# Subject: Physics

## PROGRAMME SPECIFIC OUTCOMES:

Specific outcome of Physics major syllabus prescribed by Gauhati University may be cited below:

1. Knowledge of mathematical methods for vector analysis, vector differentiation, integration of vectors, curvilinear co- ordinate system, Matrix, differential equations, Algebric operation etc.
2. Ability to understood mechanics.
3. Ability to understood waves & oscillation.
4. Knowledge of ray optics wave optics and modern optics.
5. Ability to understand the properties of matter: elasticity, surface tension & viscosity.
6. Ability to understand electrostatic and magneto statics.
7. Knowledge of classical, quantum and statistical mechanics.
8. Knowledge of computer and ability to apply computer language.
9. Know Understanding the edge of astrophysics and nuclear physics.
10. Understanding the theory of relativity.
11. Ability to undertake project work.

## COURSE OUTCOMES:

| Semester | Course code | Course Name | Course outcome |
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| I | PHY-HC-1016 | Mathematical Physics I | Mathematical physics is considered as the language of physics. On completion of the course the students will able to understand vector and its applications in various fields, differential equations and its applications, different coordinate systems, concept of probability and error. |
| | PHY-HC-1026 | Mechanics | This course would empower the student to acquire engineering skills and Practical knowledge, which help the student in their everyday life. Student will able to 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 etc.. This course will provide a theoretical basis for doing experiments in related areas. |

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| **II** | PHY-HC-2016 | Electricity and magnetism | Electricity, electrodynamics magnetism as well as basic electronics are the theoretical foundation of different practical in physics. Students will able to understand electric and magnetic fields in matter, Dilectric properties of matter magnetic properties of matter, electromagnetic induction,applications of Kirchhofff's law in different circuits, applications of network theorem in circuits. |
| | PHY-HC-2026 | Wave and optics | This course builds on the ideas of harmonics motion to cover in-depth the concept of waves in physics with particular reference on sound and light wave as the special case. Upon successful completion of this course, the students will learn different wave and optical phenomena such as superposition, polarization, interference, diffraction and different diffraction of images. |
| **III** | PHY-HC-3016 | Mathematical Physics II | This course also focuses on computer programming and numerical analysis to emphasize its role in solving problems in Physics |
| | PHY-HC-3026 | Thermal physics | This course develops a working knowledge of thermodynamics and to use this knowledge to explore various aspect in material science and the physics of condensed matter. Students will have the knowledge and skills to identify and describe the statistical nature of concepts and laws in thermodynamics. |
| | PHY-HC-3036 | Digital system and applications | On successful completion of the course students will able to solve complex integrals using residue |
| **IV** | PHY-HC-4016 | Mathematical Physics III | theorem, apply Fourier and Laplace transforms in solving differential equations, understand properties of Tensor like Transformation of coordinates, contravariant and co-variant tensors, indices rules for combining tensors. |
| | PHY-HC-4026 | Elements of Modern Physics | This course offer main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter. This course provides the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density |

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| | | | and the normalization techniques, skill development on problem solving e.g. one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier. The properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula are also discussed in this course. |
| | PHY-HC-4036 | Analog System and Applications | At the end of the course the student is expected to assimilate the following and possesses basic knowledge of the following, ♣ N and P- type semiconductors, mobility, drift velocity, fabrication of P-N junctions; forward and reverse biased junctions. ♣ Application of PN junction for different type of rectifiers and voltage regulators. ♣ NPN and PNP transistors and basic configurations namely common base, common emitter and common collector, and also about current and voltage gain. ♣ Biasing and equivalent circuits, coupled amplifiers and feedback in amplifiers and oscillators. ♣ Operational amplifiers and knowledge about different configurations namely inverting and noninverting and applications of operational amplifiers in D to A and A to D conversions. ♣ To characterize various devices namely PN junction diodes, LEDs, Zener diode, solar cells, PNP and NPN transistors. Also construct amplifiers and oscillators using discrete components. Demonstrate inverting and non-inverting amplifiers using opamps. |
| **V** | PHY-HC-5016 | Quantum Mechanics and application | After an exposition of inadequacies of classical mechanics in explaining microscopic phenomena, quantum theory formulation is introduced through Schrodinger equation in this course. The interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student. Through understanding the behavior of quantum particle encountering a i) barrier, ii) potential, the student gets exposed to solving non-relativistic hydrogen atom, for its spectrum and eigen functions. Study of influence of electric and magnetic fields on atoms will help in understanding Stark effect and Zeeman Effect respectively. |

