Description of Courses offered by the Department of Physics

11021101 General Physics (1) 3 Credit Hours Prerequisite: No

Motion in one Dimension, Vectors, Motion in two Dimensions, Newton's law of motions, Circular Motion and Other Applications of Newton's Laws, Work Energy Theorem, Conservation of Energy, Linier momentum and Collisions , Rotation of a Rigid Object About a Fixed Axis

11021202 General Physics (2) 3 Credit Hours 11021101 Pre

Electric charge, Electric force, Electric field, Gauss law, Electric potential, Electric potential Energy, Capacitance and dielectrics, Current and resistance, DC Circuits, Ohm's law, Kirchhoff's Laws, Magnetic field, Lorentz's Force Law. Sources of magnetic fields, Biot and Savart law, Ampere's law, electromagnetic induction, Faraday's and Lenz law. Induced electromotive force and self-inductance.

11021111 General Physics laboratory (1) 1 Credit Hour 11021101 Sim

Measurements and Uncertainties, Vectors and Forces in Equilibrium, Motion in One Dimension, Projectiles Motion, Force and Motion, Simple pendulum, Newton's Laws of Motion, Friction, Conservation of Energy Principle, Conservation of Linear Momentum. Viscosity

11021212 General Physics laboratory (2) 1 Credit Hour 11021202 Sim

Galvanometer Experiment, Ohm's law, Electric Field and Electric Potential, Capacitors, Wheatstone bridge, Electromotive Force, Kirchhoff's laws, Electric Circuits of Resistance, Capacitors and Inductance.

11022213 Intermediate physics laboratory 1 Credit Hour 11022121 Sim

Experiment in applied Optics: Prism, Diffraction of Light through a Single Slit, Polarization of Light, Millikan's Oil Drop Experiment, Kerr Effect, Faraday's Effect, Measurement of Plank Constant, Diffraction of Light through a Multiple Slits, Michelson Interferometer.

11023114 Electronic laboratory 1 Credit Hour 11022231 Sim

Experiments on Semiconductor devices, Diodes, Transistors, Rectification and Filtering, Voltage Stabilizer, Amplifiers, Electronic Timer.

11023215	**Advance Physics laboratory**	**2 Credit Hour**	**11022213 Pre**

Experiments on Nuclear and Atomic Physics: Rutherford Experiment, Spectrum of Gamma Radiation, Electron Spin Resonance, Frank – Hertz, Black Body Radiation, Hall Effect, Diffraction of X-Ray, Diffraction of Electrons, Measurement of Charge and Mass of an Electron. Nuclear Magnetic Resonance.

11022121	**Optics**	**3 Credit Hour**	**11021202 Pre**

Vibrations, Wave Motion and Equation of Motion, Waves, Longitudinal and Transverse waves, Polarization and Malus Law Reflection and Refraction and Snell Law, Geometrical Optics, Mirrors and Lenses, Interference, Huygens' Principle, Young's double slit, interference measurement, single slit and two slit diffraction, diffraction of X-rays and Bragg's law

11022222	**Vibrations and Waves**	**3 Credit Hour**	**11022181 Pre**

Simple and damped harmonic motion, simple harmonic and damped oscillators, energy decay, forced vibrations, forced oscillator, synchronized vibrations, wave motion of oscillators, transverse wave motion, reflectance and permeability of transverse waves, longitudinal waves, longitudinal waves in gases and in solids, electromagnetic waves, Maxwell's equations, and the Poynting vector.

11023123	**Laser physics**	**3 Credit Hour**	**11023162 Sim**

Emission and Absorption of Light, Einstein Relations, Inversion Population, Gain Factor, Optical Resonance, Laser types, Solid State Lasers, Gas laser, Diode lasers, Semiconductor Lasers, Liquid Dye Lasers, Laser of Free Electron, Modern Laser Types, Laser Characteristics, Laser Wavelength Lines, Coherent Laser Beam, Focused Laser Beams, Frequency Doubling, Application of Laser: Medical Applications, Industrial, Military, Measurements, Holography, Communications.

11024124	**Environment physics**	**3 Credit Hour**	**11023241 Pre**

Properties of Gases and Liquids. Laws of thermodynamics and the human body, Energy transfers. Transport of Heat, Mass, and Momentum, Transport of Radiant Energy, Solar Radiation, Atmosphere and radiation, Noise pollution , water, wind, physics of ground, energy for living.

11023225	**Medical physics**	**3 Credit Hour**	**11022161 Pre**

Biomechanics, biomechanical fluids, sound and hearing, light and vision, heat and heat temperature, electricity and magnetism in human body, using radiation and ionic radiations, radiation therapy, diagnostic radiology (Medical Imaging), radiobiology, dosimetry, radiation protection.

11024226 Radiation physics 3 Credit Hour 11023162 Pre

Structure Of atoms, Radiations Source, Radioactivity, interaction of radiations with matter, Radiation unit and limit, X ray Predictions radiations detection, radiations dosimeters, radiation exposure, radiation hazard, radiation shielding, and Radiation in life.

