PSO, PO, CO

Department of Physics

Programme Specific Outcome of BSc Physics Programme

- **PSO1:** Understand and apply the principles of Classical mechanics, Quantum mechanics, Thermodynamics & Statistical Mechanics , Nuclear physics and Electrodynamics
- **PSO 2:** Understand and apply the principles of Solid state physics, Optics, Photonics and Spectroscopy, Nanomaterials.
- **PSO 3:** Understand the principles of Electronics, Design and test electronic circuits and their application in communication system.
- **PSO 4:** Understand and apply the principles of Mathematical Physics and Computational Physics and do Error analysis in measurements.

These program-specific outcomes aim to equip Physics Honors students with a strong foundation in theoretical and experimental physics, as well as critical thinking and research skills necessary for further studies or careers in academia, industry, or other scientific fields.

Programme Outcomes (PO)

- PO1: Demonstrate a comprehensive understanding of fundamental principles and theories in classical mechanics, Statistical Mechanics, electromagnetism, thermodynamics, quantum mechanics, and relativity, Nanomaterials, Electronics and communication.
- PO2: Design and conduct sophisticated experiments, utilizing a range of laboratory equipment and techniques, to investigate physical phenomena and validate theoretical models and effectively communicate the results through oral presentations and written reports.
- PO3: Demonstrate proficiency in using computer programming languages and numerical simulation tools to model physical systems and simulate experimental outcomes.
- PO4: Apply critical thinking and problem-solving skills to identify, analyse, and solve complex physics problems, both independently and collaboratively, using appropriate theoretical frameworks and experimental techniques.
- PO5: Develop a deep understanding of the interconnections between different branches of physics and their applications in other scientific disciplines and real-world contexts.
- PO 6: Demonstrate knowledge of current research trends and recent advancements in physics, and critically evaluate scientific literature to stay abreast of developments in the field

- PO 7: Exhibit ethical conduct in scientific research, including responsible data handling, adherence to safety protocols, and consideration of the societal impact of physics research and technology.
- PO 8: Cultivate effective communication and teamwork skills by actively participating in group projects, discussions, and scientific presentations, and engaging with diverse perspectives within the field of physics.

Courses Outcomes (COs)

Semester-I		
CC1	Mathematical Physics I	CO 1: Understand the concept of Calculus. CO 2: Develop the knowledge of vector. CO 2: Understand the Probability theory and apply it in physical problem. CO 3: Develop the concept of Curvilinear coordinate system.
CC2	Mechanics	CO 4: Develop the knowledge of Mechanics as an introductory course that explores the fundamental principles and applications of classical mechanics like, kinematics. CO 5: Understand the concept of Newton's laws of motion, forces, energy, momentum, rotational motion, and gravitation, special theory of relativity. CO 6: Determine the mathematical concept, laboratory experiments, and problem-solving exercises. Students will develop a solid understanding of the laws that govern the motion of objects and systems.
Semester-II		
CC3	Electricity and Magnetism	**CO 7:** Electricity and Magnetism is an introductory and a very important course that explores the fundamental principles and applications of electromagnetic phenomena. Through theoretical study, mathematical analysis, laboratory experiments, and problem-solving exercises, students will develop a strong mathematical and analytical skills, as well as experimental and problem-solving abilities in the context of electricity and magnetism. CO 8: Students gain an appropriate knowledge for the practical applications of electromagnetic principles in various scientific and engineering disciplines.
CC4	Waves and Optics	**CO 9:** Waves and Optics is a comprehensive course that explores the principles and applications of wave phenomena and optics. This course covers topics such as wave properties, wave propagation, interference, diffraction, polarization, and the behaviour of light. **CO 10:** Through theoretical study, mathematical analysis, laboratory experiments, and problem-solving exercises, students will develop a solid understanding of wave mechanics and optical phenomena.

