Undergraduate Programmes

First year

SPHY011: Basic Physics 1A	**Credits: 12**	**Co-requisite / Prerequisite: None**
Content: Forces, Newton's laws, friction, torque, conditions of equilibrium, couples, velocity an acceleration, falling bodies, projectile motion, mass an weight, work, energy and power, impulse and momentum, elastic and inelastic collisions, circular motion, angular velocity and accelerations simple harmonic motion. Elasticity, hydrostatics, density and relative density, pressure in liquids, principle of Archimedes,		

SPHY012: Basic Physics 1B	**Credits: 12**	**Co-requisite / Prerequisite: None**
Content: Electrodynamics, electric charges and forces, static charges and electric fields, electric potentials, electric energy and capacitance, dielectric materials, moving charges and magnetic forces, steady electric and magnetic field, magnetic energy and inductance. Electronics, resistors, capacitors and inductors, power sources direct and alternate current circuit. Nature and propagation of light, refraction and reflection, Image formation by lenses and mirrors, Optical instrument, the eye, interference, polarization. Early models of the atom, photo electric effect, X-rays, lasers and nuclear physics.		

SPHS011: General Physics 1A	**Credits: 12**	**Co-requisite / Prerequisite: SMTH011 / none**
Content:		

Mechanics: Units Physical quantities and vectors, Kinematics, Dynamics, Statics, Work and Mechanical Energy, Impulse and momentum, and Rotational Motion. Properties of matter: Elasticity, Fluid Mechanics and Thermal Physics. Modern Physics: Atomic Structure and Nuclear Physics.

SPHS012 General Physics 1B	**Credits: 12**	**Co-requisite / Prerequisite: SMTH012 / none**
Content: Electricity and Magnetism: Electrostatics, Current electricity, Electromagnetism. Oscillations and Waves: Simple Harmonic Motion, Mechanical Waves, Acoustics, Electromagnetic Waves. Optics: Nature and Propagation of Light and Geometrical Optics.		

SSPH011: Biophysics	**Credits: 12**	**Co-requisite / Prerequisite: None**
Content: Measurements: Calibration, length, volume, weight, temperature, pressure Biomechanics: Motion, forces, Newton's laws, gravity, traction, friction, work, energy, power, momentum, impulses, body mechanics, moments Fluid mechanics: Hydrostatic pressure, body fluids, specific gravity, principles of fluid mechanics, surface tension, adhesion, diffusion Thermal Physics: Temperature, heat, heat capacities, measurements, thermal expansion, heat conduction and transfer, change of states Optics: Properties of light, light sources, reflection and refraction, image formation, optics of the eye, interference, scattering and diffraction of light, Electromagnetic spectrum. Acoustics: Sound waves, hearing acoustics, ultra and infra sonic frequencies, resonance Electricity and magnetism: Static electricity, current electricity, resistance, electric sources, bioelectricity		

Modern Physics: concepts and applications of atomic and nuclear physics, radiations and radiation therapy, Nano-medicine

SPHS000 Introduction to General Physics 1A	**Credits: 12**	**Co-requisite / Prerequisite: None**
Content: Measurements: Physics quantities and vector, scientific method, unit conversions, significant figures, measuring tools and uncertainty, operational definitions, proportional reasoning with mass and volume. Mechanics: Frame of reference, mathematical and graphical representation of motions. Impulse and momentum, types of forces, Newton's laws, induced forces, forces in 2 dimension, adding and resolving forces, rotational Motion, work kinetic and potential energy, condition for equilibrium. Energy and temperature –Thermal interaction, mixing water, specific heat capacity, mixing other substances, phase transition, latent heat, proportional reasoning with energy and temperature, and energy and temperature , and energy transfer mechanism. Properties of matter: Elasticity, fluid Mechanics and Thermal Physics Modern Physics: Atomic Structure and Nuclear Physics		

SPHB000 Introduction to General Physics 1B	**Credits: 12**	**Co-requisite / Prerequisite: None**
Content: E **Electricity and Magnetism** – electrics charges and charging process, charge distributions, electrics forces and electric field, electric potentials, electric energy, potential difference, Ohm's law, resistors in parallel and series, internal resistance capacitance and dielectric materials, Electromagnetism. **Oscillations and Waves**: Simple Harmonic Motion, Mechanical Waves, Acoustics, Electromagnetic Waves. **Optics**: Nature and Propagation of Light, Geometrical Optics and the Eye.		

Second year

SPHA021:Classical Mechanicals	**Credits: 10**	**Prerequisite: SMTH011, SPHS011, SPHB000**
Content: Definition of basic terms, ingredients of mechanics, Graphical representation of vectors, Vector addition, Vector multiplication, Vector differentiation, Vector integrals; The concept of a rigid body, Centre of mass, Rigid Body Kinematics, Degree of freedom, Right body dynamics, ,Angular momentum, Moment of Inertia, Simple Harmonic motion, Introduction to calculus of variation, Generalised coordinate, Lagrange Equation, Conservation of energy, Essence of Lagrangian Dynamics, Conservation of energy, Hamiltonian Dynamics, Ignorable coordinates, Symmetries and conservation laws.		

