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:

1. Understand the core theoretical concept of physics: Understand the core theoretical principles of physics.
2. Acquire analytical and logical skill for higher Education: Acquire the ability to analyse critical problems logically.
3. Excel in experimental physics and learn good laboratory practices and safety: Learn to handle experiments perfectly and safely.
4. 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: 1. explain vector and its applications in various fields, [understand] 2. interpret differential equations and its applications, [apply] 3. use different coordinate systems [apply] 4. 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: 1. explain Inertial and non-inertial reference frames, Newtonian motion, Galilean transformations, projectile motion, [understand] 2. interpret work and energy, Elastic and inelastic collisions, [apply] 3. explain motion under central force, simple harmonic oscillations, [understand] 4. use special theory of relativity. [apply]	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 Force Motion Unit VIII: Oscillations Unit IX: Non-Inertial Systems Unit X: Special Theory of Relativity	Understand, Apply

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: 1. explain the role of vectors and coordinate systems in Physics, [understand] 2. solve Ordinary Differential Equations, [apply] 3. apply laws of motion to various dynamical situations, [apply] 4. explain Inertial reference frames their transformations, [understand] 5. apply the concept of conservation of energy, momentum, angular momentum to basic problems, [apply] 6. explain phenomenon of simple harmonic motion, motion under central force [understand] 7. conceptualise time dilation, Length contraction using special teory of relativity. [understand] 8. use measuring instruments (like screw gauge, Vernier calipers, travelling microscope) [apply] 9. 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: 1. explain electric and magnetic fields in matter, dilectric properties of matter magnetic properties of matter, electromagnetic induction. [understand] 2. apply Kirchhofff's law in different circuits. [apply] 3. apply network theorem in circuits. [apply]	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

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: 1. explain superposition of harmonic oscillations, different types of wave motions, superposition of harmonic waves, [understand] 2. use interference and interferometer, diffraction, holography. [apply]	Unit I: Superposition of Collinear Harmonic Oscillations 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	Understand, Apply

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: 1. apply Gauss's law of electrostatics to solve a variety of problems [apply] 2. calculate the magnetic forces that act on moving charges and the magnetic fields due to currents, [apply] 3. explain about magnetic materials, [understand] 4. apply the concepts of induction to solve variety of problems. [apply] 5. measure resistance (high and low), voltage, current, self and mutual inductance, capacitor, strength of magnetic field and its variation, [apply] 6. understand different circuits RC, LCR etc. [understand]	Unit I: Vector Analysis Unit II: Electrostatics Unit III: Magnetism Unit IV : Electromagnetic Induction Unit V : Maxwell's Equations and EM Wave	Understand, Apply

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: 1. solve differential equation using power series solution method [apply] 2. solve differential equation using separation of variables method, [apply] 3. use special integrals, matrix, Fourier series. [apply]	Unit I: Frobenius Method and Special Functions Unit II: Partial Differential Equations Unit III: Some Special Integrals Unit IV: Matrix Unit V: Fourier Series	Apply

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: 1. describe laws in thermodynamics, in particular: entropy, temperature, thermodynamic potentials, Free energies, [understand] 2. explain Maxwell's relations in thermodynamics, behaviour of real gases. [understand]	Unit I: Zeroth and First Law of Thermodynamics 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	Understand

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: 1. explain the working principle of CRO [understand] 2. apply digital logic to solve real life problems [apply] 3. analyze combinational logic circuits [analyse] 4. Classify different semiconductor memories [understand] 5. organise sequential logic circuits [analyse] 6. analyze digital system design using PLD [analyse] 7. implement combinational and sequential circuits [apply]	Unit I: Introduction to CRO 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	Understand, Apply, Analyse

