Programme Specific Outcomes	**BSc (Honors)Physics** **PSO1:** Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics. **PSO2:** Students will demonstrate knowledge of classical mechanics, electromagnetism and modern physics and be able to apply this knowledge to analyze a variety of physical phenomena. **PSO3:** Students will show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions. **PSO4:** Students will be capable of oral and written scientific communication and will prove that they can think critically and work independently.
Course Outcomes	**PHM 101 : MECHANICS AND RELATIVITY** **CO1:** Understand the motion of objects in different frame of references. **CO2:** Understand laws of motion, reference frames, and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions. **CO3:** Understand the idea of conservation of angular momentum, central forces and the effective potential. **CO4:** Understand the application of central force to the stability of circular orbits, Kepler's laws of planetary motion, Orbital Precession and Rutherford scattering. **CO5:** Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia, parallel axis theorem, the inertia tensor, the motion of rigid bodies. non-inertial frames: pseudo forces, examples involving the centrifugal force and coriolis force. **CO6:** Understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle. **CO7:** Understand the basics of motion of fluid which includes streamlined and turbulent flows, equation of continuity, critical velocity, flow of a liquid through a capillary tube, capillaries in series and parallel, Stokes' formula. **CO8:** Develop understanding of special theory of relativity and its applications to understand length contraction, time dilation, relativistic addition of velocities, conservation of

	momentum and variation of mass, relativistic momentum, relativistic energy, and mass-energy relation.
Course Outcomes	**PHM 102 : MATHEMATICAL METHOD-I** **CO1:** Learn and understand calculus. Starting with review of differentiation, exponential and logarithm functions, trigonometric functions, plotting functions, differentials and basics of integration. **CO2:** Understand Gaussian integrals, integration by parts, differential and integral calculus for many variables, Lagrange multipliers and Jacobins, Taylor series and their applications in physics. **CO3:** Understand math of complex number and application of Cauchy-Riemann Equations, Residue Theorem and Taylor Series for analytic functions. **CO4:** Understand basics of vector calculus. **CO5:** Understand divergence, gradient and curl and their physical interpretation. **CO6:** Understand divergence theorem, Green's theorem, Stokes' theorem and appreciate its applications. **CO7:** Understand basics of matrices and determinants i.e. inverses, linear vector spaces, basis, basis transformations and linear operators, determinants, eigenvalues, eigenvectors, simple applications, and basics of tensors. **CO8:** Understand differential equations i.e. ordinary differential equations with constant coefficients, first order ODE's with variable coefficients, second order ODE's partial differential equations, the wave equation and the heat equation, and application of Green's function.
Course Outcomes	**PHM 103 : PHYSICS LAB** **CO1:** A working knowledge of fundamental physics and basic mechanics principles. **CO2:** The ability to identify, formulates, and solve physics problems. **CO3:** The ability to formulate, conduct, analyzes and interprets experiments in physics. **CO4:** The ability to use modern physics techniques and tools, including mathematical techniques, graphs and laboratory instrumentation.
Course Outcomes	**PHM 104 : SEMINAR & GROUP DISCUSSION** **CO1:** Understands advance problem based on topics related to PHM101 and PHM102.

