BA / BSc / BCom - Program Outcomes

On completion of undergraduate programme, the student is expected to achieve the followin programme outcomes

PO1	**Knowledge (Remembering)**	• Demonstrate basic factual and procedural knowledge in the chosen field of study. • Recall and recognize key concepts, terms, and theories. • Summarize and explain fundamental principles and historical developments.
PO2	**Comprehension(Understanding)**	• Interpret and explain the significance of information and concepts. • Translate complex ideas into simpler terms for understanding. • Compare and contrast different theories or viewpoints within the discipline.
PO3	**Application (Applying)**	• Apply theoretical knowledge to practical situations or real-world problems. • Use appropriate methods and techniques to solve discipline-specific problems. • Demonstrate the ability to implement concepts in hands-on experiences or internships.
PO4	**Analysis (Analyzing)**	• Break down complex issues into their component parts. • Identify patterns, relationships, and causes within the discipline. • Evaluate the validity of arguments and evidence.
PO5	**Synthesis (Creating)**	• Integrate knowledge from various sources to develop innovative solutions. • Design and create original projects, research, or products. • Generate new ideas, hypotheses, or theories within the field.
PO6	**Evaluation (Evaluating)**	• Assess the quality and reliability of information and data. • Critically evaluate the strengths and weaknesses of different approaches. • Make informed judgments and recommendations based on evidence.

B.Sc Physics - Programme Specific Outcome (PSO)

On completion of undergraduate programme, the student is expected to achieve the following programme specific outcomes:

PSO1	Enhancing conceptual knowledge
PSO2	Illustrate the principles of electricity, magnetism, thermodynamics, optics and spectroscopy and awareness on impact of Physics.
PSO3	Identify, formulate and analyze complex problems using basic principles of mathematics,physics and statistics.
PSO4	Develop experimental skills and independent work culture through a series of experimentsthat compliment theories and projects.
PSO5	Understand the basics of programming language and apply it to various numerical problems.

B.Sc Physics - Course Outcomes (CO)

Semester	Course Code	Course Title	Course Outcome Code	Course Outcome
1	CC-1	**MATHEMATICAL PHYSICS**	CO1	Understand the concepts of limits, derivatives and integrals and apply these techniques to solve complex mathematical and physical problem.
			CO2	Understand vector calculus the application of the gradient, divergence and curl operators in various physical contexts
			CO3	Grasp the concepts of orthogonal curvilinear system , able to convert between different coordinate systems and apply them to describe physical phenomena
			CO4	Apply Mathematical techniques to solve physical problems.
			CO5	Formulate and solve Mathematical physics problems which are essential for further studies in physics and Engineering.

1	CC-2	**MECHANICS**	CO1	Apply principles of dynamics to analyze motion in various scenarios
			CO2	Understand rotational dynamics and its applications in mechanical systems
			CO3	Analyze elasticity, beam's flexure and material behavior under stress
			CO4	Explore fluid motion, surface tension and central force motion phenomena
			CO5	Grasp oscillations and special relativity concepts in Physics context
2	CC-3	**ELECTRICITY AND MAGNETISM**	CO1	Understand polarization, susceptibility, and dielectric materials' role in capacitors and insulators within electrical circuits.
			CO2	Calculate magnetic fields produced by currents, magnets, and their effects on magnetic materials.
			CO3	Differentiate and explain ferromagnetic, paramagnetic, and diamagnetic materials, and interpret hysteresis loops.
			CO4	Apply Faraday's and Lenz's laws to calculate induced EMFs and currents in transformers and generators.
			CO5	Design, troubleshoot circuits, apply Kirchhoff's laws, and utilize instruments like ballistic galvanometers for current measurement.
2	CC-4	**WAVES AND OPTICS**	CO1	Understand the principles of wave motion, including wave propagation, superposition, and wave parameters like frequency and wavelength.
			CO2	Calculate wave velocities in various mediums, analyze their behavior, and apply wave equations to real-world scenarios.

			CO3	Master wave optics, explaining wave-particle duality, diffraction, and polarization, and applying these concepts to optical phenomena.
			CO4	Analyze interference patterns, design and operate interferometers, and predict outcomes in multi-wave interactions for optical measurements.
			CO5	Differentiate between Fraunhoffer and Fresnel diffraction, analyze patterns, and apply these principles to optical system design.
3	CC-5	**MATHEMATICAL PHYSICS -II**	CO1	Master the Fourier series method to represent periodic functions, solve boundary value problems, and analyze complex waveforms.
			CO2	Proficiently apply the Frobenius method to solve differential equations, including Legendre and Bessel equations, and explore their applications.
			CO3	Comprehensively understand and calculate various special integrals, including line integrals, surface integrals, and volume integrals in diverse contexts.
			CO4	Develop a deep understanding of error analysis, error propagation, and statistical methods to assess and minimize uncertainties in measurements.
			CO5	Master the techniques of partial differentiation, apply them to functions of multiple variables, and use them to solve physical problems.

