DEPARTMENT OF PHYSICS- PO, PSO, CO

2.6.1 PO, PSO & CO			
Department	**PO**	**PSO**	
Physics	**Students completing a Science program should be able to:** 1. Demonstrate fundamental knowledge in natural sciences 2. Apply knowledge of mathematics, natural science and computer science to find solutions to scientific and engineering problems. 3. Design and conduct experiments, analyse and interpret data and deduce valid conclusions. 4. Communicate effectively. 5. Recognize the need for life-long learning and find means to achieve the same. 6. Understand the impact of scientific solutions in a societal context and to be able to respond effectively to the needs for sustainable development in the society. 7. Apply critical thinking through independent thought and informed judgement, and develop creative and innovative solutions. 8. Develop professional, ethical and moral responsibility.	PG	**Students completing a M.Sc. program in Physics should be able to:** 1. Demonstrate substantial knowledge in various subfields of physics such as classical mechanics, mathematical physics, quantum mechanics, electrodynamics, solid state physics, statistical mechanics, lasers and optical fibers etc. 2. Acquire considerable knowledge in mathematical methods, and practical knowledge in supported fields like computer science. 3. Gain research experience within a specific field of physics through a supervised project and become familiar with contemporary research within various subfields of physics. 4. Complete an original, creative project that demonstrably advances human knowledge within their subfield. 5. Communicate effectively the results of the research project to professionals within their subfield and within the broader physics community, through both oral presentation and written work. 6. Demonstrate fluency in comprehension of the research literature in subfields of their interest. 7. Acquire scientific, technical and engineering skills to become employable in a variety of industries.

CO –PG			
Department	Course Code	Course	Course outcome
Physics	PHY1C01	Classical Mechanics	Students should be able to: . Formulate Lagrangian and Hamiltonian framework for classical systems. . Find eigen values and eigen functions for small oscillations. . Understand the foundations of nonlinear oscillations and chaotic motion.
	PHY1C02	Mathematical Physics – I	Students should be able to: . Perform mathematical manipulations using vectors, matrices and tensors. . Solve partial differential equations with appropriate initial or boundary conditions. . Become fluent in the use of Fourier and Laplace transformations to solve differential equations and derive asymptotic properties of solutions . become familiar with special functions
	PHY1C03	Electrodynamics and Plasma Physics	Students should be able to: . Interpret the deeper meaning of the Maxwell's equations and derive the wave equation using it. . Understand the propagation of plane electromagnetic waves in lossless media and interfaces. . Derive the wave characteristics of wave guides and cavity resonators. . Understand the basics of relativistic electrodynamics . Analyze the motion of charged particles in electromagnetic fields . Formulate kinetic and fluid descriptions of plasma
	PHY1C04	Electronics	Students should be able to: .Understand the characteristics of field effect transistors and design amplifiers, switches and logic gates using them. . Familiarize with the working principle of optoelectronic devices. .Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation and filtering on electronic signals . Minimize Boolean algebra using Karnaugh map and representation using logic gates.
	PHY1P01	General Physics Practical -I	Students should be able to: . Measure Y & σ of a material . Determine viscosity of a given liquid . Measure mode constants of a vibrating strip

			. Determine the resistance and inductance of an unknown inductor . Measure magnetic susceptibility of a material . Analyze various diffraction patters
	PHY1P02	Electronics Practical – I	Students should be able to: . Design a single stage bipolar transistor amplifier . Design and construct a Darlington pair amplifier . Design and construct an R.F oscillator using tunnel diode . Design and construct OPAMP based summing and averaging amplifier, Wien bridge oscillator, astablemultivibrator, integrator and differentiator . Design and construct a voltage controlled oscillator using timer IC 555
	PHY2C05	Quantum Mechanics -I	Students should be able to: . Learn the mathematical tools needed for analyzing quantum mechanical systems. . Learn the fundamental postulates of quantum mechanics . Solve time-independent Schrodinger equation for particle in a box, finite potential barrier, harmonic oscillator, hydrogen atom etc. . Demonstrate the matrix representation of the eigenvalue problem and angular momentum operators. . Estimate scattering amplitude and cross-section
	PHY2C06	Mathematical Physics – II	Students should be able to: . Apply techniques of complex analysis, such as contour integrals, to the study of special functions of mathematical physics . become familiar with the basic ideas of group theory . Solve partial differential equations with appropriate initial or boundary conditions with Green function techniques. . Understand Integral equations and Integral transforms
	PHY2C07	Statistical Mechanics	Students should be able to: . Define and discuss the concepts of microstate and macrostate and phase space of a model system .Understand the behavior of microcanonical, canonical and grand canonical ensembles. . Formulate density matrix for various ensembles . Discuss the thermodynamic behaviour of an ideal Fermi gas and Bose gas.
	PHY2C08	Computational Physics	Students should be able to: . Code elementary programs in Python