GE2	Thermal Physics and Statistical Mechanics	**CO 11:** Thermal Physics and Statistical Mechanics is a special course that combines the principles of thermal physics with the concepts of statistical mechanics. This course covers topics such as laws of thermodynamics, kinetic theory of gases, heat transfer mechanisms, statistical distributions, and equilibrium statistical mechanics. **CO 12:** Through theoretical study, mathematical analysis, and problem-solving exercises, students will develop a comprehensive understanding of the behaviour of thermal systems at both macroscopic and microscopic levels.
Semester-III		
CC5	Mathematical Physics II	**CO 13:** Upon successful completion of this course, students will be equipped with a comprehensive understanding of various mathematical techniques commonly used in physics. Specifically, they will be able to learn and analyse Fourier Series, Understand the Frobenius method and its significance in solving differential equations with regular singular points, Grasp the concepts of Beta and Gamma Functions, Comprehend the principles of variational calculus and its role in solving optimization problems in physics.
CC6	Thermal Physics	**CO 14:** This course covers topics such as laws of thermodynamics, kinetic theory of gases, heat transfer mechanisms, and statistical mechanics. Through theoretical study, mathematical analysis, and problem-solving exercises, students will develop a deep understanding of thermal phenomena and their implications in various scientific and engineering disciplines.
CC7	Digital Systems and Applications	**CO 15:** This course covers topics such as digital logic gates, Boolean algebra, combinational and sequential circuits, digital arithmetic, memory systems, and digital system design . **CO 16:** By the end of this course, students will have a solid understanding of digital systems and their applications. They will be able to design and analyse digital circuits using various techniques and tools. Students will also gain practical skills in digital system implementation and troubleshooting. They will develop problem-solving and critical thinking abilities in the context of digital systems and be prepared to apply their knowledge in various technological domains.
SEC 1	Electrical Circuits and Network Skills	**CO 17:** This course covers topics such as circuit elements, Ohm's law, Kirchhoff's laws, network theorems, transient analysis, and frequency response. **CO 18:** Through theoretical study, problem-solving exercises, and hands-on experiments, students will develop a strong foundation in electrical circuits and acquire essential skills for circuit analysis and design.

GE3	Solid State Physics	**CO 19:** This course covers topics such as crystal structures, electronic band theory, lattice vibrations, electrical and thermal properties of solids, magnetism, and semiconductor physics. Through theoretical study, mathematical analysis, and laboratory experiments, students will develop a deep understanding of the behaviour of solids and their technological applications.
Semester-IV		
CC8	Mathematical Physics III	**CO 20.1 :** After completing this course, students will possess a strong foundation in advanced mathematics relevant to engineering. They will be able to employ complex analysis to understand and solve problems involving complex variables, utilize integral transforms to simplify the analysis of engineering systems, and effectively work with matrices and eigenvalues to model and solve various engineering scenarios. **CO 20.2:** will equip them with the necessary mathematical tools to address complex engineering challenges and excel in their respective fields of study and future careers.
CC9	Elements of Modern Physics	**CO 21.1:** This course covers topics such as quantum mechanics, special relativity, atomic and nuclear physics, particle physics, and the basics of condensed matter physics. By the end of this course, students will have a solid foundation in the principles and applications of modern physics. **CO 21.2:** Students will also gain an introductory understanding of condensed matter physics. They will develop problem-solving and analytical skills through theoretical study and laboratory experiments.
CC10	Analog Systems and Applications	**CO 22.1:** Analog Systems and Applications is an in-depth course that focuses on the principles, design, and applications of analog electronic systems. This course covers topics such as analog signal processing, amplifiers, filters, analog-to-digital and digital-to-analog conversion, and practical circuit design techniques. **CO 22.2:** Through theoretical study, practical applications, and hands-on projects, students will develop a strong understanding of analog electronic systems and their diverse applications in various fields.
SEC B	Renewable Energy & Energy Harvesting	**CO 23:** This course covers topics such as solar energy, wind energy, hydroelectric power, biomass energy, and emerging technologies for energy harvesting. Through theoretical study, practical applications, and case studies, students will develop a deep understanding of renewable energy systems, their advantages, limitations, and their role in sustainable energy production.
GE4	Digital, Analog Circuits and Instrumentation	**CO 24.1:** Students will have a solid understanding of digital and analog circuits, as well as instrumentation techniques. **CO 24.2:** They will be able to design, analyse, and troubleshoot electronic circuits, including both digital and analog components. Students will also gain practical skills through hands-on laboratory.
Semester-V		