3	CC-6	**THERMAL PHYSICS**	CO1	Understand and apply the principles of energy conservation, work, heat transfer, and state variables in thermodynamic systems.
			CO2	Grasp the concept of entropy, its role in energy transfer, and its application in defining the direction of natural processes.
			CO3	Master the concepts of internal energy, enthalpy, Helmholtz free energy, and Gibbs free energy, and apply them in thermodynamic analysis.
			CO4	Analyze the interrelationships between thermodynamic properties using Maxwell's relations, and apply them to solve complex problems.
			CO5	Explore the distribution of molecular velocities, molecular collisions, and deviations from ideal behavior in real gases, explaining phenomena like phase transitions.
3	CC-7	**DIGITAL SYSTEMS AND APPLICATIONS**	CO1	Understand the design and operation of digital logic circuits, including gates, flip-flops, and multiplexers, for various applications.
			CO2	Master Boolean algebra and its application to simplify logic expressions and design efficient digital systems.
			CO3	Design and analyze data processing circuits, including multiplexers, decoders, and encoders, for information manipulation.
			CO4	Develop skills in designing and

				implementing arithmetic circuits for tasks such as addition, subtraction, multiplication, and division.
			CO5	Design and analyze sequential circuits, timers, shift registers, and 4-bit counters for applications in digital systems.
4	SEC 2	**ELECTRICAL CIRCUIT NETWORK SKILLS**	CO1	Develop a strong foundation in electrical concepts, including voltage, current, resistance, and Ohm's law, for circuit analysis.
			CO2	Gain proficiency in analyzing and designing electrical circuits, considering series and parallel connections, and applying Kirchhoff's laws.
			CO3	Understand the operation of generators and transformers, their types, and their role in electrical power generation and distribution.
			CO4	Master the principles of electric motors, their types, and applications, and learn to troubleshoot motor-related issues.
			CO5	Learn about safety measures, protection devices, and electrical wiring techniques for building and maintaining electrical systems.
4	CC-8	**MATHEMATICAL PHYSICS -III**	CO1	Develop a deep understanding of complex numbers, functions, and their applications in physics, including contour integrals.
			CO2	Master integral transforms such as Fourier, Laplace, and Z-transforms

				and apply them to solve complex mathematical physics problems.
			CO3	Proficiently use Laplace transforms to analyze linear systems, differential equations, and dynamic processes in physics and engineering.
			CO4	Apply integral transforms to solve problems in wave propagation, heat conduction, and other physical phenomena.
			CO5	Explore advanced concepts like residues, singularities, and complex integration techniques for solving complex physical problems.
4	CC-9	**ELEMENTS PF MODERN PHYSICS**	CO1	Understand the wave-particle duality of light, quantization of energy, and its application in explaining phenomena like the photoelectric effect.
			CO2	Grasp Heisenberg's Uncertainty Principle and its implications on the simultaneous measurement of position and momentum in quantum mechanics.
			CO3	Comprehend the concept of matter waves, de Broglie wavelength, wave-particle duality, and analyze wave functions in quantum systems.
			CO4	Solve quantum problems involving particles confined to one-dimensional rigid boxes and interpret energy Eigen states and

				wave functions.
			CO5	Explore nuclear physics, radioactivity, nuclear reactions, and laser principles, their applications in technology and scientific research.
4	CC-10	**ANALOG SYSTEMS AND APPLICATIONS**	CO1	Understand the behavior and applications of semiconductor diodes, including rectification and voltage regulation in electronic circuits.
			CO2	Master the theory and operation of BJTs as amplifiers and switches and apply them in electronic circuit design.
			CO3	Analyze amplifier configurations, including coupled amplifiers, and design them for various gain and frequency requirements.
			CO4	Grasp the principles of feedback in amplifiers, including stability, bandwidth, and distortion reduction, and apply feedback techniques.
			CO5	Learn to design and analyze sinusoidal oscillators and understand operational amplifiers using a black-box approach, and apply them in practical circuits.
5	DSE-1	**NUCLEAR AND PARTICLE PHYSICS**	CO1	Understand nuclear structure, including size, shape, and binding energy, and apply this knowledge to describe isotopes and isotones.
			CO2	Master the concepts of nuclear models like the shell model and liquid-drop model to predict nuclear properties and behaviors.