11022231 Electronics 3 Credit Hour 11021202 Pre

Direct current circuits, alternating current circuits, semiconductors, diode theory, diode circuits, special-purpose LEDs, transistors, transistor basics and bias circuits, voltage amplifiers, power amplifiers, field transistor effect and its circuits, operational amplifier theory, operational amplifier circuits and applications, generators wave and frequency generators, timer.

11023132 Electromagnetic (1) 3 Credit Hour 11022181 Pre

Electrostatic Fields, The Electric Field Vector, The Flux Density Vector, The Gauss Theorem, Boundary Conditions, The Laplace-Poisson Equation, The Electrostatic Potential, The Legendre's Expansion of Potential, The Laplace Equations in Spherical Coordinates, Series Expansion of the Coulomb Potential, Legendre's Polynomials, A Conducting Sphere in a Uniform Field, Ampere's Law. Magnetic field in matter bara and diamagnetic.

11023233 Electromagnetic (2) 3 Credit Hour 11023132 Pre

The bound currents, magnetic field in linear materials. the force between currents, Magnetic Induction, the variable current with time, Maxwell equations, the conservation of charge and energy as well as momentum in electromagnetic fields, Electromagnetic waves, boundary conditions on traveling electromagnetic waves, the reflection and refraction laws in electromagnetic waves, electromagnetic radiation, waveguide.

11023234 Digital electronics 3 Credit Hour 11022131 Pre

Number systems and Codes, Logic States, Decimal, Binary and Hexadecimal Systems, Hexadecimal to Binary Conversion, Binary to Decimal Conversion, Binary Addition and Subtraction, Basic logic Gates, Gate Invertors, Half Adder and Full Adder. Boolean Algebra and Reduction Techniques, Exclusive- OR and Exclusive- NOR Gates, Arithmetic Operations and circuits, Code Converters. Coder/Decoder, Integrated Circuits, Karnaugh Map for Three and Four Variables. Multiplexers, and De-multiplexers, Flip-Flops, Counter circuits.

11023241 Thermodynamics 3 Credit Hour Prerequisite: 11022161

Expectation values, Probability, ensemble theory, thermal equilibrium, temperature, fluctuations, partition function, Helmholtz free energy, ideal gas, atom in a box, atoms in a box, equipartition of energy, Planck's law and Stephen-Boltzmann's law, emission and absorption, photons in solids, Gibbs coefficient and Gibbs sum, Fermi-Dirac distribution and Bose-Einstein distribution.

11024142	**Statistical mechanics**	**3 Credit Hour**	**11023162 Pre** **11023241 Pre**

Statistics, Binomial Distribution, Macroscopic and Microscopic States, Entropy and the number of Microstates, Gibbs Paradox, Liouville's Theorem, Partition Function, Micro-canonical Ensemble, Quantum States and Phase Space, Canonical Ensemble, Energy Fluctuation in Canonical Ensemble

11024143	**Energy physics**	**2 Credit Hour**	**11022181 Pre** **11023241 Pre**

Energy, work and energy, power, energy conservation, electric energy and its generation and transfer, fossil fuels, oil, shale, natural gas, coal, nuclear energy, nuclear fission and fusion, solar energy, solar energy uses, electromagnetic waves, photovoltaic electricity, water energy, water wheels, dams, tides, wave energy, bioenergy, photosynthesis, biofuels, bioenergy sources and consumption, reuse, and recyclable waste.

11023151	**Classical mechanics (1)**	**3 Credit Hour**	**11022181 Pre**

Matrices and vectors calculus, Newton's mechanics-single particle and the Motion in to dimension, Conservation Laws, Linear and Nonlinear Oscillations, Gravitation

11023252	**Classical mechanics (2)**	**2 Credit Hour**	**11023151 Pre**

Calculus of Variation using Euler's equations, Lagrange equations of motion, Hamilton's equations of motion used to describe central force motion, Generalized Coordinates, dynamic of system of particle, center of mass, Elastic and inelastic collision, The energy, linier momentum and angular momentum.

11023253	**Astro Physics**	**3 Credit Hour**	**11023233 Pre** **11023151 Pre**

Stars (its movements, distances, luminosity, absolute magnitude, temperatures and sizes, multi-stars systems, variable stars distribution, inter-stellar mediums, births and ages of stars, death of stars(white dwarf, pulsating neutron stars, black hole),the Milky way, galaxies, the cosmos).

11022161	**Modern physics**	**3 Credit Hour**	**11021202 Pre**

Special and general relativity, particle characteristics of waves, electromagnetic waves, black body radiation, Compton phenomenon, particle wave properties, De Broglie waves, principle of uncertainty, atomic structure, Bohr's atom, atomic excitation, quantum mechanics, wave equation, Schrödinger equation, particle in box, quantum theory of a Hydrogen atom

11023162	**Quantum mechanics (1)**	**3 Credit Hour**	**11022181 Pre** **11022161 Pre**

The Limitation of the Classical Physics, Heisenberg's Uncertainty Principles, Operators and Hilbert's Space, Reciprocal Relationships, Schrodinger's Equations, Wave Mechanics, Solving the Schrodinger's Equations in One Dimension, Schrodinger's Equations in One Dimension, Simple Harmonic Oscillator, Momentum, Rotational and Spin Momentum Effects, Hydrogen Atom, Solve the Schrodinger Equation for Hydrogen Atom.