CC11	Quantum Mechanics and applications	**CO 24.1:** Students will have a comprehensive understanding of quantum mechanics principles and applications. They will be able to analyse quantum systems, quantum dynamics, and quantum measurements. Additionally, students will gain knowledge of quantum applications in various fields such as atomic physics, condensed matter physics, and quantum information. **CO 24.2:** Students will also get knowledge about practical skills through problem-solving, data analysis, and research projects, and be able to effectively communicate scientific ideas in the field of quantum mechanics.
CC12	Solid State Physics	**CO 25.1:** In this course, students will have a comprehensive understanding of solid state physics principles and applications. They will be able to analyse the electronic, magnetic, and optical properties of solid materials and understand the behaviour of electrons and lattice vibrations in crystalline structures. **CO 25.2:** Students will also gain practical skills through laboratory experiments and develop the ability to effectively communicate and present scientific ideas in the field of solid state physics.
DSE1	Advanced Mathematical Physics - I	**CO 26.1:** This is an advanced and a very useful course for students for future study. After this course Students will gain a strong foundation in tensor analysis and linear vector spaces, equipping them with essential mathematical tools to tackle complex problems in various scientific and engineering domains. They will be able to work with tensors, understand their geometric and physical interpretations, and use tensor calculus to solve real-world problems. **CO 26.2:** This course will prepare students for advanced studies and research in fields where tensor analysis is crucial, as well as enhance their analytical and problem-solving skills in a wide range of disciplines.
DSE2	Nuclear and Particle Physics	**CO 27.1 :** By the end of this course, students will have the understanding of nuclear and particle physics principles and applications. They will be able to learn nuclear structure, radioactive decay, and nuclear reactions. Additionally, students will gain knowledge of elementary particles, their interactions, and the Standard Model of particle physics. **CO 27.2:** They will also develop practical skills through data analysis and research projects and be able to effectively communicate scientific ideas in the field of nuclear and particle physics.
Semester-VI		
CC13	Electromagnetic Theory	**CO 27.1:** After completion of this course, students will have a solid understanding of electromagnetic theory and its applications. They will be able to analyse and solve problems related to electric and magnetic fields, electromagnetic waves, and Maxwell's equations. **CO 27.2:** Students will also gain practical skills in applying electromagnetic theory to real-world applications, such as antenna design, transmission

CC14	Statistical Mechanics	**CO 28.1:** Statistical mechanics is one of the most important theoretical courses. By the end of this course, students will have a solid foundation in statistical mechanics and the ability describe the behaviour of physical systems at a microscopic level. **CO 28.2:** They will be equipped with the skills to apply statistical mechanics to a wide range of problems, both theoretical and experimental, and understand the underlying principles that govern the behaviour of matter.
DSE3	Communication Electronics (Theory) OR	**CO 29.1:** This course will give a solid understanding of communication electronics principles and techniques. Students will be able to design, analyse, and evaluate electronic circuits and systems for communication applications. **CO 29.2:** Students will also have some advanced level knowledge on analog and digital modulation techniques and some basic ideas of satellite communication and mobile telephony systems by the end of this course.
	Nano Materials and Applications	**CO 30.1:** This course will give a solid understanding of Nanoscale Systems, Synthesis of Nanostructure Materials, Different characteristic of nanomaterial specially optical property and electron transport. **CO 30.2:** Students will also gain knowledge about practical application of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED olar cells). They also able to Synthesis of metal nanoparticles by chemical route, Synthesis of semiconductor nanoparticles, Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer, XRD pattern of nanomaterials and estimation of particle size.
DSE4	Digital Signal Processing	**CO 31.1:** By the end of this course, students will have a solid understanding of digital signal processing theory, techniques, and applications. They will be able to analyse and process digital signals using various transformation and filtering techniques. **CO 33.2:** Students will also gain practical experience through programming exercises and laboratory experiments, enabling them to apply DSP algorithms to real-world signals and effectively communicate their findings.