Department of Physics

Goalpara College, Goalpara 783101, Assam, India

PROGRAMME SPECIFIC OUTCOME (BSc Physics)

- Knowledge of mathematical methods for vector analysis, vector differentiation, integration of vectors, curvilinear co- ordinate system, Matrix, differential equations, Algebric operation etc.
- Ability to understood mechanics.
- Ability to understood waves & oscillation.
- Knowledge of ray optics wave optics and modern optics.
- Ability to understand the properties of matter: elasticity, surface tension & viscosity.
- Ability to understand electrostatic and magneto statics.
- Knowledge of classical, quantum and statistical mechanics.
- Knowledge of computer and ability to apply computer language.
- Know Understanding the edge of astrophysics and nuclear physics.
- Understanding the theory of relativity.
- Ability to understand thermodynamics and the laws of thermodynamics and their applications.
- Understand the Solid-state Physics, Crystal and its internal composition and external behaviour
- Understand electronics, Circuit construction and critical circuit analysis.
- Understand the basic instrumental skills and their usages through hand on mood.
- Ability to undertake project work.

Course Outcome
B.Sc. Physics (Honours) Syllabus (CBCS)

SEMESTER I

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
Successful students should be able to understand vector and its applications in various fields, differential equations and its applications, different coordinate systems, concept of probability and error.	Unit I: Vector Calculus	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: First and Second order Differential Equations	Remember, Understand, Apply, Analyze, Evaluate
	Unit III: Orthogonal Curvilinear Coordinates	Remember, Understand, Apply, Analyze, Evaluate
	Unit IV: Dirac Delta function and its Properties	Remember, Understand, Apply, Analyze, Evaluate
	Unit V: Introduction to Probability	Remember, Understand, Apply, Analyze, Evaluate
	Unit VI: Theory of Errors	Remember, Understand, Apply, Analyze, Evaluate

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course students should be able understand Inertial and non- inertial reference frames, Newtonian motion, Galilean transformations, projectile motion, work and energy, Elastic and inelastic collisions, motion under central force, simple harmonic oscillations, special theory of relativity.	Unit I: Fundamentals of Dynamics	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: Work and Energy	Remember, Understand, Apply, Analyze, Evaluate
	Unit III: Collisions	Remember, Understand, Apply, Analyze, Evaluate
	Unit IV: Rotational Dynamics	Remember, Understand, Apply, Analyze, Evaluate
	Unit V: Elasticity	Remember, Understand, Apply
	Unit VI: Fluid Motion	Remember, Understand, Apply
	Unit VII: Gravitation and Central Force Motion	Remember, Understand, apply, analyse, evaluate
	Unit VIII: Oscillations	Remember, understand, apply
	Unit IX: Non-Inertial Systems	Remember, Understand, Apply, Analyse
	Unit X: Special Theory of Relativity	Remember, Understand, Apply

SEMESTER II

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After successful completion of this course, students will be able to Understand electric and magnetic fields in matter, Dielectric properties of matter magnetic properties of matter, electromagnetic induction, applications of Kirchhofff's law in different circuits, applications of network theorem in circuits.	Unit I: Electric Field and Electric Potential	Remember, Understand, Analyze, Evaluate, Apply
	Unit II: Dielectric Properties of Matter	Remember, Understand, Analyze, Evaluate, Apply
	Unit III: Magnetic Field	Remember, Understand, Analyze, Evaluate, Apply
	Unit V: Electromagnetic Induction	Remember, Understand, Analyse, Apply
	Unit VI :Electrical Circuits	Remember, Understand, Analyse, Evaluate, Apply
	Unit VI: Wave Optics	Understand, Analyse, Evaluate, Apply
	Unit VII: Interference	Understand, Analyse, Evaluate, Apply
	Unit VIII: Interferometer	Understand, Analyse, Evaluate, Apply

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After successful completion of this course, students will be able to Understand superposition of harmonic oscillations, different types of wave motions, superposition of harmonic waves, interference and interferometer, diffraction, holo-graphy	Unit I: Superposition of Collinear Harmonic Oscillations	Remember, Understand, Analyze, Evaluate, Apply
	Unit II: Superposition of Two Perpendicular Harmonic Oscillations	Remember, Understand, Analyze, Evaluate, Apply
	Unit III: Wave Motion	Remember, Understand, Analyze, Evaluate, Apply
	Unit IV: Velocity of Waves	Remember, Understand, Analyse, Apply
	Unit V: Superposition of Two Harmonic Waves	Remember, Understand, Analyse, Evaluate, Apply
	Unit VI: Wave Optics	Understand, Analyse, Evaluate, Apply
	Unit VII: Interference	Understand, Analyse, Evaluate, Apply
	Unit VIII: Interferometer	Understand, Analyse, Evaluate, Apply

