Course Outcomes for

Four Year Undergraduate Programme: B.Sc. (Major in Physics)

offered by

Department of Physics, Kamrup College, Chamata

(in affilaition to Gauhati University)

1st Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Mathematical Physics and Mechanics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	This course introduces mathematical physics and mechanics. The basic objectives of the course are: 1. to introduce essential primary concepts in mathematical physics such as calculus of vectors, curvilinear coordinates and Dirac delta function which are required for developing insight of the theories of physics, 2. to introduce the concepts of dynamics of particles, energy, oscillation and basic properties of matter which will equip students with the tools required for applying the concepts of physics in practical problems and 3. to train the students with concept visualisation through some laboratory practices.	On successful completion of the course, 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 realisation through laboratory practices.
2nd Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Mathematical Physics & Electricity and Magnetism **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To introduce the methods of solving differential equations. 2. To introduce various concepts of matrix algebra. 3. To intorduce Electric field from vector calculus point of view and use of potential formulation to solve electrostatic problems. 4. To intorduce Magnetic fields of current carrying conductors, torus, solenoids etc. Study magnetic properties of matter. 5. To intorduce analysis of AC circuits like LCR, and use of network theorems in electrical circuits.	After the successful completion of the course, students will be able to understand methods of solving various differential equations appearing in physics. It will give an idea of how to study evolution of a physical system. Through matrix algebra students will be able to compute various matrix operations which are required for solving physical problems. They will be able to understand electric field and magnetic fields in matter, dielectric properties of matter, magnetic properties of matter, application of Kirchhoff's law in different circuits, and application of network theorem in different circuits. The students will also get accustomed to using multimeters and potentiometers, and they will be able to determine some of the important physical quantities related to electricity and magnetism for a better understanding of the topic.

3rd Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Waves and Optics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To learn the superposition of harmonic waves and oscillations, different types of wave motions, formation of standing waves and velocity of waves in media. 2. To learn optical phenomena such as interference, diffraction and polarization in terms of the wave model 3. To learn the principles and applications of optical instruments like biprism, interferometer and diffraction grating etc. 4. To learn hand on experiments with prism, biprism, spectrometer, Newton's ring apparatus, grating, CRO, sodium and mercury light sources etc.	On successful completion of the course students will understand Simple Harmonic Oscillation and superposition principle; understand the classical wave equation in transvers and longitudinal waves and solutions of few physical systems on its basis; understand the concept of normal modes in transvers and longitudinal waves; understand the interference as superposition of waves from coherent sources and also understand the basic principle of Young's double slit experiment, Fresnel's Biprism, Newton's Rings, Michelson interferometer etc. ; understand the basic concept of diffraction, Fresnel and Fraunhofer diffraction from a slit ; understand the concept of polarisation of light, the production and detection of polarized light; understand working principle of prism, biprism, spectrometer, Newton's ring apparatus, grating, CRO, sodium and mercury light sources etc.
4th Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Classical Mechanics **Theory Credit:** 4 **No. of Required Classes:** 60 **No. of Contact Classes:** 60 **No. of Non-Contact Classes:** 0	The basic objectives of the course are 1. to introduce the laws of classical dynamics 2. to train students in solving problems of motion of particles, systems of particles and fluids and 3. to introduce relativity and hence the idea of how space and time play role in dynamics of matter.	On successful completion of the course students will be able to apply the laws of classical dynamics to physical problems of motion of particles, systems of particles and fluids in various fields of physics and natural science as a whole. They will also get the exposure of the idea of how space and time play role in dynamics of matter.
Course Name: Quantum Mechanics I **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To learn about the inadequacies of classical mechanics, the origin and need of quantum mechanics, historical developments in quantum mechanics. 2. Dual nature of radiation & matter, description of matter wave through wave packet. 3. Probabilistic nature and wave function, Schrödinger equation, the uncertainty principle, stationary and non-stationary states. 4. Applications of Schrödinger equation in different cases like infinite and finite potential well, tunneling effect, linear harmonic oscillator and H-atom. 5. Formulation of quantum mechanics in terms of operators.	On successful completion of the course students will be able to learn physical and mathematical fundamentals of Quantum physics, and various topics in it. These concepts are used in various branches of physics, like condensed matter physics, lasers, quantum statistics, atomic and molecular physics, particle physics, astrophysics and optics etc.