			CO3	Analyze the decay of unstable nuclei through alpha, beta, and gamma radiation, and calculate decay rates and half-lives.
			CO4	Investigate nuclear reactions, including fusion and fission, and apply principles like cross-sections and reaction mechanisms to solve problems.
			CO5	Explore the interaction of nuclear radiations with materials, study radiation detection methods, and delve into particle physics, including the Standard Model.
5	DSE-2	**CLASSICAL DYNAMICS**	CO1	Apply conservation laws of energy and momentum to various physical systems, enabling accurate predictions and problem solving in dynamics.
			CO2	Understand Einstein's special theory of relativity, including time dilation, length contraction, and the relativistic addition of velocities.
			CO3	Analyze the interaction of charged particles with electromagnetic fields, understand wave-particle duality, and study radiation emission and absorption.
			CO4	Analyze systems with non-inertial reference frames including Coriolis and centrifugal forces in the context of Classical Mechanics
			CO5	Undestand Lagrangian and Hamiltonian mechanics , solving problems using variational principles

				and generalized coordinates
5	CC-11	**QUANTUM MECHANICS AND APPLICATIONS**	CO1	Understand the time evolution of quantum systems using the time-dependent Schrödinger equation and its applications.
			CO2	Solve the time-independent Schrodinger equation to analyze stationary states and energy levels in quantum systems.
			CO3	Analyze quantum systems with arbitrary potentials, discussing bound states, wave functions, and energy spectra
			CO4	Explore the behavior of atoms in external electric and magnetic fields, including energy level shifts and Zeeman effect.
			CO5	Study the quantum mechanics of hydrogen atoms and multi-electron systems, understanding electron configurations and spectral lines.
5	CC-12	**SOLID STATE PHYSICS**	CO1	Understand crystal structures, including Bravais lattices, unit cells, and crystallographic notations, and apply them to various materials.
			CO2	Analyze lattice vibrations and phonon dispersion in crystals, explaining thermal and mechanical properties of materials.
			CO3	Master magnetic behavior in solids, including paramagnetism, ferromagnetism, and antiferromagnetism, and apply this knowledge.
			CO4	Explore dielectric behavior in materials, including polarization,

				permittivity, and applications in capacitors and insulators.
			CO5	Comprehend electronic band structures, bandgaps, and conductivity in solids, and the phenomenon of superconductivity in certain materials.
6	DSE-3	**DISSERTATION**	CO1	Demonstrate motivation in selecting a compelling research topic for dissertation
			CO2	Develop a well-designed methodology to conduct rigorous experiments
			CO3	Achieve a high level of content depth and critical analysis in the project
			CO4	Effectively communicate and interpret results in the context of current physics literature
			CO5	Deliver a polished and engaging presentation style during presentation.
	DSE-4	**EXPERIMENTAL TECHNIQUES**	CO1	Perform accurate measurements, calibrate instruments, and analyze experimental data using statistical methods for precision.
			CO2	Analyze signals, design systems for data acquisition, and understand signal processing techniques for experimental setups.
			CO3	Implement effective shielding and grounding strategies to minimize electromagnetic interference and ensure safety in experimental environments.
			CO4	Select, install, and operate various transducers and industrial

				instruments for measuring physical parameters in industrial settings.
			CO5	Operate digital multimeters proficiently for electrical measurements and understand the principles and applications of vacuum systems.
6	CC-13	**ELECTROMAGNETIC THEORY**	CO1	Achieve a deep understanding of Maxwell's equations, including their differential and integral forms, and apply them to analyze electromagnetic phenomena.
			CO2	Analyze the behavior of electromagnetic waves in unbounded media, covering concepts such as wave propagation, wave impedance, and radiation patterns.
			CO3	Explore the interaction of electromagnetic waves with different bounded media, understanding reflection, refraction, and transmission at boundaries.
			CO4	Examine polarization states in electromagnetic waves, including linear, circular, and elliptical polarizations, and their applications.
			CO5	Study rotatory polarization, its effects on light propagation, and apply this knowledge to understand the principles and applications of optical fibers.
	CC-14	**STATISTICAL MECHANICS**	CO1	Understand classical statistical mechanics, including the Boltzmann distribution, and apply it to describe macroscopic systems at equilibrium.

			CO2	Analyze radiation behavior using classical statistical mechanics, explaining blackbody radiation and other electromagnetic phenomena.
			CO3	Master quantum statistical mechanics, elucidating radiation properties through quantum principles, such as Planck's law and photon statistics.
			CO4	Grasp the Bose-Einstein statistics governing indistinguishable bosons, describing their behavior in systems like Bose-Einstein condensates.
			CO5	Understand Fermi-Dirac statistics for indistinguishable fermions, explaining electron behavior in conductors, semiconductors, and degenerate matter.

