

Physics Courses Description

Course Number	Credit hours	Course	Prerequisite
0300121	3	General Physics (1)	--
Units and Dimensions, Motion in a straight line, Vectors, Motion in the plane, Newton's Laws, friction, Work, Energy and Power, Lineal Momentum and Collisions, Rotational Motion.			

Course Number	Credit hours	Course	Prerequisite
0300122	3	General Physics (2)	0300121
Electric charge, Electric force: Coulomb's law, Electric field, Gauss law, Electric potential, Capacitance and dielectrics, Current and resistance, DC Circuits, ohm's law, Electromotive force, Magnetic field, Sources of magnetic field, Electromagnetic Induction and Faraday's Law.			

Course Number	Credit hours	Course	Prerequisite
0300123	3	Principles of Astronomy	--
The important and principles of astronomy, frame of reference, tides, law of gravity, Kepler's laws, astronomical units, electromagnetic spectrum, telescopes, solar system, stars, galaxies.			

Course Number	Credit hours	Course	Prerequisite
0300124	3	Scientific Culture	--
Human knowledge and science, Nature of human knowledge, What is science? Historical development of science, The effect of the society on the development of science, The modern sciences, The importance of technology and its effect on modern sciences, The global problems and the role of science in their solutions, Modern scientific revolution, Science and the society-problems and humanity.			

Course Number	Credit hours	Course	Prerequisite
0302111	3	Physics Laboratory (1)	0300123*
Students perform 10 experiments of 3 hr/week duration, The general concepts in mechanical physics , These experiments are: experimental and data analysis, measurements and uncertainties, vectors and forces in equilibrium, newton's second law of motion, projectiles motion, collision in two dimension, friction, simple pendulum, hook's law and rotational motion.			

Course Number	Credit hours	Course	Prerequisite
0302112	3	Physics Laboratory (2)	0300122*
Students perform 10 experiments of 3 hr/week duration, The experiments are: electric field mapping, Ohm's law, Kirchhoff's laws, resistivity of a conductor, variation of resistance with temperature, Wheatstone bridge, charging and discharging of a capacitor, power transfer, tangent galvanometer, electrochemical equivalent of copper.			

Course Number	Credit hours	Course	Prerequisite
0302201	3	Mathematical Physics (1)	0300122
Infinite series, Applications of series, series expansion, complex numbers and its algebra, complex infinite series, Euler formula, linear algebra, determinants, matrices and vectors, linear vector spaces, Partial differentiation, boundary point problems, Leibniz rule, multiple integrals, Jacobian transformation, vector analysis, multiplication and differential operators.			

Course Number	Credit hours	Course	Prerequisite
0302203	3	General Physics (3)	0300122
Electricity and magnetism: Faraday's law and Lenz's law, self-inductance and mutual inductance, RLC-circuits, alternating current, transformers, rectifiers, filters, Maxwell's equations and electromagnetic waves. Universal gravitation: law of universal gravitation, gravitational field and potential energy, satellites. Fluid mechanics: pressure, Archimedes's principle, Bernoulli's equation, applications.			

Course Number	Credit hours	Course	Prerequisite
0302230	3	Optics	0300122
The nature of light, the speed of light, refraction index, concept of the ray, refraction, reflection on polished and unpolished surfaces, total internal reflection, Huygens' principle, Fermat's principle, prisms and dispersion. Plane and spherical mirrors, image formation. convex and concave mirrors, thin lenses, thick lenses, lens aberrations. Optical instruments: camera, eye, simple magnifier, compound microscope, telescope.			

Course Number	Credit hours	Course	Prerequisite
0302236	1	Optics Laboratory	0202230*
This laboratory contains of group of experiments, depending on theoretical materials in Geometrical Optics and in Waves and Light. Students perform this group of experiments for 3 practical hours weekly. These experiments are: Lenses and mirror, Inverse square law, refraction, prism spectrometer of light, Diffraction of light –diffraction grating, Michelson interferometer, Newton's rings, Fresnel Mirrors ,Blamer series of hydrogen			

Course Number	Credit hours	Course	Prerequisite
0302262	3	Modern Physics	0300122
Special theory of relativity (kinematics and dynamics) Quantum nature of radiation, Wavelike properties of particles, Rutherford-Bohr model, Nuclear structure and radioactivity; Nuclear reactions.			

