Programme Specific Outcomes (PSOs)
and
Course Outcomes (COs)

For

Bachelor of Science in Physics Programme

The Department of Physics,

St. Anthony's College,

Shillong

PROGRAMME SPECIFIC OUTCOMES

The Department of Physics, St. Anthony's College, Shillong offers the three year undergraduate Honours course in Physics. The Department has a defined set of Programme Specific Outcomes (PSOs) which guides the teaching learning and evaluation process in the Department. On completion of this course the student should attain the following attributes.

PSO1. A scientific attitude and temperament

PSO2. Acquire a comprehensive knowledge and sound understanding of the fundamentals of the subject and its relevance to the present context.

PSO3. Develop practical, analytical and mathematical skills in the subject.

PSO4. Develop skills of experimental techniques, measurement, data analysis, calculation and error estimation.

PSO5. Be able to apply one's knowledge and understanding of the subject and skills to new contexts

PSO6. Be able to identify and analyze problems and issues and seek solutions to real - life problems.

PSO7. Demonstrate subject-related and transferable skills that are relevant to Physics - related jobs and other employment opportunities.

PSO8. Develop the ability to transmit technical information relating to all areas in Physics in a clear and concise manner in writing and oral for better understanding.

PSO9. Attain sufficient conceptual knowledge of the subject needed for higher studies and research in the subject

PSO10. Be capable of self-paced and self-directed learning aimed at personal development and for improving knowledge and skills in all areas of Physics.

COURSE OUTCOMES (COs)

The Department follows the syllabus and curriculum structure as mandated by the affiliating University. During the three years of the BSc Physics Honours programme, spread over 6 semesters, 8 theory papers and 5 practical papers are taught. The Semester wise distribution of the Papers and their Course Outcomes are listed below.

SEMESTER-I	
Name of the Paper: Mathematical Physics-I, Mechanics, Waves and Acoustics **Paper Code:** PHY01(T)	Upon completion of this course the students will learn, understand and develop the concepts of **CO1.** Vector algebra **CO2.** Ordinary differential equations **CO3.** Frames of reference and their applications **CO4.** Conservative forces, their properties and applications **CO5.** Dynamics of a system of particles and its applications to different systems **CO6.** Rigid body dynamics **CO7.** Theory of Elasticity and its applications **CO8.** Dynamics of fluids **CO9.** Simple harmonic motions and its applications **CO10.** Oscillations and waves **CO11.** Ultrasonics their properties and applications **CO12.** Sound and acoustics
SEMESTER-II	
Name of the Paper: Electromagnetism, Electronics – I	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Theory of electrostatics **CO2.** Electric fields in Dielectric media **CO3.** Electrical images and its applications

Paper **Code:** PHY02(T)	**CO4.** Magnetostatics **CO5.** LR, CR and LCR circuits - Series and Parallel **CO6.** Basics of Power supply **CO7.** Laws of Mutual and self inductance and their applications **CO8.** Maxwell's equations **CO9.** Basic circuit analysis **CO10.** Analog and Digital signals **CO11.** Elementary digital electronics and Boolean algebra
Name of the Paper: Experimental Physics-I **Paper Code:** PHY02(P)	Upon completion of this course, students will understand the theory and be able to perform the following experiments and apply the underlying principles to perform other such experiments. Also it should help them develop conceptual knowledge of the underlying theory through experiential learning. **CO1.** Determination of the value of acceleration due to gravity using compound pendulums **CO2.** Determination of the moment of inertia by using torsional pendulum. **CO3.** Determination of the rigidity modulus of a cylindrical body by static torsion apparatus **CO4.** Determination of the co-efficient of viscosity of liquid by capillary tube method. **CO5.** Determination of the surface tension of a liquid by Jaeger's method. **CO6.** Determination of the frequency of a tuning fork by Melde's method. **CO7.** To verify the inverse square law in magnetism **CO8.** Determination of the resistance per unit length of the potentiometer wire by Carey-Foster method.

	CO9. Determination of the value of the capacitance of an unknown capacitor by using the de-Sauty's bridge.
SEMESTER-III	
Name of the Paper: Thermal Physics, Optics **Paper Code:** PHY03(T)	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Kinetic theory of gases and its applications. **CO2.** Transport phenomena in gases **CO3.** Laws of thermodynamics and their applications to understand different characteristics of gases **CO4.** Liquefaction of gases **CO5.** Theory of Black body radiation **CO6.** Theory of geometric optics and image formations **CO7.** Aberration in image formations **CO8.** Theory of Black body radiation **CO9.** Theory of Interference, diffraction and polarizaton **CO10.** Introductory theory of dispersion and scattering **CO11.** Introduction to lasers and fibre optics
Name of the Paper: Experimental Physics-II **Paper Code:** PHY03(P)	Upon completion of this paper, students will understand the theory and be able to perform the following experiments and apply the underlying principles to perform other such experiments. Also it should help them develop conceptual knowledge of the underlying theory through experiential learning. **CO1.** Determination of the co-efficient of linear expansion of a solid by using Pullinger's apparatus and optical lever. **CO2.** Determination of the specific heat of a liquid by the method of cooling. **CO3.** Determination of the co-efficient of thermal conductivity of a good

