic example of it.</li> <li>• The dynamics of rotating rigid bodies using Euler's equation.</li> <li>• The concept of inertia tensor and the method of finding principal axes of rigid bodies in detail.</li> <li>• The dynamics of fluid motion using vector calculus.</li> </ul>

	Course Code	Course Name	Course Outcome (CO)
<b>Semester I</b>	DSC1/ Minor-1: BASIC PHYSICS-I (Practical)	Classical Mechanics (Practical)	<p>The students are made familiar with</p> <ul style="list-style-type: none"> <li>• Basic laboratory instruments to measure length.</li> <li>• Also made aware about possible systematic and random errors that are associated with such instruments.</li> <li>• The measurement of moment of inertia of different geometrical objects and different elastic constants of materials.</li> <li>• They also learn to measure the coefficient of Viscosity</li> <li>• At the completion of this course they will also be able to measure height of large structures using sextant.</li> </ul>
	SEC-1 (Practical)	Introduction to Computer Programming and Graph Plotting	<p>After the completion of the course the students will learn:</p> <ul style="list-style-type: none"> <li>• Basic concepts of data plotting with the help of GNU PLOT.</li> <li>• Fitting Data with the help of GNU PLOT</li> <li>• Understand how to write an algorithm, iteration techniques, simple mathematical logic operations, loop operations with the help of PYTHON.</li> <li>• Usage of the code as simple calculator</li> <li>• Various numerical methods to solve many problems numerically. e.g. finding solution of a equation, sorting, simulation etc</li> <li>• Doing simple matrix operations using Python language.</li> <li>• Visualize physical problems and their solutions on a computer.</li> </ul>
<b>Semester II</b>	DSC2/ Minor-2: BASIC PHYSICS-II (Theory)	(A) Basic Electricity and Magnetism (Theory)	<ul style="list-style-type: none"> <li>• To learn about basic concepts of electrical charges and currents and their properties</li> <li>• Understand the concept of conductors, dielectrics, inductance and capacitance.</li> <li>• Understand the concept of electrostatic potential, energy</li> <li>• Calculation of potential for different systems</li> <li>• Gather knowledge on the motion of charged particles in magnetic, electric or</li> </ul>

<b>Semester II</b>	DSC2/ Minor-2: BASIC PHYSICS- II (Theory)	(B) Introduction to Thermodynamics (theory)	<p>combination of both fields</p> <ul style="list-style-type: none"> <li>• Basic principle of working of Cyclotron</li> <li>• Basics of magnetostatics, understanding of Biot Savart's law, Ampere's Circuital etc.</li> <li>• Simple mathematical Problems</li> </ul> <p>After getting exposure to this course, the students will</p> <ul style="list-style-type: none"> <li>• Understand the principle of calorimetry</li> <li>• Understand the basic principle and laws of Thermodynamics.</li> <li>• Understand the concepts of Entropy, various thermodynamic potentials and their applications in various systems</li> <li>• Gain knowledge about microscopic behavior of systems</li> <li>• Understand the interrelationship between thermodynamic functions and ability to use such relationships to solve practical problems.</li> <li>• Gain knowledge in kinetic theory of gas.</li> </ul>
	DSC2/ Minor-2: BASIC PHYSICS- II (Practical)	Electricity and Magnetism and Thermal Physics (Practical)	<ul style="list-style-type: none"> <li>• Students will get practical training on handling various electrical components such as resistors, ammeters, voltmeters, potentiometers, metre bridge, power supplies.</li> <li>• to determine different physical quantities of thermal physics like pressure coefficients, thermal coefficients</li> </ul>
	SEC-2	Scientific Writing Skills(LATEX) Practical	<p>The students learn</p> <ul style="list-style-type: none"> <li>• The difference between WYSIWYG and WYSIWYM.</li> <li>• To create LATEX files and compile them using the software.</li> <li>• To create different chapters, sections, subsections, paragraph inside a document.</li> <li>• Especially they will learn to write all kinds of mathematical equations using LATEX. to create lists, use different kinds and sizes of fonts and put figures and tables at appropriate places. Arguably the most important lesson are the use of citation from bibliography and referring equations, figures, tables etc. inside a document without worrying about their numbering.</li> </ul>

			<ul style="list-style-type: none"> <li>Changing and placing the figures, alignments Packages: amsmath, amssymb, graphics, graphicx, Geometry, algorithms, color, Hyperref etc</li> </ul>
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Semester	Course Code	Course Name	Course Outcome (CO)
Semester I and Semester II	IDC (Interdisciplinary)	Frontiers in Physics (Theory)	<p>The course gives an idea of</p> <ul style="list-style-type: none"> <li>Basic laws of Nature</li> <li>Role of proper reasoning and experiments, with examples.</li> <li>Difference between science and pseudoscience.</li> <li>Understanding our Universe, Dark matter Dark energy Big Bang Theory, Life of Star. Origin of Life</li> <li>.</li> <li>Matter: Atoms and molecules: The physical basis of the Periodic table.</li> <li>Heat and Thermodynamics: Basic idea about the kinetic theory of gases</li> <li>The three laws of thermodynamics.</li> <li>Basics of elementary Particles, the Standard Model of particles &amp; interactions.</li> <li>Forces: Laws of falling bodies, Inertia, Gravitation, Electricity and Magnetism, Light and its dual property.</li> <li>The microscopic world of Quantum Mechanics.</li> <li>Special and General Theory of Relativity</li> </ul>