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: 1. 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 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] 2. measure of Planck's constant using black body radiation, [apply] 3. determine Stefan's Constant, coefficient of thermal conductivity of a bad conductor and a good conductor [apply] 4. determine the temperature coefficient of resistance [apply] 5. examine variation of thermos emf across two junctions of a thermocouple with temperature etc. [analyse]	Unit I: Laws of Thermodynamics Unit II: Thermodynamic Potentials Unit III: Kinetic Theory of Gases Unit IV : Theory of Radiation Unit V : Statistical Mechanics	Understand, Apply, 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: 1. determine of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser. [apply] 2. find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser. [apply] 3. find the polarization angle of laser light using polarizer and analyzer [apply] 4. execute experiments with semiconductors [apply] 5. record and reconstruct holograms [apply] 6. describe a Michelson interferometer or a Fabry Perot interferometer [understand] 7. measure the refractive index of air [apply]	Unit I: Sources and detectors Unit II: Holography Unit III: Photonics: Fibre Optics	Understand, 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: 1. solve complex integrals using residue theorem [apply] 2. apply Fourier and Laplace transforms in solving differential equations [apply] 3. 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: 1. describe modern development in physics, starting from Planck's law, development of the idea of probability interpretation and the formulation of Schrodinger equation. [understand] 2. exaplin the structure of nucleus, radioactivity, fission and fusion [understand] 3. 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: 1. 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] 2. explain feedback in amplifiers and the oscillator circuits [understand] 3. classify operational amplifiers and their applications. [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

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: 1. describe simple harmonic oscillation and superposition principle, importance of classical wave equation in transverse and longitudinal waves [understand] 2. describe a range of physical systems based on wave equation [understand] 3. 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] 4. Demonstrate understanding of interference and diffraction experiments, Polarization. [apply] 5. use various optical instruments [apply] 6. make finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. [apply] 7. find out resolving power of optical equipment, the motion of coupled oscillators [apply] 8. 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: 1. identify and write different parts of technical reports, [understand] 2. write article, thesis [apply] 3. make presentation in latex [apply] 4. use different format of chart based on need [apply] 5. plot data from different sources using Origin plot.[apply]	Unit I: Introduction Unit II: Technical Writing in LaTex Unit III: Scientific graphing and data analysis	Understand, 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: 1. 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] 2. apply Schrodinger equation to square well potential and harmonic oscillator [apply] 3. solve the Schrödinger equation for hydrogen atom [apply] 4. 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: 1. explain the main features of crystal lattices and phonons [understand] 2. describe the elementary lattice dynamics and its influence on the properties of materials [understand] 3. describe the main features of the physics of electrons in solids [understand] 4. explain the dielectric ferroelectric and magnetic properties of solids [understand] 5. 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: 1. describe advanced electronics devices such as UJT, JFET, MOSFET, CMOS etc., [understand] 2. explain detailed process of IC fabrication, Digital Data serial and parallel Communication Standards [understand] 3. describe communication systems.[understand]	Unit I: Devices Unit II: Power supply and Filters 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	Understand

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: 1. describe the errors in measurement and statistical analysis of data required while performing an experiment [understand] 2. 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: 1. describe the sub atomic particles and their properties. [understand] 2. explain different nuclear techniques and their applications in different branches of physics and societal application. [understand] 3. 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: 1. describe the Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media [understand] 2. explain production and detection of different types of polarized EM waves [understand] 3. 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: 1. 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: 1. 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: 1. explain the origin and evolution of the Universe. [understand] 2. describe the measurement of basic astronomical parameters such as astronomical scales, luminosity and astronomical quantities. [understand] 3. describe the developments in observational astrophysics [understand] 4. explain the instruments implemented for astronomical observation [understand] 5. describe the formation of planetary system and its evolution with time, [understand] 6. explain the physical properties of Sun and the components of the solar system [understand] 7. describe the difference between stellar and interstellar components of our Milky Way galaxy [understand] 8. describe the origin and evolution of galaxies, presence of dark matter and large scale structures of the Universe. [understand]	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

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: 1. explain Newton's Laws of Motion [understand] 2. describe Special Theory of Relativity by 4-vectoer approach and fluids. [understand] 3. explain Lagrangian and Hamiltonian of a system [understand] 4. 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: 1. describe the role of electronics in communication [understand] 2. describe details of communication techniques based on Analog Modulation, Analog and digital Pulse Modulation including PAM, PWM, PPM, ASK, PSK, FSK, [understand] 3. explain communication and Navigation systems such as GPS and mobile telephony system. [understand]	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