SEMESTER III

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After successful completion of the course, students will be able to solve differential equation using power series solution method, solve differential equation using separation of variables method, special integrals, different properties of matrix, Fourier series.	Unit I: Frobenius Method and Special Functions	Remember, Understand, Analyse, Evaluate, Apply
	Unit II: Partial Differential Equations	Remember, Understand, Analyse, Evaluate, Apply
	Unit III: Some Special Integrals	Remember, Understand, Analyse, Evaluate, Apply
	Unit IV: Matrix	Remember, Understand, Analyse, Evaluate, Apply
	Unit V: Fourier Series	Remember, Understand, Analyse, Evaluate

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
Upon successful completion, students will have the knowledge and skills to identify and describe the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, Thermo-dynamics potentials, Free energies, Maxwell's relations in thermo- dynamics, behaviour of real gases.	Unit I: Zeroth and First Law of Thermodynamics	Remember, understand, apply
	Unit II: Second Law of Thermodynamics	Remember, understand, apply, evaluate
	Unit III: Entropy	Remember, Understand, Analyze, Evaluate, Apply
	Unit IV: Thermodynamic Potentials	Remember, Understand, Analyse, Apply
	Unit V: Maxwell's Thermodynamic Relations	Remember, understand, apply, evaluate
	Unit VI: Distribution of Velocities	Understand, apply, evaluate
	Unit VII: Molecular Collisions	Remember, understand, apply, evaluate
	Unit VIII: Real Gases	Remember, understand, apply, evaluate

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After successful completion of the course student will be able to understand the working principle and application of CRO, Integrating circuits, develop a digital logic and apply it to solve real life problems, Analyze, design and implement combinational Logic circuits, Classify different semiconductor memories, Analyze, design and implement sequential logic circuits. Also students will be able to analyze digital system design using PLD, Simulate and implement combinational and sequential circuits.	Unit I: Introduction to CRO	Remember, Understand, Apply & Analyze.
	Unit II: Integrated Circuits	Remember & Understand.
	Unit III: Digital Circuits	Understand, Apply & Analyze.
	Unit IV: Boolean Algebra	Remember, Understand, Apply, Analyze & Evaluate.
	Unit V: Data Processing Circuits	Understand & Apply.
	Unit VI: Arithmetic Circuits	Understand, Apply & Analyze.
	Unit VII: Sequential Circuits	Understand, Apply & Analyze.
	Unit VIII: Timers - IC 555	Understand & Apply
	Unit IX: Shift Registers	Understand, Apply & Analyze.
	Unit X: Counters (4 bits)	Understand & Apply.
	Unit XI: Computer Organization	Remember, Apply & Analyze.
	Unit XII: Intel 8085 Microprocessor Architecture	Understand, Apply & Analyze.
	Unit XII: Intel 8085 Microprocessor Architecture	Remember, Understand & Apply.

SEMESTER IV

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course students will able to solve complex integrals using residue theorem, apply Fourier and Laplace transforms in solving differential equations, understand properties of Tensor like Transformation of coordinates, contravariant and covariant tensors, indices rules for combining tensors.	Unit I: Complex Analysis	Remember, Understand, Analyse, Evaluate
	Unit II: Complex Integration	Remember, Understand, Analyse, Evaluate
	Unit III: Fourier Transforms	Remember, Understand, Analyse, Evaluate, Apply
	Unit IV: Laplace Transforms	Remember, Understand, Analyse, Evaluate, Apply
	Unit V: Tensor Algebra	Remember, Understand, Analyse, Evaluate, Apply

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After completion of the course students will be able to learn modern development in Physics, Starting from Planck's law, it development of the idea of probability interpretation and the Schrodinger equation. Students will also get preliminary idea of structure of nucleus, radioactivity, Fission and Fusion, Gas filled Detectors and Laser.	Unit I: Quantum Theory and Blackbody Radiation	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: Uncertainty and Wave-Particle Duality	Remember, Understand, Apply, Evaluate
	Unit III: Schrödinger Equation	Remember, Understand, Apply, Evaluate
	Unit IV: One-dimensional Box and Step Barrier	Remember, Understand, Apply, Evaluate
	Unit V: Structure of the Atomic Nucleus	Remember, Understand, Apply, Evaluate
	Unit VI: Radioactivity	Remember, Understand, Apply, Evaluate
	Unit VII : Detection of nuclear radiation	Remember, Understand, Apply, Evaluate
	Unit VIII: Fission and Fusion	Remember, Understand, Apply, Evaluate
	Unit IX: Lasers	Remember, Understand, Apply, Evaluate

