Department of Physics

Programme Specific Outcome (BA/B.Sc. in Physics)

The programme specific outcome of the syllabus prescribed for the major students of physics is mentioned below:

- Understand the core theoretical concept of physics: Understand the core theoretical principles of physics.
- Acquire analytical and logical skill for higher Education: Acquire the ability to analyse critical problems logically.
- Excel in experimental physics and learn good laboratory practices and safety: Learn to handle experiments perfectly and safely.
- Trained to take up jobs in allied fields: Use the knowledge of physics to seek opportunities in other allied fields.

COURSE OUTCOME

BSc in Physics (Honours) syllabus (CBCS)

1st Semester (Honours)

Paper Name: Mathematical Physics I
Paper Code: PHY-HC-1016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain vector and its applications in various fields, [understand] • interpret differential equations and its applications, [apply] • use different coordinate systems [apply] • use concept of probability and error [apply]	Unit I: Vector Calculus Unit II: First and Second order Differential Equations Unit III: Orthogonal Curvilinear Coordinates Unit IV: Dirac Delta function and its Properties Unit V: Introduction to Probability Unit VI: Theory of Errors	Understand, Apply

Paper Name: Mechanics
Paper Code: PHY-HC-1026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain Inertial and non-inertial reference frames, Newtonian motion, Galilean transformations, projectile motion, [understand]	Unit I: Fundamentals of Dynamics Unit II: Work and Energy Unit III: Collisions Unit IV: Rotational Dynamics Unit V: Elasticity Unit VI: Fluid Motion Unit VII: Gravitation and Central	Understand, Apply

• interpret work and energy, Elastic and inelastic collisions, [apply] • explain motion under central force, simple harmonic oscillations, [understand] • use special theory of relativity. [apply]	Force Motion Unit VIII: Oscillations Unit IX: Non-Inertial Systems Unit X: Special Theory of Relativity	

Paper Name: Mechanics
Paper Code: PHY-HG-1016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the role of vectors and coordinate systems in Physics, [understand] • solve Ordinary Differential Equations, [apply] • apply laws of motion to various dynamical situations, [apply] • explain Inertial reference frames their transformations, [understand] • apply the concept of conservation of energy, momentum, angular momentum to basic problems, [apply] • explain phenomenon of simple harmonic motion, motion under central force [understand] • conceptualise time dilation, Length contraction using special teory of relativity. [understand] • use measuring instruments (like screw gauge, Vernier calipers, travelling microscope) [apply] • learn various principles and associated measurable parameters of measuring instruments. [understand]	Unit I: Vectors Unit II: Laws of Motion Unit III: Momentum and Energy Unit IV : Rotational Motion Unit V : Gravitation Unit VI : Oscillations Unit VII : Elasticity Unit VII : Special Theory of Relativity	Understand, Apply

Paper Name: Electricity & Magnetism
Paper Code: PHY-HC-2016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain electric and magnetic fields in matter, dilectric properties of matter magnetic properties of matter, electromagnetic induction. [understand] • apply Kirchhofff's law in different circuits. [apply] • apply network theorem in	Unit I: Electric Field and Electric Potential Unit II: Dielectric Properties of Matter Unit III: Magnetic Field Unit IV: Magnetic Properties of Matter Unit V: Electromagnetic Induction Unit VI: Electrical Circuits Unit VII: Network Theorems Unit VIII: Ballistic Galvanometer	Understand, Apply

circuits. [apply]		

Paper Name: Waves & Optics
Paper Code: PHY-HC-2026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain superposition of harmonic oscillations, different types of wave motions, superposition of harmonic waves, [understand] • use interference and interferometer, diffraction, holography. [apply]	Unit I: Superposition of Collinear Harmonic Oscillations	Understand, Apply
	Unit II: Superposition of Two Perpendicular Harmonic Oscillations	
	Unit III: Wave Motion	
	Unit IV: Velocity of Waves	
	Unit V: Superposition of Two Harmonic Waves	
	Unit VI: Wave Optics	
	Unit VII: Interference	
	Unit VIII: Interferometer	
	Unit IX: Diffraction	
	Unit X: Fraunhofer Diffraction	
	Unit XI: Holography	

Paper Name: Electricity & Magnetism
Paper Code: PHY-HG-2016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • apply Gauss's law of electrostatics to solve a variety of problems [apply] • calculate the magnetic forces that act on moving charges and the magnetic fields due to currents, [apply] • explain about magnetic materials, [understand] • apply the concepts of induction to solve variety of problems. [apply] • measure resistance (high and low), voltage, current, self and mutual inductance, capacitor, strength of magnetic field and its variation, [apply] • understand different circuits RC, LCR etc. [understand]	Unit I: Vector Analysis	Understand, Apply
	Unit II: Electrostatics	
	Unit III: Magnetism	
	Unit IV : Electromagnetic Induction	
	Unit V : Maxwell's Equations and EM Wave	