	conductor by Searle's method. **CO4.** Determine the mechanical equivalent of heat by Joule's calorimeter. **CO5.** Determination of the refractive index of a prism by a spectrometer using monochromatic light. **CO6.** Determination of the radius of curvature of a lens by Newton's ring method. **CO7.** Determination of the grating constant by using a spectrometer. **CO8.** Determine the wavelength of a laser beam using plane diffraction grating. **CO9.** Determination of the refractive index of the materials of convex lens by measuring its focal length (displacement method) and radii of curvature (using spherometer). **CO10.** To study the frequency response of a series and parallel LCR circuit
SEMESTER-IV	
Name of the Paper: Special Theory of Relativity, Quantum Mechanics –I, Atomic Physics-I, Nuclear Physics-I and Solid State Physics-I **Paper Code:**	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Basics of the theory of relativity **CO2.** Introductory to quantum mechanics and Schrodinger's equation **CO3.** Introductory Atomic Physics and Modern Physics **CO4.** Introductory Nuclear Physics – Radioactivity, properties of nucleus, Nuclear reactions **CO5.** Basic elementary particle Physics and Cosmic rays **CO6.** Introductory Solid State Physics - theory of crystals and their structure

PHY04(T)	**CO7.** Introductory theory of Superconductivity
Name of the Paper: Experimental Physics-III **Paper Code:** PHY04(P)	Upon completion of this course, students will understand the theory and be able to perform the following experiments and apply the underlying principles to perform other such experiments. Also it should help them develop conceptual knowledge of the underlying theory through experiential learning. **CO1.** Determination of the energy gap of a semiconductor diode. **CO2.** To study the characteristics of LDR, Photodiode **CO3.** Measurement of current in an external circuit by using Potentiometer. **CO4.** Use of a multimeter to measure the output voltages of half wave and full wave rectifiers and find the value of ripple factors. **CO5.** Determination of Planck's constant by photocell or by heating method. **CO6.** Determination of the specific charge (e/m) of an electron by magnetron/Thomson's method. **CO7.** Determination of the value of an unknown low resistance by using potentiometer. **CO8.** Determination of the emf of a battery by using potentiometer. **CO9.** Verification of Thevenin's theorem. **CO10.** Verification of Norton's theorem. **CO11.** Verification of Superposition theorem.
SEMESTER-V	
Name of the Paper: Mathematic Physics-II, Quantum	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Different coordinate systems and their inter relations ips

Mechanics-II **Paper Code:** PHY05(T-A)	**CO2.** Theory of matrices and their properties; Characteristic equations, Eigen vectors and Eigen Values **CO3.** Second order differential equations and their solutions **CO4.** Legendre and Hermite Polynomials **CO5.** Partial differential equations and their solutions **CO6.** Gamma and Beta functions and their properties **CO7.** Elementary tensor analysis **CO8.** Operator formalism of Quantum Mechanics **CO9.** Applications of time independent Schrodinger's equation **CO10.** Angular momentum operators in spherical polar coordinates **CO11.** Solution of Hydrogen problem using Schrodinger's equation in polar coordinates
Name of the Paper: Classical Mechanics, Electrodynamics, Statistical Physics, Energy Sources **Paper Code:** PHY05(T-B)	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Introductory Lagrangian and Hamiltonian formulation of Classical Mechanics **CO2.** Maxwell's Equations in vacuum and material media **CO3.** Electric field inside matter **CO4.** Boundary conditions satisfied by E and D at the interface between two homogeneous dielectrics **CO5.** Electromagnetic Potentials **CO6.** Electromagnetic waves, Poynting's theorem and Poynting Vector **CO7.** Thermodynamic relations **CO8.** Introductory statistical Mechanics **CO9.** Renewable energy sources