	CO2: The ability to communicate their ideas effectively, both orally and in writing. **CO3:** Understands function effectively in multidisciplinary teams and topics.
Course Outcomes	**PHM 201: OSCILLATIONS, WAVES & ACOUSTICS** **CO1:** Understand the concepts of mechanics, acoustics and the properties of matter. **CO2:** Ability to recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems, point out the limitations and be able to refer to very different solutions of identical oscillator equations due to different initial and boundary conditions. **CO3:** Understand how several waves or parts of waves interact, and be able to calculate and analyze diffraction and interference phenomena, and explain the conditions required for such phenomena to appear. **CO4:** Able to calculate what happens when waves move from one medium to another, and be able to explain dispersion and group and phase velocity. **CO5:** Use Lissajous figures to understand simple harmonic vibrations of same frequency and different frequencies. **CO6:** Able to solve wave equation and understand significance of transverse waves. **CO7:** Able to solve wave equation of a longitudinal vibration in bars free at one end and also fixed at both the ends. **CO8:** Obtain boundary conditions of a longitudinal vibration in bars free at one end and also fixed at both the ends. **CO9:** Gain knowledge on applications of transverse and longitudinal waves. **CO10:** Understand application of acoustics in noise and music, musical scale, sonar and ultrasonic.
Course Outcomes	**PHM 202: ELECTRICITY & MAGNETISM** **CO1:** Understand the basic concepts of electric and magnetic fields. **CO2:** Understand the concept of conductors, dielectrics, inductance and capacitance. **CO3:** Gain knowledge on the nature of magnetic materials. **CO4:** Understand the concept of static and time varying fields. **CO5:** Gain knowledge on electromagnetic induction and its applications **CO6:** Gain knowledge on EM waves, propagation and their properties. **CO7:** Ability to use Maxwell's equations in calculations featuring: both free and stationary electromagnetic waves.
Course Outcomes	**PHM 203: PHYSICS LAB** **CO1:** Understand physical characteristics of SHM and obtaining solution of the oscillator using experiment. **CO2:** Use both analytical mathematics and numerical methods to explore the subjects mentioned above. In particular you should be able to analyse experimental oscillator or

	wave phenomena, such as sound, using suitable methods. **CO3:** Use Lissajous figures to understand simple harmonic vibrations of same frequency and different frequencies. **CO4:** Solve wave equation and understand significance of transverse waves. **CO5:** Solve wave equation of a longitudinal vibration in bars free at one end and also fixed at both the ends. **CO6:** Obtain boundary conditions of a longitudinal vibration in bars free at one end and also fixed at both the ends. **CO7:**Gain knowledge on applications of transverse and longitudinal waves.
Course Outcomes	**PHM 204: SEMINAR & GROUP DISCUSSION** **CO1:** Understands advance problem based on topics related to PHM201 & PHM202. **CO2:** The ability to communicate their ideas effectively, both orally and in writing. **CO3:** Understands function effectively in multidisciplinary teams and topics.
Course Outcomes	**PHM 301: OPTICS** **CO1:** Understand phenomenon based on light and related theories . **CO2:** Get skills to identify and apply formulas of optics and wave physics **CO3:** Understand the event like reflection, refraction, interference, diffraction etc **CO4:** Understand the applications of diffraction and polarization. **CO5:** Understand the applications of interference in design and working of interferometers. **CO6:** Understand the resolving power of different optical instruments. **CO7:** Understand working of optical fiber and their applications in communication
Course Outcomes	**PHM 302: THERMAL & STATISTICAL PHYSICS** **CO1:** Understand the process of thermal conductivity, viscosity and diffusion in gases. **CO2:** Understand the basic statistical methods and concepts like probability, random variables, expected value, variance, estimators and common probability distributions. **CO3:** Understand the relation between microscopic and macroscopic description through statistical mechanics; know and can apply the laws of thermodynamics and principles of free energy; describe thermodynamic processes and heat engines and master the use of the chemical potential to describe diffusive equilibrium, phase equilibrium and chemical processes. **CO4:** Understand the efficiency of Carnot's engine and the significance of first law and second of thermodynamics and implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems.

	CO5: Ability to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations. **CO6:** Understand the interrelationship between thermodynamic functions and ability to use such relationships to solve practical problems.
Course Outcomes	**PHM 303: INTRODUCTION TO QUANTUM MECHANICS** **CO1:** Understand the origins of quantum mechanics **CO2:** Understand and explain the differences between classical and quantum mechanics **CO3:** Understand the idea of wave function **CO4:** Understand the uncertainty relations **CO5:** Understand the Schroedinger wave mechanics and operator formalism **CO6:** Solve the Schroedinger equation for simple 1D time-independent potentials **CO7:** Appreciate the importance and develop an understanding of angular momentum **CO8:** Spot, identify and relate the eigenvalue problems for energy, momentum, angular momentum and central potentials **CO9:** Develop the idea of spin and quantum statistical mechanics
Course Outcomes	**PHM 304: PHYSICS LAB** **CO1:** Understand optical components and systems. **CO2:** Understand, and choose, different models for light. **CO3:** Ability to calculate light level and ray paths in optical systems. **CO4:** Understand the operating principle of some important types of optical instruments.
Course Outcomes	**PHM 305: SEMINAR & GROUP DISCUSSION** **CO1:** Understands advance problem based on topics related to PHM301, PHM302 and PHM303. **CO2:** The ability to communicate their ideas effectively, both orally and in writing. **CO3:** Understands function effectively in multidisciplinary teams and topics.
Course Outcomes	**PHM 401: SOLID STATE PHYSICS**