Course Number	Credit hours	Course	Prerequisite
0302296	3	Electronics (1)	0300122
Fundamental Concepts, Diodes and Application, Bipolar Junction Transistor, Small Signal Bipolar Amplifier, Field-Effect Transistors, Operational Amplifier, Operational Amplifier Applications, Digital Electronics.			

Course Number	Credit hours	Course	Prerequisite
0302297	1	Electronics Laboratory	0320296*
Students perform 10 experiments of 3 hr/week duration. The experiments are: Measurements, RC Networks, RLC Circuits, Diode and Transistor Characteristics, Rectification and Filtering, Zener Diode, Diode Clippers and Clamps, Transistor Biasing, Transistor Amplifiers, Operational Amplifiers, Comparators, Oscillators.			

Course Number	Credit hours	Course	Prerequisite
0302299	3	Introduction of Astronomy	---
Nature of astronomy, Historical background, light and electromagnetic radiation, Telescopes and observatories, solar system, Stars properties, constellations, Galaxies.			

Course Number	Credit hours	Course	Prerequisite
0302301	3	Mathematical Physics (2)	0302201
Fourier series and transforms, Dirichlet's conditions, Parseval's theorem. Ordinary differential equations (separable functions, first order and second order), Laplace transforms, Dirac delta function, Greens functions, Calculus of variations, Euler and Lagrange equations, Brachistochrones, isoperimetric problem. Special functions, factorial, gamma beta and error functions, elliptic integrals, series solution of differential equations, Legendre and Bessel orthogonal polynomials.			

Course Number	Credit hours	Course	Prerequisite
0302320	3	Electromagnetic Theory (1)	0300122 &0302201
Vector Calculus, Coulomb's law, Electric Field ,Gauss's Law, electric Potential, Electric Potential energy, Fields in matter, Electric Polarization, The Electric displacement Vector, Magnetic Force, Magnetic Field, Ampere's Law, and the vector Potential.			

Course Number	Credit hours	Course	Prerequisite
0302329	3	Electrical Circuits	0300122
Fundamentals of electromechanical energy conversion. Motors and generators, transformers, single and three-phase power circuits, three-phase induction motor.			

Course Number	Credit hours	Course	Prerequisite
0302332	3	Physics of Waves and Vibrations	0300121
Simple harmonic motion with applications, damped harmonic motion, energy dissipation, the quality factor, forced oscillations, resonance and the resonance power curve, coupled oscillations of mechanical and electrical systems, the coupling strength, Transverse waves: wave variables, wave equation, impedance, group and phase velocities, wave propagation in periodic structures, reflection and transmission of waves, longitudinal waves, Waves in more than one dimension.			

Course Number	Credit hours	Course	Prerequisite
0302333	3	Classical Mechanics	0302201
Quick review of elements of Newtonian mechanics, motion in one, two and three dimensions, motion of a system of particles, motion of rigid bodies, gravitation, moving coordinate systems. Static's, Lagrange equations, Hamilton equations, tensor algebra, rotational dynamics of rigid bodies, theory of small oscillations.			

Course Number	Credit hours	Course	Prerequisite
0302342	3	Theory of Special Relativity	0302262
Criticism of Newtonian mechanics and Maxwell's equations, hypotheses and the development of Einstein's theory, the meaning of the four-dimensional vector, relative mechanics.			

Course Number	Credit hours	Course	Prerequisite
0302343	3	Thermodynamics	0302201
Thermodynamics systems and processes, Temperature, Work, The first law of thermodynamics and some of its applications, The second law of thermodynamics, The Carnot cycle, Entropy and reversible processes, Thermodynamic relations, Enthalpy, The Helmholtz function, The Gibbs function, Maxwell's thermodynamic relations, some application of thermodynamics to real substance, Heat capacity relations.			