11023263	**Quantum mechanics (2)**	**3 Credit Hour**	**11023162 Pre**

A Review of the Model of the Hydrogen Atom, The interaction of the Electron with the Magnetic Field, Matrix Representation of Angular Momentum and Spin, Commutation of the Angular Momentum and the Spin, Time-Independent Perturbation Theory, The Hydrogen Atom and the Helium Atom, Collision and Scattering Theory, Applications of Quantum Mechanics in Nuclear Physics, Time-dependent Perturbation Theory.

11023164	**Atomic and molecular physics**	**3 Credit Hour**	**11023162 Pre**

Classical atomic theories, quantum mechanics, hydrogen atoms, spin and angular momentum and magnetic moment of the electron, interactions with electric and magnetic fields, Zeeman effect, Stark effect, interaction with electromagnetic radiation, transition probabilities and Einstein coefficients, dipole approximation, quadrupole interactions, two electron atoms, the spin wave function and the Pauli's principle, stable and excited states, multi-electron atoms, Thomas and Fermi models, molecular structure and spectra of diatomic molecules.

11024165	**Nuclear physics**	**3 Credit Hour**	**11023162 Pre**

Nuclear Properties, Nuclear Force, nuclear models nuclear decay, beta decay, gamma decay, an overview of nuclear reactions, fissions and fusion, some applications to orbital models, nuclear distortion, and uniform model, electromagnetic interactions, weak interactions.

11024266	**Theory of special relativity**	**3 Credit Hour**	**11022161 Pre**

The foundations of classical mechanics, deviations from Newtonian dynamics, the essence and propagation of light, the description of relativistic motion, Lorentz-Einstein transformations, relativity and lengths and chronometry, accelerated motions, relative dynamics, mass of static and moving particles, equivalence of mass and energy, Lorenz transformations of energy and momentum, quadruple vectors ,Relativity Electromagnetism, Summary of relativistic Electromagnetic.

11024271	**Solid State Physics**	**3 Credit Hour**	**11023162 Pre** **11023263 Pre**

Definition of solid state, crystals grow, crystals, amorphous and nanoparticles, atomic bonding, crystal , miller indices, lattice constants, lattice defects, Fourier transformation in periodic systems, wave diffraction and reciprocal lattice and brillouin zone, x-ray diffraction, lattice vibrations and phonons, thermal properties of materials, heat capacity, plank distribution , density of state , Debye model, Einstein model, free electron (fermi gas) model, electric ,optical and thermal properties of electron gas.

11023172	**Material Science**	**3 Credit Hour**	**11022161 Pre**

Classification of Materials, atomic structures and solid crystals structure, binding forces and crystal systems, diffusion , stable and unstable ,mechanical properties of metals ,stress and strain, electrical properties materials, conductors, semiconductors and insulators, thermal properties of materials, thermal conductivity and expansion, magnetic properties of materials, types of magnetic materials, magnetic storage systems, optical properties of materials, reflection, absorption and transparent

11022181	**Mathematical physics (1)**	**3 Credit Hour**	**11021202 Pre**

Complex numbers, complex algebra and complex series, vector analysis, Green's and Stoke theorems, linear equations: matrices and determinants, Laplace transform, Cramer's rule, matrix operations, coordinate transformations, linear and orthogonal transformations, Fourier series, wave and periodic functions, Fourier transform, differential equations, partial differential equations, linear equations of first, second and third order (homogeneous and inhomogeneous).

11022182	**Mathematical physics (2)**	**3 Credit Hour**	**11022181 Pre**

Conjugate variables, Euler's equation, Lagrange's equations, Gamma function, Beta function, Beta functions in terms of Gamma functions, Stirling's equation , Bessel 's equation, plots of Bessel's function and its zeros , differential equations solved by Bessel's equation, Laplace's equation applied to a constant temperature plate, wave equation, heat flow equation, contour integrals, residue theorem.

11022283	**Computer Applications in Physics**	**3 Credit Hour**	**11022161 Pre**

Excel Applications: understand Worksheets, Create Spreadsheets and Enter Data, Graphical Objects, Add Graphics to worksheets, Perform calculations with Functions, Excel Applications in physics:in one dimensions, projectile motion, simple pendulum, simple harmonic motion, Kirchhoff's laws and electric circuits, Introduction to Matlab, basic mathematical operations, matrix, plotting and graphs using matlab, derivatives and integrations , scripts, numerical methods, Euler methods, applications in solving physical problems by matlab, introduction to Python program, using python to solve mathematical and physical problems.