	CO1: Understand the basic concepts of force between atoms and bonding between molecules. **CO2:** Understanding of diffraction experiment and reciprocal lattice **CO3:** Understand crystal vibrations: phonon heat capacity and thermal conductivity **CO4:** Understand free electron Fermi gas: density of states, Fermi level, and electrical conductivity **CO5:** Understand electrons in periodic potential: energy bands theory classification of metals, semiconductors and insulators **CO6:** Understand semiconductors: band gap, effective masses, charge carrier distributions, doping, pn junctions **CO7:** Understand metals: Fermi surfaces, temperature dependence of electrical conductivity **CO8:** Understand the relationship between conductors and insulators and super conductivity **CO9:** Understand the properties of matter and classifications - polarization **CO10:** Understand the properties of semi conductors **CO11:** Understand the relationship between semiconductors devices and understand the applications of semiconductor devices
Course Outcomes	**PHM 402: SEMICONDUCTOR DEVICES AND CIRCUITS** **CO1:** Understand the properties of semi conductors. **CO2:** Understand the basics of diode and working of rectifier circuits and characteristics. **CO3:** Understand the relationship between semiconductors devices and understand the applications of semiconductor devices **CO4:** Understand time and frequency analysis of analog electronic circuits and signals both analytical and with simulations. **CO5:** Understand about analog passive and active components and how these can be exploited to construct amplifiers, oscillators, regulators and filters. **CO6:** Understanding and ability to analyze the characteristics of transistor and transistor biasing circuits. **CO7:** Understanding and ability to work with of single stage and multistage amplifier. **CO8:** Understand the relationship between amplifier and oscillators. **CO9:** Understand the applications of op-amps i inverting and non inverting modes.
Course Outcomes	**PHM 403: NUCLEAR PHYSICS** **CO1:** Understand the ideas of basics of nucleus and their energy. **CO2:** Understand the procedures for nuclear fission and fusion. **CO3:** Understand the properties of positive rays, experimental proof by frank and hertz method.

	CO4: Understand the relationship between various types of couplings. **CO5:** Understand the properties of x-ray s verification. **CO6:** Ability to apply fundamental conservation laws and symmetries to judge the viability of production and decay processes for nuclei and elementary particles. **CO7:** Ability to have insight into the interplay between theory, models, and data from modern experiments and into how the major open questions are being addressed. **CO8:** A basic understanding of nuclear properties and models that describe the quantum structure, decay, and reactions of nuclei. **CO9:** Understand basic knowledge about the Standard Model of elementary particles and interactions. **CO10:** Understand basic knowledge about the quark-gluon plasma . **CO11:** Understand the roles of nuclear and particle physics in energy production, medicine, and astrophysics - for example how to search for dark matter and how to understand the origin of the elements in the universe.
Course Outcomes	**PHM 404: PHYSICS LAB** **CO1:** Understand the applications of diode, npn transistor, OP-AMP and logic gates . **CO2:** Understand half adder and full adder. **CO3:** Understand tunnel diode characteristics. (V-I)
Course Outcomes	**PHM 405: SEMINAR & GROUP DISCUSSION** **CO1:** Understands advance problem based on topics related to PHM401, PHM402 and PHM403. **CO2:** The ability to communicate their ideas effectively, both orally and in writing. **CO3:** Understands function effectively in multidisciplinary teams and topics.
Course Outcomes	**PHM 501: MATHEMATICAL METHODS II** **CO1:** Understand the basic elements of signals and linear time-invariant systems, including the complex exponential and sinusoidal signals, unit step function and unit impulse function (Dirac delta function), discrete time unit step and unit impulse sequences, continuous and discrete time system, linear time invariant (LTI) systems, continuous time LTI systems, and properties of LTI systems. **CO2:** Ability to solve ordinary second order differential equations important in the physical sciences; solve physically relevant partial differential equations using standard methods like separation of variables, series expansion (Fourier-type series) and integral transforms. **CO3:** Understand how to expand a function in a Fourier series, and under what conditions such an expansion is valid. You will be aware of the connection between this and integral transforms (Fourier and Laplace) and be able to use the latter to solve mathematical