Course Number	Credit hours	Course	Prerequisite
0302355	3	Computer Application in Physics (1)	0302201
Basics about matlab, Simple matrices, Operators and flow control, Graphics, M – Files			

Course Number	Credit hours	Course	Prerequisite
0302356	3	Computer Application in Physics (2)	0302355
Ordinary differential equations, such as those of classical mechanics. Partial differential equations, such as Maxwell's equations and the Diffusion and Schrödinger equations. Matrix methods, such as systems of equations and eigenvalue problems applied to Poisson's equation and electronic structure calculations			

Course Number	Credit hours	Course	Prerequisite
0302360	3	Quantum Mechanics (1)	0302201 & 0302262
Wave function, Schrödinger equation in one dimension, statistical interpretation of wave function, uncertainty principle, stationary states, application to one dimensional potentials (infinite square well, harmonic oscillator, free particle, Dirac potential, finite square well) Matrix quantum mechanics, Hilbert spaces, observables, Hermitian operators, Dirac notation.			

Course Number	Credit hours	Course	Prerequisite
0302365	3	Advanced Physics Laboratory (1)	0302262 & 0302201
Students perform 10 experiments of 4 hr/week duration. The experiments are: Blackbody Radiation, specific charge (e/m), Electric Diffraction, Frank – Herz, photoelectric Effect, Hall Effect, Zeeman Effect Magnetic field, thermoelectricity, solar Energy.			

Course Number	Credit hours	Course	Prerequisite
0302366	3	Statistical Physics	0302343
Macro-states and microstates, distinguishable particles, Boltzmann distribution, Partition function and thermodynamics quantities, density of states, Maxwell-Boltzmann distribution and the ideal gas, monatomic and diatomic molecules, specific heat of real gases, quantum statistics, symmetric and antisymmetric wave functions, Fermi-Dirac statistics, electron gas, Pauli paramagnetism, Bose-Einstein statistics, Bose-Einstein condensation, photon gas, blackbody radiation..			

Course Number	Credit hours	Course	Prerequisite
0302372	3	Introduction to Biomedical Physics	-----
Definition of forces in the man body, skeletal physics, energy work and power of the man body, the concepts of heat ,cold, and pressure, cardiovascular system physics, electricity in the man body, sound and light, X-rays, radiotherapy physics.			

Course Number	Credit hours	Course	Prerequisite
0302373	3	Radiation Protection	0302262
Properties of ionized radiation, Biological effects of radiation, radiation units, radiation protection equipments, Radiotherapy & Radiation protection, Nuclear Medication.			

Course Number	Credit hours	Course	Prerequisite
0302382	3	Radiation Physics	0302262
Fundamentals of radiation physics: radioactivity and decay, sources of ionizing radiation, natural decay series, production and properties of ionizing radiation; interactions of photons, charged particles and neutrons with matter. Radiation detectors; concepts of radiation dosimetry (theoretical and experimental, cavity theory and ionization chambers).			

Course Number	Credit hours	Course	Prerequisite
0302391	3	Material Science	-----
Classification of Materials: metals, ceramics, polymers, composites, crystallography, phase Transformation, Material Deformation, Mechanical Properties, Heat Treatment, smart Materials.			

Course Number	Credit hours	Course	Prerequisite
0302396	3	Electronics (II) (Digital electronics)	0302296
Number systems and Codes, Digital Electronic, Signals and switches, Basic logic Gates, Boolean Algebra and Reduction Techniques, Exclusive- OR and Exclusive- NOR Gates, Arithmetic Operations and circuits, Code converters. Multiplexers, and De-multiplexers, Flip-Flops and Registers, practical considerations for Digital Design, counter circuits, shift Registers, Multi-vibrators, Interfacing to the Analog Word, Microprocessor Fundamentals.			

Course Number	Credit hours	Course	Prerequisite
0302420	3	Electromagnetic Theory (2)	0302320
Magnetization, the Field of Magnetized Objects, The Electromotive Force, Electromagnetic Induction, Maxwell's equations, the Wave Equation, Electromagnetic Waves in Vacuum and Matter, Electric and Magnetic Dipole Radiation.			