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course, students will be able to understand about the physics of semiconductor p-n junction and devices such as rectifier diodes, Zener diode, photodiode etc. and bipolar junction transistors. Students will also learn transistor biasing and stabilization circuits, the concept of feedback in amplifiers and the oscillator circuits, students will also have an understanding of operational amplifiers and their applications.	Unit I: Semiconductor Diodes	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: Two-terminal Devices and their Applications	Remember, Understand, Analyze, Evaluate.
	Unit III: Bipolar Junction Transistors	Understand, Apply, Analyze.
	Unit IV: Amplifiers	Remember, Understand, Apply, Analyze, Evaluate.
	Unit V: Coupled Amplifier	Understand, Apply, Analyze.
	Unit VI: Feedback in Amplifiers	Remember, Apply, Analyze.
	Unit VII: Sinusoidal Oscillators	Understand, Apply, Analyze.
	Unit VIII: Operational Amplifiers	Understand & Apply.
	Unit IX: Applications of Op-Amps	Understand, Apply, Analyze.
	Unit X: Conversion	Remember, understand, Apply.

SEMESTER V

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course, students will be able to understand about the physics of semiconductor p-n junction and devices such as rectifier diodes, Zener diode, photodiode etc. and bipolar junction transistors. Students will also learn transistor biasing and stabilization circuits, the concept of feedback in amplifiers and the oscillator circuits, students will also have an understanding of operational amplifiers and their applications.	Unit I: Time Dependent Schrödinger Equation	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: Time Independent Schrödinger Equation	Remember, Understand, Apply, Analyze, Evaluate
	Unit III: Bound States	Remember, Understand, Apply, Analyze, Evaluate
	Unit IV: Hydrogen-like Atoms	Remember, Understand, Apply, Analyze, Evaluate
	Unit V: Atoms in Electric & Magnetic Fields	Remember, Understand, Apply, Analyze, Evaluate
	Unit VI: Many Electron Atoms	Remember, Understand, Apply, Analyze, Evaluate

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After completion of the course students will be able to learn modern development in Physics, Starting from Planck's law, it development of the idea of probability interpretation and the Schrodinger equation. Students will also get preliminary idea of structure of nucleus, radioactivity, Fission and Fusion, Gas filled Detectors and Laser.	Unit I: Quantum Theory and Blackbody Radiation	Remember, Understand, Apply, Analyze, Evaluate
	Unit II: Uncertainty and Wave-Particle Duality	Remember, Understand, Apply, Evaluate
	Unit III: Schrödinger Equation	Remember, Understand, Apply, Evaluate
	Unit IV: One-dimensional Box and Step Barrier	Remember, Understand, Apply, Evaluate
	Unit V: Structure of the Atomic Nucleus	Remember, Understand, Apply, Evaluate
	Unit VI: Radioactivity	Remember, Understand, Apply, Evaluate
	Unit VII : Detection of nuclear radiation	Remember, Understand, Apply, Evaluate
	Unit VIII: Fission and Fusion	Remember, Understand, Apply, Evaluate
	Unit IX: Lasers	Remember, Understand, Apply, Evaluate

Paper Name: Advanced Mathematical Physics I
Paper Code: PHY-HE-5036

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
Upon completion of this course, students will be able to solve problems in Physics related to Linear Vector space, Matrix algebra, Tensor.	Unit I: Linear Vector Spaces	Remember, Understand, Analyse, Evaluate, Apply
	Unit II: Matrix	Remember, Understand, Analyse, Evaluate, Apply
	Unit III: Cartesian Tensors	Remember, Understand, Analyse, Evaluate, Apply
	Unit IV :General Tensors	Remember, Understand, Analyse, Evaluate, Apply

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
Upon completion of this course, students will have the understanding of the sub atomic particles and their properties. They will gain knowledge about the different nuclear techniques and their applications in different branches of Physics and societal application. The course will develop problem based skills and the acquire knowledge can be applied in the areas of nuclear, medical, archeology, geology and other interdisciplinary fields of Physics and Chemistry.	Unit I: General Properties of Nuclei	Remember, understand, apply
	Unit II: Nuclear Models	Remember, understand, apply
	Unit III: Radioactivity decay	Remember, understand, apply, analyse, evaluate
	Unit IV: Nuclear Reactions	Remember, understand, apply, analyse, evaluate
	Unit V: Interaction of Nuclear Radiation with matter	Remember, understand, apply, analyse
	Unit VI: Detector for Nuclear Radiations	Remember, understand, apply, analyse
	Unit VII: Particle Accelerators	Remember, understand, apply, analyse
	Unit VIII: Particle physics	Remember, understand, apply