Practicals

Laboratory provides a wide space for students to nurture their hidden scientific potential, creative thinking and systematic analyzing skills. Through B. Sc Physics programme, students will realize how theory, experiment and observation are mutually correlated and help each other to expand the frontiers of knowledge of the physical universe. By conducting various experiments, students will be able to internalize a number of skills and they will be benefited in life in many ways as follows:

CONSOLIDATED STRUCTURE OF MODEL I PRACTICALS

FOR SEMESTERS I - VI

Semester	**Title of the Practical**	**CO**	**COURSE OUTCOME**
Sem-1	**MATHEMATICAL PHYSICS- C1 LAB**	CO1	Application of computer programming and numerical Analysis in solving problems in Physics
		CO2	Mastery of C/C++ for advanced Physics simulation.
	MECHANICS-C2 LAB	CO1	Mastery of advanced experimental techniques to precisely analyze viscosity, elastic constants, and acceleration due to gravity.
		CO2	Develop a spirit of consistency and patience to take not of observations with high degree of accuracy
Sem-2	**ELECTRICITY AND MAGNETISM-C3 LAB**	CO1	Evaluate circuit behavior, applying Thevenin’s and Norton’s theorem for complex analysis.
		CO2	Analyze LCR circuits, demonstrating advanced problem solving skills in electrical experiments
		CO3	Apply critical thinking to trouble shoot circuits, demonstrating mastery in measurements
	WAVES AND OPTICS-LAB	CO1	Employ analytical thinking to measure angle of the prism accurately using Schuster’s focusing
		CO2	Apply advanced concepts to determine refractive index and dispersive power
		CO3	Utilize complex calculations to find precise wavelengths in optical experiments.
Sem-3	**SKILL**	CO1	Create intricate digital designs,

	ENHANCEMENT Lab-SEC1 Lab		showcasing mastery in graphic design software
		CO2	Analyze complex IT problems, demonstrating advanced problem –solving skills.
		CO3	Synthesize creative solutions, applying software for entrepreneurial ventures effectively.
	MATHEMATICAL PHYSICS -II	CO1	Apply Scilab for advanced data analysis, showcasing expertise in computational tools
		CO2	Analyze complex systems, employing Gauss elimination for mathematical problem-solving
	THERMAL PHYSICS C6 LAB	CO1	Evaluate advanced heat transfer concepts through Searle's method with precision
		CO2	Analyze intricate thermoelectric phenomena, demonstrating expertise in thermal physics
	DIGITAL SYSTEMS AND APPLICATIONS C-7 LAB	CO1	Apply advanced logic design skills to create complex digital circuits
		CO2	Analyze intricate waveforms, demonstrating expertise in digital system measurements.
SEM 4	**MATHEMATICAL PHYSICS –III C8 LAB**	CO1	Utilize Scilab for advanced simulations ,solving complex mathematical Physics scenarios
		CO2	Analyze intricate mathematical problems, demonstrating expertise in Dirac delta function
	ELEMENTS PF MODERN PHYSICS C-9 LAB	CO1	Apply advanced methods to measure fundamental constants .
		CO2	Analyze complex experimental data demonstrating precision in experimentation and synthesize intricate measurements effectively determining the wavelength of laser source
	ANALOG SYSTEMS AND APPLICATIONS C-10 LAB	CO1	Synthesize intricate operational amplifier application, demonstrating advanced problem solving skills
		CO2	Apply advanced techniques for analyzing

			PN junction and Zener Diode
SEM 5	**QUANTUM MECHANICS AND APPLICATIONS C-11 LAB**	CO1	Utilize Scilab for advanced simulations ,solving problems on quantum mechanics
		CO2	Apply advanced quantum physics principles to analyze Zeeman effect
	SOLID STATE PHYSICS C-12 LAB	CO1	Verify Curie-Weiss Law for ferroelectric material
		CO2	Apply advanced techniques to precisely measure magnetic susceptibility in solids
SEM 6	**EXPERIMENTAL TECHNIQUES DSE4 LAB**	CO1	Evaluate and synthesize complex data comparing various types of cables
		CO2	Apply advanced design skills to create and analyze clippers and clampers
	ELECTROMAGNETIC THEORY C-13 LAB	CO1	Analyze complex optical data demonstrating expertise in refractive index determination
		CO2	Apply advanced electromagnetism principles for precise specific rotation measurement.
	STATISTICAL MECHANICS C-14 LAB	CO1	Solve advanced statistical Mechanics problems using Scilab
		CO2	Synthesize and analyze intricate data, effectively comparing radiation models and plotting distribution functions