	problems relevant to the physical sciences. **CO4:** Understand Fourier analysis of continuous-time signals and systems. **CO5:** Understand frequency and time domain characteristics system. **CO6:** Understand sampling and reconstruction of signal.
Course Outcomes	**PHM 502: CLASSICAL MECHANICS** **CO1:** Understand the fundamental concepts of analytical mechanics such as generalised coordinates and moment, the Lagrange and Hamilton functions, the action, cyclic coordinates and the relation between symmetries and conserved quantities, as well as the use of Poisson brackets. **CO2:** Ability to use the Lagrange and Hamilton equations to solve complex mechanical problems, and to use phase space based arguments to achieve a qualitative understanding of the existing solutions, as well as to apply variational calculus to more general problems. **CO3:** Understand the fundamental concepts of special relativity and their physical consequences, such as the Lorentz transformation, invariant quantities, the metric, and four-vectors and more general tensors, as well as their use in covariant formulations of physical laws. **CO4:** Ability to perform calculations using relativistic mechanics and conservation laws, including Newton's second law on covariant form. **CO5:** Ability to use Maxwell's equations in calculations featuring: free and stationary electromagnetic waves, polarization, problems with stationary sources, use of the multipole expansion, and time-dependent sources with electromagnetic radiation, including radiation from a dipole. **CO6:** Understanding of the field formulation of the Lagrange-Hamilton formalism.
Course Outcomes	**PHM 503: DIGITAL SYSTEMS & MICROPROCESSORS** **CO1:** Understand the fundamentals of codes and number system **CO2:** Understand the binary arithmetic , logics and boolean functions **CO3:** Understand the functions and working of flipflop circuits register s and counters **CO4:** Understand the applicattions into memory circuits **CO5:** Understand synchronous sequential circuits, registers and multiplexer-demultiplexer. **CO6:** Ability to computer evolution and performance and understand microprogrammed control. **CO7:** Understanding of 8085 microprocessor and ability to program.
Course Outcomes	**PHM 504: NETWORK THEORY**

	CO1: Understand basic of circuital law and simplify the network using reduction techniques. **CO2:** Ability to analyze the circuit using Kirchhoff's law and Network simplification theorems **CO3:** Ability to infer and evaluate transient response, Steady state response, network functions **CO4:** Ability to obtain the maximum power transfer to the load , and Analyze the series resonant and parallel resonant circuit **CO5:** Understand and evaluate two-port network parameters , design attenuators and equalizers **CO6:** Able to Synthesize one port network using Foster and Cauer Forms **CO7:** Understand basics of graph theory.
Course Outcomes	**PHM 505: ELECTROMAGNETIC THEORY** **CO1:** Ability to use vector calculus to static electricmagnetic fields in different engineering situations. **CO2:** Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems. **CO3:** Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering. **CO4:** Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications. **CO5:** Ability to formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media, and also solve such problems in simple geometries using separation of variables and the method of images. **CO6:** Ability to define and derive expressions for the energy both for the electrostatic and magnetostatic fields, and derive Poyntings theorem from Maxwell's equations and physical interpret. **CO7:** Ability to describe and make calculations of plane electromagnetic waves in homogeneous media, including reflexion of such waves in plane boundaries between homogeneous media. **CO8:** Understanding of electrodynamics and relativity.
Course Outcomes	**PHM 506: DIGITAL & MICROPROCESSOR LAB** **CO1:** Understanding of digital systems. **CO2:** Ability to use IC in different applications like, to verify laws and theorems of Boolean algebra, to study basic combinational circuits ect. **CO3:** Understand working and use of flip-flop circuits.