SPHB021: Modern Physics	**Credits: 10**	**Prerequisite: SMTH011, SPHS011, SPHB000**
Content: Special and general relativity, Quantization of electromagnetic radiation, Wave-particle duality, Atomic Physics, Nuclear structure, Radioactivity, Nuclear reactions, Radiation and matter, and Elementary particles		

SPHA022: Electrodynamics and Electronics	Credits: 10	Prerequisite: SMTH012, SPHS012, SPHB000

Content:

Electrodynamics

Electric field, Divergence and curl of electric field, electric potential, work and energy, conductors, Laplace equation and method of images, Polarization, the field of a polarized object, electric displacement, linear dielectrics, Lorentz force law, Biot – Savart law, Divergence and curl of magnetic field and magnetic vector potential, Magnetization, the field of a magnetized object, auxiliary field, linear and non-linear media, Inductance and RL, RC and RCL circuits.

Electronics

Charge carriers in semiconductors, equilibrium distribution of electrons and holes, statistical laws, the Fermi-Dirac distribution function, the distribution function and the fermi energy, The equilibrium distribution of electron and hole equations, the intrinsic carrier concentration, dopant atoms and energy levels. qualitative description of the doping process, n-type and p-type semiconductors and equilibrium distribution of electrons and holes in an extrinsic semiconductor.

SPHB022: Waves and Physical Optics	Credits: 10	Prerequisite: SMTH012, SPHS012, SPHB000

Content:

Waves: General Wave Properties, Simple Harmonic Oscillators (SHO), Damped Harmonic Oscillators (DHO), Forced Damped Harmonic Oscillators (FDHO), Fourier Methods.

Physical Optics: Interference, Superposition of waves, Interference Patterns, Interference Fringes, Diffraction, Opaque object, Fraunhofer Diffraction, Fresnel Diffraction, Diffraction Gratings, Thin Films Interference, Newton Rings, Polarization of Light.

Third year

SPHA031: Quantum Mechanics	**Credits: 16**	**Co-requisite / Prerequisite: SMTA021 / SPHA021, SPHB021**
Content: Background to quantum mechanics, Wave functions and plane waves, Schrödinger equation, Free and potential energy field particle, Properties of the Schrödinger equation, Discrete and continuous probability functions, Probability density and current density, Operators and expectation values, Fourier transforms and their applications to quantum particles, Bra and Ket notations, Application of Schrödinger equation, application of quantum mechanics to one dimensional systems. Three dimensional systems generalisation, Eigenfunctions and eigenvalues, The harmonic oscillator, Angular momentum, The hydrogen atom, Identical particles.		

SPHB031: Thermodynamics And Statistical Mechanics	**Credits: 16**	**Co-requisite / Prerequisite: SMTA021 / SPHA021, SPHB021**
Content: **Thermodynamics:** Fundamental concepts; Ideal and real gases; 1^{st}, 2^{nd} and 3^{rd} laws of Thermodynamics; Thermodynamic potentials.		

Statistical Mechanics: Energy States and Energy Levels; Macrostates and Microstates; Thermodynamic Probability; Bose-Einstein Statistics; Fermi-Dirac Statistics; Maxwell-Boltzmann Statistics; Bose-Einstein Distribution Function; Fermi-Dirac Distribution Function; Maxwell-Boltzmann Distribution Function; Applications: Bose-Einstein Statistics; Blackbody Radiation; Einstein Theory of Heat Capacity; Liquid Helium; Applications: Fermi-Dirac; Valence Electrons.

SPHA032:Solid State Physics	**Credits: 16**	**Co-requisite / Prerequisite: SMTA022 / SPHA022, SPHB022**
Content: Atoms in crystals, Crystallography, X-ray diffraction theory, Defects and disorders in crystals, Dislocations in crystals, Thermal vibrations, Free electrons in crystals, Electrical conductivity and the band theory, Semiconductors and Physics of p-n junctions		

SPHB032: Electrodynamics and Electronics	**Credits: 16**	**Co-requisite / Prerequisite: SMTA022 / SPHA022, SPHB022**
Content: **Electrodynamics:** Ohm's law, electromotive force, motional emf, Faraday's law, the induced electric field, inductance, energy in magnetic field, electrodynamics before Maxwell, how Maxwell fixed ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations in matter, Boundary conditions and conservation laws. **Electronics:** Basic structure of the pn junction, zero applied pn junction, built-in potential barrier, electric field in the pn junction, space charge width, Reverse and forward bias pn junction and capacitance in the pn junction.		

Ideal pn junction diode, diode non-linearity, diode models, load lines, half wave and full wave rectifications, ripple factor, capacitor smoothing

Introduction, transistor mechanisms, circuit configurations, transistor characteristics, transistor gain estimations, common base T- network models, trans-conductance, hybrid parameters and equivalent and phase shift oscillator.