Name of the Paper: Experimental Physics-IV **Paper Code:** PHY05(P)	Upon completion of this course, students will understand the theory and be able to perform the following experiments and apply the underlying principles to perform other such experiments. Also it should help them develop conceptual knowledge of the underlying theory through experiential learning. **CO1.** Measurement of temperature by using a thermocouple. **CO2.** Determination of wavelength of the spectral lines of an element by using a plane diffraction grating and spectrometer. **CO3.** Determination of electrical conductivity of solid electrolyte by Kaulrauch method. **CO4.** Determination of the co-efficient of thermal conductivity of a bad conductor by Lee's method. **CO5.** Determination of the specific rotation of solution using polarimeter. **CO6.** Determination of Young's modulus (Y) of glass using Cornu's Method. **CO7.** Determine the refractive index of the material of a prism. **CO8.** To measure the width of single slit from the study of its Fraunhoffer diffraction. **CO9.** Determination of the wavelength of sodium light using biprism. **CO10.** Determination of the monochromatic wavelength by Michelson interferometer. **CO11.** Determination of the reduction factor of a tangent galvanometer and also the value of horizontal component of earth's magnetic field by electrolysis method. **CO12.** Determination the velocity of ultrasonic waves in liquid.

SEMESTER-VI	
Name of the Paper: Solid State Physics-II, Electronics-II and Fortran Programming **Paper Code:** PHY06(T-A)	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Crystal structures and their symmetry **CO2.** Theory of diffraction by crystals **CO3.** Bonding in Crystals **CO4.** Theory of Lattice vibrations **CO5.** Quantum mechanical treatment of free electrons in metals **CO6.** Introduction to band theory of solids **CO7.** Langevin theory of diamagnetism and paramagnetism **CO8.** Weiss theory of ferromagnetism; anti – ferromagnetism and ferri - magnetism **CO9.** Introductory theory of Superconductors **CO10.** FET, OPAMP, Amplifiers, and Oscillators **CO11.** Elements of communication systems, features of radio communication **CO12.** TTL Logic families, multiplexer, demultiplexer, digital comparator **CO13.** Fortran 77 programming language
Name of the Paper: Atomic Physics-II, Molecular Spectroscopy, Nuclear Physics –II, Astrophysics **Paper Code:**	Upon completion of this course the students are expected to learn, understand and develop the concepts of **CO1.** Vector atom model **CO2.** Zeeman effect – experiment and theory **CO3.** Theory of Alkali spectrum **CO4.** Two electrons system: L-S coupling, j-j coupling, Pauli's exclusion principle, spectra of helium atom and alkaline earth atoms, singlet and triplet fine structure, selection rules

PHY06(T-B)	**CO5.** Types of molecular spectra – rotational, vibrational and electronic spectra **CO6.** Quantum mechanical theory of rigid body rotator **CO7.** Electronic spectra: Electronic band systems, sequence and progression, Frank Condon principle **CO8.** Raman effect and its brief quantum mechanical explanation, **CO9.** Fundamental ideas of UV and IR spectroscopy **CO10.** Nucleus and its properties **CO11.** Binding energy of a nucleus and its variations **CO12.** Semi empirical Binding energy Formula **CO13.** Different Nuclear models **CO14.** Properties of nuclear forces, two nucleon system, square well solution of the deuteron problem **CO15.** Geiger – Nuttal law, Gamow's theory of α decay, Fermi's theory of β – decay **CO16.** Nuclear radiation and energy levels **CO17.** Biological effects of nuclear and electromagnetic radiations **CO18.** Nuclear Reactions and its energetics **CO19.** Nuclear Fission and the Bohr Wheeler theory of nuclear fission **CO20.** Four factor formula for a nuclear multiplication factor **CO21.** Nuclear reactors and its types **CO22.** Nuclear fusion and fusion in plasma, **CO23.** Tokamak experiment in fusion systems. **CO24.** Basic theory of Elementary Particles **CO25.** Fundamental interactions, forces and fields **CO26.** Symmetries and Conservation laws, Baryon and Lepton number conservation **CO27.** Resonant particles: discovery and important properties **CO28.** Gell-mann Nishijima scheme and the quark model **CO29.** Stellar evolution **CO30.** Spectral Classification of stars

	CO31. Star systems **CO32.** Solar cycles, its activity, Butterfly diagram and Photosphoric phenomena
Name of the Paper: Experimental Physics-V **Paper Code:** PHY06(P)	After completion of this paper, students will understand the theory and be able to perform the following experiments and apply the underlying principles to perform other such experiments. Also it should help them develop conceptual knowledge of the underlying theory through experiential learning. **CO1.** To study the a full wave rectifier **CO2.** To study the characteristics of a transistor in different configurations **CO3.** To study the characteristics of JFET. **CO4.** To design and study simple logic gates using ICs **CO5.** To study Lissajous figures using C.R.O. **CO6.** To study the frequency response of RC coupled amplifier. **CO7.** To write simple Fortran programs. **CO8.** Study the operation and characteristics of a GM counter.