Course Name: Analog Electronics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To introduce students to analog electronics with hands-on practice on implementing some of these in hardware. 2. To make the students understand the physics of semiconductor p-n junction and application in devices like diodes, rectifiers, etc. 3. To understand the working of bipolar junction transistors, biasing, stabilization circuits, and various applications like amplifiers, oscillators, etc. together with feedback. 4. To know the basics of Operational Amplifiers and applications. 5. To understand the basics of the use of CRO in measurements with hands-on experience with some applications	On successful completion of the course, students will be able to understand the physics of semiconductor p-n junction and devices such as rectifier diodes, Zener diode, photodiode, etc.; they will understand the basics of bipolar junction transistors, 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.
Course Name: Mathematical Physics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To solve partial differential equations using separation of variables, including Laplace's equation and the wave equation. 2. To apply Fourier series expansion to represent periodic functions using sine and cosine functions. 3. To understand complex analysis principles, including analytic functions, integration and residue theorem. 4. To develop proficiency in tensor algebra, covering transformations, contravariant and covariant tensors and tensor algebra. 5. To gain a preliminary knowledge to probability theory, focusing on independent random variables, probability distributions, and mean and variance calculations.	On successful completion of the course, the students will be equipped with the techniques related to solving partial differential equations using separation of variables method, application of Fourier series analysis, solving complex integrations, dealing with tensors and probability distributions which are relevant while dealing with wave mechanics, electrodynamics, quantum mechanics, theory of relativity and experimental physics.
5th Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Atomic and Molecular Physics **Theory Credit:** 4 **Practical Credit:** 0 **No. of Required Classes:** 60 **No. of Contact Classes:** 60 **No. of Non-Contact Classes:** 0	1. To learn the development of atom models. 2. To learn the origin of atomic spectra and their modifications under different physical conditions. 3. To learn the basics of molecular spectra for diatomic molecule and a few applications.	Students will be ability to describe the atomic spectra of one and two valance electron atoms and will also understand the change in behavior of atoms and corresponding modification of their spectra in external applied electric and magnetic field. They will understand the basic principle of pure rotational, vibrational, Rotation-Vibration and Raman spectra of molecules and their few applications.

Course Name: Condensed Matter Physics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To provide the elementary idea about crystal structure, bonding and lattice dynamics in solids. 2. To make the students understand the concepts of transport properties, dielectric properties, ferroelectric properties and magnetic properties in solids. 3. To familiarise the students with nanomaterials, thin film, soft matter and superconductivity.	On successful completion of the course students will be able to acquire the basic knowledge of crystal structure, bonding in solids and elementary idea lattice dynamics of materials, dielectric, ferroelectric and magnetic properties of solids, the physics of 36 electrons in solids, basic idea about nanomaterials, thin film and soft matter and understand the basic concept in superconductivity.
Course Name: Heat and Thermodynamics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To understand principles of thermodynamics 2. To provide concepts of thermodynamic functions 3. To address the basic framework of kinetic theory of gases	Upon completion of this course, students will be able to learn thermal properties of gas molecules and their collisions. With this course, students will acquire knowledge of thermodynamics with practical insights into thermal physics, which will help them to understand real world situations.
Course Name: Electromagnetic Theory **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To lay the foundation of electromagnetism through Maxwell's equations. 2. Behaviour of electromagnetic waves as it propagates through vacuum and other media. 3. Various effects that occur as electromagnetic waves propagate from one medium to another medium. 4. Basic concepts of waveguides and fibre optics. 5. Various aspects of electromagnetic wave polarisation	After the successful completion of the course, students will acquire the concepts of Maxwell's equations, 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 of waveguides and fibre optics.

6th Semester		
COURSE DETAILS	**COURSE OBJECTIVE**	**LEARNING OUTCOME**
Course Name: Nuclear and Particle Physics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. basic knowledge about the nucleus and other subatomic particles and their properties. 2. knowledge about the radioactive disintegration of a nucleus and the laws of radioactive decays 3. Knowledge on basic nuclear instrumentation and experimental techniques of nuclear physics. 4. Basic knowledge of particle physics.	On successful completion of the course, the students shall be able to understand the structure and properties of a nucleus. They will also know about the properties of strong nuclear force that keeps the nuclei bound. They will learn about the radioactive decays and various laws of radioactive disintegration. Students will have adequate knowledge on the construction and working principles of particle accelerators and detectors. Moreover, students will be introduced to the world of particle physics – types and interactions. The acquired knowledge can be applied in the areas of nuclear medicine, medical physics, archaeology, geology and other interdisciplinary fields of Physics and Chemistry. It will enhance the special skills required for these fields.
Course Name: Digital Electronics **Theory Credit:** 3 **Practical Credit:** 1 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To introduce the students to the basics of digital electronics and applications with handson experience in implementing some hardware. 2. To help students develop a digital logic and apply it to solve real-life problems 3. To analyze, design and implement various combinational and sequential logic circuits 4. To classify different semiconductor memories.	After successful completion of the course student will be able to develop, implement and analyze digital logic circuits and apply them to solve real-life problems and classify different semiconductor memories
Course Name: Astronomy and Astrophysics **Theory Credit:** 4 **Practical Credit:** 0 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To introduce the students with fundamental concepts and observational techniques in astronomy including virtual observatory tools, 2. to introduce them with physical processes occurring inside the celestial objects and 3. to introduce the physical concepts required for the study of recent frontiers in astrophysics.	On successful completion of this course students will be able to understand the fundamental concepts in astronomy. They will be able to apply physics of celestial objects in understanding the universe. They will be equipped with the skills required for (i) observational astronomy (ii) virtual observatory tools and (iii) physical concepts of recent frontiers in astrophysics.

Course Name: Statistical Mechanics **Theory Credit:** 4 **Practical Credit:** 0 **No. of Required Classes:** 45 **No. of Contact Classes:** 45 **No. of Non-Contact Classes:** 0	1. To provide basic concepts of statistical mechanics 2. Describing various thermodynamical phenomena using probability theory 3. To learn classical and quantum statistics	Upon completion of the course, students will get accustomed to the microscopic origin of thermodynamic processes. After successful completion of the course, students will be able to perceive classical and quantum pictures of physical and chemical events