Paper Name: Mathematical Physics II
Paper Code: PHY-HC-3016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • solve differential equation using power series solution method [apply]	Unit I: Frobenius Method and Special Functions	Apply
	Unit II: Partial Differential Equations	
	Unit III: Some Special Integrals	
	Unit IV: Matrix	

• solve differential equation using separation of variables method, [apply] • use special integrals, matrix, Fourier series. [apply]	Unit V: Fourier Series	

Paper Name: Thermal Physics
Paper Code: PHY-HC-3026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe laws in thermodynamics, in particular: entropy, temperature, thermodynamic potentials, Free energies, [understand] • explain Maxwell's relations in thermodynamics, behaviour of real gases. [understand]	Unit I: Zeroth and First Law of Thermodynamics	Understand
	Unit II: Second Law of Thermodynamics	
	Unit III: Entropy	
	Unit IV: Thermodynamic Potentials	
	Unit V: Maxwell's Thermodynamic Relations	
	Unit VI: Distribution of Velocities	
	Unit VII: Molecular Collisions	
	Unit VIII: Real Gases	

Paper Name: Digital Systems & Applications
Paper Code: PHY-HC-3036

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the working principle of CRO [understand] • apply digital logic to solve real life problems [apply] • analyze combinational logic circuits [analyse] • Classify different semiconductor memories [understand] • organise sequential logic circuits [analyse] • analyze digital system design using PLD [analyse] • implement combinational and sequential circuits [apply]	Unit I: Introduction to CRO	Understand, Apply, Analyse
	Unit II: Integrated Circuits (qualitative treatment only)	
	Unit III: Digital Circuits	
	Unit IV: Boolean Algebra	
	Unit V: Data Processing Circuits	
	Unit VI: Arithmetic Circuits	
	Unit VII: Sequential Circuits	
	Unit VIII: Timers: IC 555	
	Unit IX: Shift Registers	
	Unit X: Counters	
	Unit XI: Computer Organization	
	Unit XII: Intel 8085 Microprocessor Architecture	
	Unit XIII: Introduction to Assembly Language	

Paper Name: Thermal Physics & Statistical Mechanics
Paper Code: PHY-HG-3016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical	Unit I: Laws of Thermodynamics	Understand, Apply, Analyse
	Unit II: Thermodynamic Potentials	
	Unit III: Kinetic Theory of Gases	
	Unit IV : Theory of Radiation	
	Unit V : Statistical Mechanics	

interpretations, Maxwell's thermodynamic relations, fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion, black body radiations, Stefan-Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances, quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics. [understand] • measure of Planck's constant using black body radiation, [apply] • determine Stefan's Constant, coefficient of thermal conductivity of a bad conductor and a good conductor [apply] • determine the temperature coefficient of resistance [apply] • examine variation of thermos emf across two junctions of a thermocouple with temperature etc. [analyse]		

Paper Name: Applied Optics
Paper Code: PHY-SE-3074

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • determine of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser. [apply] • find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser. [apply] • find the polarization angle of laser light using polarizer and analyzer [apply] • execute experiments with semiconductors [apply] • record and reconstruct holograms [apply] • describe a Michelson interferometer or a Fabry Perot	Unit I: Sources and detectors Unit II: Holography Unit III: Photonics: Fibre Optics	Understand, Apply

interferometer [understand] • measure the refractive index of air [apply]		

Paper Name: Mathematical Physics III
Paper Code: PHY-HC-4016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • solve complex integrals using residue theorem [apply] • apply Fourier and Laplace transforms in solving differential equations [apply] • explain properties of tensor like transformation of coordinates, contravariant and co-variant tensors, indices rules for combining tensors [understand]	Unit I: Complex Analysis Unit II: Complex Integration Unit III: Fourier Transforms Unit IV: Laplace Transforms Unit V: Tensor Algebra	Understand, Apply

Paper Name: Elements of Modern Physics
Paper Code: PHY-HC-4026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe modern development in physics, starting from Planck's law, development of the idea of probability interpretation and the formulation of Schrodinger equation. [understand] • exaplin the structure of nucleus, radioactivity, fission and fusion [understand] • conceptualize the principle of Laser [understand]	Unit I: Quantum Theory and Blackbody Radiation Unit II: Uncertainty and Wave-Particle Duality Unit III: Schrödinger Equation Unit IV: One-dimensional Box and Step Barrier Unit V: Structure of the Atomic Nucleus Unit VI: Radioactivity Unit VII : Detection of nuclear radiation Unit VIII: Fission and Fusion Unit IX: Lasers	Understand