SEMESTER VI

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course students will acquire the concepts of Maxwell's equations,	Unit I: Maxwell Equations	Remember, understand, Evaluate, apply
	Unit II: EM Wave Propagation in Unbounded Media	Remember, understand, Evaluate, apply

propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media, production and detection of different types of polarized EM waves, general information as waveguides and fibre optics	Unit III: EM Wave in Bounded Media	Remember, understand, Evaluate, apply
	Unit IV: Polarization of Electromagnetic Waves	Remember, understand, Evaluate, apply
	Unit V: Rotatory Polarization	Remember, understand, Evaluate, apply
	Unit VI: Optical Fibres	Remember, understand, apply, Create

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
On successful completion of the course students will be learn the techniques of Statistical Mechanics to apply in various fields including Astrophysics, Semi-conductors, Plasma Physics, Bio-Physics, Chemistry and in many other directions.	Unit I: Classical Statistics	Remember, understand, apply
	Unit II: Classical Theory of Radiation	Remember, understand, apply
	Unit III: Quantum Theory of Radiation	Remember, understand, apply
	Unit IV: Bose-Einstein Statistics	Remember, understand, apply
	Unit V: Fermi-Dirac Statistics	Remember, understand, apply

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

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
After successful completion of the course, students will be able to apply the concepts of Calculus of Variations, Group Theory and Probability Theory to solve numerical problems in Physics.	Unit I: Calculus of Variations	Remember, Understand, Analyse, Evaluate, Apply
	Unit II: Group Theory	Remember, Understand, Analyse, Evaluate, Apply
	Unit III: Advanced Probability	Remember, Understand, Analyse, Evaluate, Apply

Paper Name: Classical Dynamics
Paper Code: PHY-HE-6056

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
Upon completion of this course, students will have the overview of Newton's Laws of Motion, Special Theory of Relativity by 4-vectoer approach and fluids. Students will also have the understanding of the Lagrangian and Hamiltonian of a system. By the end of this course, students will be able to solve the seen or unseen problems/ numericals in classical mechanics.	Unit I: Classical Mechanics of Point Particles	Remember, understand, apply, analyse, evaluate
	Unit II: Small Amplitude Oscillations	Remember, understand, apply
	Unit III: Special Theory of Relativity	Remember, understand, apply, analyse
	Unit IV: Fluid Dynamics	Remember, understand, apply, analyse, evaluate

Four-year Undergraduate Programme
Subject: Physics
Semester: First
Course Name: *Mathematical Physics and Mechanics*
Existing Base Syllabus: HS Maths and Physics
Course Level: PHY101, and subsequent level as per NEP structure

<table>
<tr><td colspan="4">THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45</td></tr>
<tr><td colspan="2">PART A: MATHEMATICAL PHYSICS</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Unit no.</td><td>Unit content</td></tr>
<tr><td>Unit 1</td><td>Vector Calculus</td><td rowspan="6">On successful completion of the course, the students will be able to understand the calculus of vectors and concept of curved spaces which play central roles in developing insight of the theories of physics. They will learn the powerful method of computation through Dirac delta function which often appears in complex problems of physics. Students will be able to understand and apply the concepts of dynamics of particles, energy, oscillation and basic properties of matter in various problems of physics, technology and engineering. They will be trained in concept realization through laboratory practices.</td><td>Remember, Understand, Analyse, Evaluate, Apply</td></tr>
<tr><td>Unit 2</td><td>Curvilinear Coordinates</td><td>Remember, Understand, Analyse, Evaluate, Apply</td></tr>
<tr><td>Unit 3</td><td>Dirac Delta Finction</td><td>Remember, Understand, Analyse, Evaluate, Apply</td></tr>
<tr><td colspan="2">PART B: MECHANICS</td><td></td></tr>
<tr><td>Unit no.</td><td>Unit content</td><td>Bloom’s Taxonomic Level Achieved</td></tr>
</table>

Unit 1	Reference Frames		Remember, Understand, Analyse, Evaluate, Apply
Unit 2	Gravitation and Central fore motion		Remember, Understand, Analyse, Evaluate, Apply
Unit 3	Conservation laws		Remember, Understand, Analyse, Evaluate, Apply
Unit 4	Dynamics of Rigid bodies		Remember, Understand, Analyse, Evaluate, Apply
Unit 5	Work and Energy		Remember, Understand, Analyse, Evaluate, Apply
Unit 6	Oscillations		Remember, Understand, Analyse, Evaluate, Apply
Unit 6	Properties of Matter		Remember, Understand, Analyse, Evaluate, Apply