	CO4: Ability to use the microprocessor kit.
Course Outcomes	**PHM 507: NETWORK & SYSTEMS LAB** **CO1:** Understand of theory of networks. **CO2:** Understand Thevenin's, Norton's, Superposition and Tellegen's Theorem **CO3:** Ability to determination of 2-port Network parameters. **CO4:** Ability to determination of impedance and phase in AC circuits.
Course Outcomes	**PHM 601: QUANTUM MECHANICS** **CO1:** Develop knowledge and understanding of the concept that quantum states live in a vector space. **CO2:** Develop a knowledge and understanding of the meaning of measurement **CO3:** Elate this abstract formulation to wave and matrix mechanics **CO4:** Develop a knowledge and understanding of perturbation theory, level splitting, and radiative transitions **CO5:** Develop a knowledge and understanding of the relation between conservation laws and symmetries **CO6:** Develop a knowledge and understanding of the role of angular momentum in atomic and nuclear physics **CO7:** Understand the approximate methods for solving stationary and time-dependent problems **CO8:** Develop a knowledge and understanding of the scattering matrix and partial wave analysis **CO9:** Solve problems in quantum mechanics **CO10:** Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations
Course Outcomes	**PHM 602: ATOMIC & MOLECULAR SPECTRA** **CO1:** Understand basic elements of practical spectroscopy i.e. signal-to-noise ratio, resolving power, width and intensity of spectral transitions. **CO2:** Understand many electron atoms and interaction of spins i.e. LS and JJ coupling. **CO3:** Understand effect of external fields to spectra like, Lande's-factor and Anomalous Zeeman effect. **CO4:** Understand rotational, vibrational, electronic and Raman spectra of molecules and their applications. **CO5:** Able to describe electron spin and nuclear magnetic resonance spectroscopy and their applications.

	CO6: Understand working of IR spectrometer, Raman spectrometer and principles of electron spin resonance, NMR and Mossbauer spectroscopy. **CO7:** Understand basics of three-level and four-level lasers, Ruby, He-Ne and semiconductor lasers, laser spectroscopy.
Course Outcomes	**PHM 603: SEMICONDUCTOR DEVICES** **CO1:** Understand basic concepts of semiconductor physics, diffusion length, relaxation time, band bending, Einstein's relationship and Continuity Equation. **CO2:** Understand junction physics i.e. physics of metal –metal junctions, metal semiconductor junctions. pn junctions: spatial variation of electric fields, potential etc., **CO3:** Understand of bipolar junction transistor: fabrication and operational regions. **CO4:** Understand of principle and working unipolar devices and hetero-junction MESFETs. **CO5:** Understand of principle and working MOS-devices and ferroelectric semiconductor. **CO6:** Understand basic optical memories, magnetic memories, CCD.
Course Outcomes	**PHM 604: MIXED SIGNAL CIRCUIT DESIGN** **CO1:** Understand basic concepts of semiconductor physics, BJT, operation of transistor and CE,CB and CC configuration. **CO2:** Understand and able to solve problems related to power amplifiers, transformers, coupled amplifiers, class A and B operation, power calculations and efficiency. **CO3:** Understand use of H-parameters, small signal analysis, Bode plots and frequency response. **CO4:** Understand effect of bypass and coupling capacitor, Miller capacitance, high frequency analysis of a transistor , tuned circuits. **CO5:** Able to design linear and nonlinear applications of op-amps. **CO6:** Understand logic families and their comparison i.e. bipolar logic families RTL, DTL, DCTL, and different TTL families.
Course Outcomes	**PHM 605: COMPUTATIONAL SCIENCE & PROGRAMMING** **CO7:** Understand MATLAB applications and Graphics, 2-D, 3-D. **CO8:** Understand stability and convergence of numerical algorithms. **CO9:** Able to code numerical differentiation and integration, and partial differential equations in MATLAB.

	CO10: Able to program numerical techniques like least squares, finite differences in time, graph models, etc. **CO11:** Understand techniques like Fourier series, Chebyshev, Legendre, Bessel, Green's functions, discrete Fourier series and fast Fourier transform.
Course Outcomes	**PHM 606: ELECTRONICS LAB** **CO1:** Understanding of OP-AMP based applications like invertor, summer, integrator and differentiator. **CO2:** Able to Measurement of h-parameters **CO3:** Understand complementary symmetry type push-pull amplifier. **CO4:** .Understand phase-shift oscillator. **CO5:** Able to design tuned amplifier
Course Outcomes	**PHM 607: PROGRAMMING LAB** **CO1:** Understand MATLAB programming. **CO2:** Able to write codes for numerical techniques. **CO3:** Able to solving ODE in MATLAB