Paper Name: Analog Systems & Applications
Paper Code: PHY-HC-4036

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe about the physics of semiconductor p-n junction and devices such as rectifier diodes, zener diode, photodiode etc. and bipolar junction transistors, transistor biasing and stabilization circuits [understand] • explain feedback in amplifiers and the oscillator circuits [understand]	Unit I: Semiconductor Diodes Unit II: Two-terminal Devices and their Applications Unit III: Bipolar Junction Transistors Unit IV: Amplifiers Unit V: Coupled Amplifier Unit VI: Feedback in Amplifiers Unit VII: Sinusoidal Oscillators Unit VIII: Operational Amplifiers Unit IX: Applications of Op-Amps Unit X: Convversion	Undesratnd

• classify operational amplifiers and their applications. [understand]		

Paper Name: Waves & Optics
Paper Code: PHY-HG-4016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe simple harmonic oscillation and superposition principle, importance of classical wave equation in transverse and longitudinal waves [understand] • describe a range of physical systems based on wave equation [understand] • explain of normal modes in transverse and longitudinal waves: their frequencies and configurations, interference as superposition of waves from coherent sources derived from same parent source, [understand] • Demonstrate understanding of interference and diffraction experiments, Polarization. [apply] • use various optical instruments [apply] • make finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. [apply] • find out resolving power of optical equipment, the motion of coupled oscillators [apply] • explain Lissajous figures and behaviour of transverse, longitudinal waves [understand]	Unit I: Superposition of Two Collinear Harmonic Oscillations Unit II: Superposition of Two Perpendicular Harmonic Oscillations Unit III: Waves Motion Unit IV: Fluids Unit V : Sound Unit VI : Wave Optics Unit VIII : Michelson Interferometer Unit IX : Diffraction Unit X : Polarization	Understand, Apply

Paper Name: Research & Technical Writing
Paper Code: PHY-SE-4024

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • identify and write different parts of technical reports, [understand] • write article, thesis [apply] • make presentation in latex [apply] • use different format of chart based on need [apply] • plot data from different	Unit I: Introduction Unit II: Technical Writing in LaTex Unit III: Scientific graphing and data analysis	Understand, Apply

sources using Origin plot.[apply]		

Paper Name: Quantum Mechanics & Applications
Paper Code: PHY-HC-5016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the principles in quantum mechanics, such as the Schrödinger equation, the wave function, the uncertainty principle, stationary and non-stationary states, time evolution of solutions, as well as the relation between quantum mechanics and linear algebra. [understand] • solve the Schrödinger equation for hydrogen atom [apply] • describe angular momentum and spin, as well as the rules for quantization and addition of these, spin-orbit coupling and Zeeman Effect. [understand]	Unit I: Time Dependent Schrödinger Equation Unit II: Time Independent Schrödinger Equation Unit III: Bound States Unit IV: Hydrogen-like Atoms Unit V: Atoms in Electric & Magnetic Fields Unit VI: Many Electron Atoms	Understand, Apply

Paper Name: Solid State Physics
Paper Code: PHY-HC-5026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the main features of crystal lattices and phonons [understand] • describe the elementary lattice dynamics and its influence on the properties of materials [understand] • describe the main features of the physics of electrons in solids [understand] • explain the dielectric ferroelectric and magnetic properties of solids [understand] • explain the basic concept in superconductivity. [understand]	Unit I: Crystal Structure Unit II: Elementary Lattice Dynamics Unit III: Magnetic Properties of Matter Unit IV: Dielectric Properties of Materials Unit V: Ferroelectric Properties of Materials Unit VI: Free Electron Theory of Metals Unit VII: Superconductivity	Understand

Paper Name: PHY-HE-5046
Paper Code: Physics of Devices and Instruments

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to:	Unit I: Devices Unit II: Power supply and Filters	Understand

• describe advanced electronics devices such as UJT, JFET, MOSFET, CMOS etc., [understand] • explain detailed process of IC fabrication, Digital Data serial and parallel Communication Standards [understand] • describe communication systems.[understand]	Unit III: Active and Passive Filters Unit IV: Multivibrators Unit V: Phase Locked Loop(PLL) Unit VI: Processing of Devices Unit VII: Digital Data Communication Standards Unit VIII: Introduction to communication systems	