			. Learn how to use lists, tuples, and dictionaries in Python programs . Perform arithmetic operations and data plotting using Python. . Implement numerical methods such as curve fitting, numerical integration, ordinary differential equation solving and Fourier transforms in Python. . Simulate 1D and 2D motion and 1D Schrodinger equation
	PHY2P03	General Physics Practical - II	Students should be able to: . Determine the surface tension and Thermal conductivity of a given liquid . Measure ionization potential of Mercury . Determine thickness of air film using a Fabry-Perrot etalon . Analyze beam profile of a given laser. . Determine Cauchy's constants using liquid prism . Draw magnetic hysteresis curve.
	PHY2P04	Electronics Practical – II	Students should be able to: . Study the V-I characteristics of a unijunction transistor and trigger a SCR using it. . Design and construct a monostable multivibrator and a triangular wave generator using OPAMP . Design and construct an astablemultivibrator using timer IC 555 . Analyze a 4 bit binary counter (IC 7493) and a 4 bit decade counter(IC 7490) at various modes . Set up four bit shift register IC 7495 and verify shift operations
	PHY3C09	Quantum Mechanics - II	Students should be able to: . Apply approximation methods for time-independent problems. . Solve variational equation to find the ground state of H and He atoms. . Analyze atom-field interactions using time-dependent perturbation theory. . Discuss relativistic quantum mechanics . Understand the principles of canonical quantization of fields
	PHY3C10	Nuclear and Particle Physics	Students should be able to: . Develop an understanding of nuclear forces . Analyze the mechanism and energetics of radioactive decay . Understand the formalism models describing the structure and properties of nuclei and nuclear collisions.

			. Become familiar with nuclear radiation detectors and associated electronics . Demonstrate knowledge of the elementary particles and the forces governing them.
	PHY3C11	Solid State Physics	Students should be able to: . Classify real solid materials based on basic concepts like atomic arrangement, microstructure and crystal binding. . Apply the theory of X-ray diffraction in reciprocal space to determine the lattice structure of crystalline materials. . Formulate basic model of lattice vibrations for describing the physics of crystalline materials. . Formulate electron properties in a periodic potential and develop a qualitative understanding of the relation between band structure and the electrical/optical properties of a material. . Explain the physical principles for different types of electric and magnetic phenomena in solid materials. . Understand the foundations of superconductivity.
	Elective -I PHY3E05	Experimental Techniques	Students should be able to: . Use roughing pump, turbo pump, ion bump and different vacuum gauges. . Fabricate thin films and measure the thickness accurately. . Become familiar with accelerator techniques. . Employ nuclear techniques for material analysis. . Employ X-ray diffraction technique to analyze crystalline structure of materials
	PHY4Pr	Project	Students should be able to: . Demonstrate a detailed physical and mathematical understanding of an advanced topic in physics . Demonstrate specialized analytical skills and techniques necessary to carry out research in an advanced topic in physics . Approach and solve new problems in an advanced topic in physics . Analyze, interpret and critically evaluate research findings . Comply with regulatory frameworks and practice professional ethics relevant to physics
	PHY3P05	Modern Physics Practical -I	Students should be able to: . Determine the carrier concentration in the given semiconductor specimen . Use an ESR spectrometer measure the g factor . Determine dielectric constant of a nonpolar

			liquid . Determine the numerical aperture, attenuation and band width of an optical fiber . Measure the band gap energy of a semiconductor using four probe method and diodes . Determine charge to mass ratio of the electron by Thomson's method.
	PHY4C12	Atomic and Molecular Spectroscopy	Students should be able to: . Understand the effect of electric & magnetic field on atomic spectra. . Understand the rotationally and vibrationally active transitions in diatomic molecules, selection rules governing them and detection instruments. . Analyze the rotational Raman spectrum of symmetric top molecules . Derive transport properties through vibrational analysis of band systems. . Apply spin resonance spectroscopy to explore the chemical species with unpaired electrons in materials.
	Elective –II PHY4E13	Laser Systems, Optical Fibers and Applications	Students should be able to: . Learn working principle and energy level diagrams various CW and pulsed lasers. . Analyze optical resonators to determine stable operating regimes. . Understand the effect of nonlinear susceptibility terms in light-matter interactions. . Understand the basic characteristics of an optical fiber, solve the scalar wave equation and the identify the propagating modes of a fiber.
	Elective -III PHY4E20	Microprocessors and Applications	Students should be able to: . The student will be able to analyze, specify, design, write and test assembly language programs of moderate complexity. . Learn timing, memory interfacing and data transfer schemes in 8085 microprocessor based systems. . Effectively utilize microcontroller peripherals. . Design and implement microprocessor-based embedded systems. . Become familiar with 8051 microcontroller.
	PHY4Pr1	Project	Students should be able to: . Demonstrate a detailed physical and mathematical understanding of an advanced topic in physics . Demonstrate specialized analytical skills and techniques necessary to carry out research in an

			advanced topic in physics . Approach and solve new problems in an advanced topic in physics . Analyze, interpret and critically evaluate research findings . Comply with regulatory frameworks and practice professional ethics relevant to physics
	PHY4P06	Modern Physics Practical –II	Students should be able to: . Use a GM counter to measure the absorption coefficient of a material for beta & gamma rays . Determine the end point energy of the beta particles using Feather analysis . Record the absorption spectrum of a molecule and determine the dissociation energy . Determine refractive index of a transparent material by measuring the Brewster's angle . Determine the velocity and compressibility of sound in liquids . Characterize a Zener diode at low and ambient temperatures . Interface ADC 0800/0808 to a 8085 microprocessor and write ALP to convert a given DC voltage
	PHY4P07	Computational Physics Practical	Students should be able to use Python to: . Do least square fitting . Implement Trapezoidal method and Simpson's method for numerical integration . Implement Newton Raphson method for finding solutions of an algebraic equation . Solve second order differential equation using Runge-Kutta method . Do Monte Carlo simulations . Simulate the trajectory of a particle moving in a Coulomb field . Solve Schrödinger equation for a particle in a box, numerically find the eigen values and plot the wave functions . Simulate a two slit photon interference experiment
	Viva Voce (Comprehensive)		