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| | PHY-HC-5026 | Solid State Physics | This course provides an introduction to the physics of Condensed Matter or solid state physics. This study attempts to explain various types of phenomena like different crystalline unit cell, magnetic properties of matter, super-conductivity and super fluidity. This is considered as the basic concept towards the material science. |
| **VI** | PHY-HC-6016 | Electromagnetic Theory | Achieve an understanding of the Maxwell_s equations, role of displacement current, gauge transformations, scalar and vector potentials, Coulomb and Lorentz gauge, boundary conditions at the interface between different media. Apply Maxwell_s equations to deduce wave equation, electromagnetic field energy, momentum and angular momentum density and wave propagation in the unbounded, bounded, vacuum, dielectric, guided and unguided media. Understand the fundamentals of propagation of electromagnetic waves through optical fibres and calculate numerical apertures for step and graded indices and transmission losses. |
| | PHY-HC-6026 | Statistical Mechanics | This course gives the basic concepts and definition of physical quantities in classical statistics and classical distribution law and the application of classical statistics to theory of radiation. Understanding the failure of classical statistics and need for quantum statistics. Learn the following statistics to derive and understand, 1. Bose Einstein statistics and its applications to radiation 2. Ferm-Dirac statistic and its applications to quantum systems. |

## DEPARTMENT OF PHYSICS

| PAPER | COURSE | OUTCOME |
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| HC-1016<br>(Theory) | Mathematical methods - 1 | The students will gain knowledge about vector algebra and about the solution of differential equations and its application in the physical world. Also they shall learn about the different co-ordinate frames together with the concept of probability and various sources of error and how to calculate them. |
| HC – 1026<br>(Theory) | Mechanics | At the end of the prescribed syllabus, the students will acquire basic knowledge of mechanics, gravitation and will understand how to apply the conservation of rotational motion in different parts of physics. They shall also gain knowledge of special theory of relativity. |
| HC-2016<br>(Theory) | Electrical and Magnetism | Students will be able to understand electric and magnetic fields in matter, dielectric properties of matter, magnetic properties of matter, electromagnetic induction, and applications of Kirchofff's law in different circuits, applications of network theorem in circuits. |
| HC – 2026<br>(Theory) | Waves and Optics | 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, holography. |
| 301 (Theory)<br>(Non – CBCS) | Mathematical methods - III | To motivate the students to apply matrices for solving problems in spectroscopy, nuclear physics. |
| | Electrostatics | Will gain knowledge about the electric field, electrostatic energy and dielectrics. |
| 302 (Theory)<br>(Non – CBCS) | Current Electricity | Students will get the knowledge about direct current and alternating current and its application in electrical circuits. |

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| | Magnetostatics | Acquire basic knowledge of magnetic properties. |
| 401 (Theory)<br>(Non – CBCS) | Mathematical methods - IV | Will gain knowledge about solution of second order differential equation and also about probability and also practical application |
| | Introducton To Computer And Computer Programming | Will gain basic knowledge about flow chart and algorithm. |
| 402 (Theory)<br>(Non – CBCS) | Wave Optics | To provide a knowledge of the behaviour of light |
| | Special Theory of relativity | Will gain negation of ether concept and also about the geometry of space-time and space-time interval. |
| 501(Theory)<br>(Non – CBCS) | Mathematical methods - V | Will acquire the concept of complex algebra |
| | Classical Mechanics | The concept of central force system and application of variational principle to solve different problems in mechanics will be learnt. |
| 502(Theory)<br>(Non – CBCS) | Atomic Physics | To provide a detailed study of atom and also to learn the impact of magnetic fields in spectra. |
| 503(Theory)<br>(Non – CBCS) | Quantum Mechanics | To motivate the students to apply schrodinger equation or solvingproblems in Wave mechanics, Nuclear physics etc.., |
| | Astro Physics | Will have the concept of stellar co-ordinate system, distance measurement and stellar classification. |
| 504(Theory)<br>(Non – CBCS) | Electronics | To motivate the students to apply the principles of electronics in their day-to-day life. It deals with both analog and digital electronics. |

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| 601(Theory)<br>(Non – CBCS) | Nuclear Physics | To acquire knowledge and apply it to study the structure of nucleus. Know the formation of nucleus and their binding energy. To motivate the students and analyze the energy released by the nucleus during the fission and fusion process. |
| 602(Theory)<br>(Non – CBCS) | Mathematical Methods - VI | Students will gain the knowledge of tensors. |
| | Solid State Physics | The students will get to know about the structure of a solid and also the concept of the magnetic properties of matter. |
| 603 (Theory)<br>(Non – CBCS) | Modern Optics | Knowledge about laser, holography, optical fibres and their application will be acquired by the students. |
| | Electromagnetic Theory | Thorough knowledge of electromagnetic nature of wave will be gained together with the proof of basic laws of reflection and refraction. |
| 604(Theory)<br>(Non – CBCS) | Statistical Mechanics | Will gain the knowledge of statistical system and its co-ordinate together with application of MB, FD and BE statistics. |
| | Principles of Programming Concepts and C++ Programming | On successful completion of this subject the students have the programming ability in C++ Language to deal with physics problems. |