Paper Name: Experimental Techniques
Paper Code: PHY-HE-5016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe the errors in measurement and statistical analysis of data required while performing an experiment [understand] • explain the working principle, efficiency and applications of transducers & industrial instruments like digital multimeter, RTD, Thermistor, Thermocouples and Semiconductor type temperature sensors [understand]	Unit I: Measurements Unit II: Signals and Systems Unit III: Shielding and Grounding Unit IV: Transducers & industrial instrumentation (working principle, efficiency, applications) Unit V: Digital Multimeter Unit VI: Impedance Bridges and Q-meter Unit VII: Vacuum Systems	understand

Paper Name: Nuclear and Particle Physics
Paper Code: PHY-HE-5056

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe the sub atomic particles and their properties. [understand] • explain different nuclear techniques and their applications in different branches of physics and societal application. [understand] • applied the concept of nuclear physics in medical, archeology, geology and other interdisciplinary fields of Physics and Chemistry. [apply]	Unit I: General Properties of Nuclei Unit II: Nuclear Models Unit III: Radioactivity decay Unit IV: Nuclear Reactions Unit V: Interaction of Nuclear Radiation with matter Unit VI: Detector for Nuclear Radiations Unit VII: Particle Accelerators Unit VIII: Particle physics	Understand, Apply

Paper Name: Electromagnetic Theory
Paper Code: PHY-HC-6016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level

After the completion of this course, the students will be able to: • describe the Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media [understand] • explain production and detection of different types of polarized EM waves [understand] • describe waveguides and fibre optics. [understand]	Unit I: Maxwell Equations Unit II: EM Wave Propagation in Unbounded Media Unit III: EM Wave in Bounded Media Unit IV: Polarization of Electromagnetic Waves Unit V: Rotatory Polarization Unit VI: Optical Fibres	Understand

Paper Name: Statistical Mechanics
Paper Code: PHY-HC-6026

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • apply Statistical Mechanics to in various fields including Astrophysics, Semiconductors, Plasma Physics, Bio-Physics, Chemistry and in many other directions. [apply]	Unit I: Classical Statistics Unit II: Classical Theory of Radiation Unit III: Quantum Theory of Radiation Unit IV: Bose-Einstein Statistics Unit V: Fermi-Dirac Statistics	Apply

Paper Name: Advanced Mathematical Physics II
Paper Code: PHY-HE-6036

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • apply the concepts of Calculus of Variations, Group Theory and Probability Theory to solve numerical problems in Physics [apply]	Unit I: Calculus of Variations Unit II: Group Theory Unit III: Advanced Probability Theory	Apply

Paper Name: Astronomy and Astrophysics
Paper Code: PHY-HE-6046

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain the origin and evolution of the Universe. [understand] • describe the measurement of basic astronomical parameters such as astronomical scales, luminosity and astronomical quantities. [understand] • describe the developments in	Unit I: Stellar properties Unit II: The Sun and the solar system Unit III: Positional Astronomy Unit IV: Astronomical Techniques Unit V: Galaxies Unit VI: Large Scale Structure and Cosmology	Understand

observational astrophysics [understand] • explain the instruments implemented for astronomical observation [understand] • describe the formation of planetary system and its evolution with time, [understand] • explain the physical properties of Sun and the components of the solar system [understand] • describe the difference between stellar and interstellar components of our Milky Way galaxy [understand] • describe the origin and evolution of galaxies, presence of dark matter and large scale structures of the Universe. [understand]		

Paper Name: PHYSICS-DSE: CLASSICAL DYNAMICS
Paper Code: PHY-HE-6056

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • explain Newton's Laws of Motion [understand] • describe Special Theory of Relativity by 4-vectoer approach and fluids. [understand] • explain Lagrangian and Hamiltonian of a system [understand] • solve the seen or unseen problems/numericals in classical mechanics.[apply]	Unit I: Classical Mechanics of Point Particles Unit II: Small Amplitude Oscillations Unit III: Special Theory of Relativity Unit IV: Fluid Dynamics	Understand, Apply

Paper Name: Communication Electronics
Paper Code: PHY-HE-6016

Course Outcome	Unit/ Topic	Bloom's Taxonomy Level
After the completion of this course, the students will be able to: • describe the role of electronics in communication [understand] • describe details of communication techniques based on Analog Modulation, Analog and digital Pulse Modulation including PAM, PWM, PPM, ASK, PSK, FSK, [understand] • explain communication and	Unit I: Electronic communication Unit II: Analog Modulation Unit III: Analog Pulse Modulation Unit IV: Digital Pulse Modulation Unit V: Satellite Communication Unit VI: Mobile Telephony System Unit VII: GPS navigation system	Understand

	Navigation systems such as GPS and mobile telephony system. [understand]		