Course Number	Credit hours	Course	Prerequisite
0302431	3	Laser Physics	0302360& 0302230
Theory of three and four levels lasers, types of lasers, solid state lasers, gas laser, diode lasers & examples, cavities of laser, stability of laser cavity using matrix optics, Optics of Gaussian beam, theory of pulsed lasers for three and four levels lasers, selection of wavelength of laser using dispersion elements like: Prisms, Fabry - Perot, birefringence plates, Non-linear optics and harmonic generation, application of lasers.			

Course Number	Credit hours	Course	Prerequisite
0302432	3	Physics of Spectroscopy	0302360
Wavelength distribution of radiation from a sample that can be used by identify the characteristics of atoms or molecules in the sample, wave function , Schrödinger equation, Fourier analysis, traveling waves, polarization, interference, Rutherford-Bohr model, molecular structure, interaction of radiation with matter, Einstein coefficients.			

Course Number	Credit hours	Course	Prerequisite
0302460	3	Quantum Mechanics (2)	0302360
Quantum mechanics in three dimensions, Schrödinger equation in spherical coordinates, Hydrogen atom, Angular Momentum, Spin, Time independent Perturbation theory (degenerate and non-degenerate), fine structure of hydrogen atom, Zeeman effect, hyperfine structure, variational techniques, ground state of helium, H ₂ molecule ion spectrum, The WKB approximation.			

Course Number	Credit hours	Course	Prerequisite
0302463	3	Nuclear Physics	0302360
Basic Nuclear Concepts and Nuclear Properties, Nuclear Force: The Two-Body Nucleon System, Nuclear Force: Nucleon-Nucleon Scattering, Nuclear Models, Radioactive Decay, Nuclear Reactions.			

Course Number	Credit hours	Course	Prerequisite
0302465	3	Solid State Physics (1)	0302360
An Introductory survey, crystal lattices, structure of solids, Elastic Scattering of waves, Bonding, lattice Vibrations, Electron States.			

Course Number	Credit hours	Course	Prerequisite
0302469	3	Elementary Particles	0302360
Historical introductions (electron, proton, mesons, antiparticles, neutrinos, strange particles), Quark model, vector bosons, standard model of elementary particles, fundamental forces, quantum chromo dynamics (QCD), quantum electrodynamics (QED), weak interactions, decays and conservation laws, relativistic kinematics, Lorentz transformation, four vector notation, relativistic collisions, symmetries, flavor symmetries, charge conjugation and parity, CP violation.			

Course Number	Credit hours	Course	Prerequisite
0302472	3	Atomic and Molecular Physics	0302360
Review of one-electron hydrogen atoms: fine structure, hyper film structure; interaction with external electric and magnetic fields; two-electron atoms. Many-electron atoms: the central field approximation, electron configurations, LS-coupling and atomic terms and energy levels; The Hartree-Fock and the self-consistent field; j-j coupling, the periodic table and systematic of atomic spectra. Interaction of multi electron atoms with electromagnetic fields. Molecular Structure and Spectra, of diatomic molecules.			

Course Number	Credit hours	Course	Prerequisite
0302473	3	Physics of Semiconductors	0302465
Semiconductor Crystal Structure, The Energy Band Structure of Crystals, Transport of Carriers in Semiconductors, Semiconductor Diode Devices and Frequency Speed Behavior, The Bipolar Junction Transistor (BJT).			

Course Number	Credit hours	Course	Prerequisite
0302475	3	Advanced Physics Laboratory (2)	0302463*& 0302262
Students perform 10 experiments of 4 hr/week duration. The experiments are: Laser Diode, Faraday effect, Rutherford, scattering, X-Ray, Geiger counter, Statistical Nature of Radioactive decay, Gamma spectroscopy using NaI(Tl), Detector, Range of Alpha particle in air, Electron spin Resonance, Law of distance and absorption of gamma or beta rays.			

Course Number	Credit hours	Course	Prerequisite
۰۳۰۲۴۷۹	3	Special Topics in Physics	-----
Determined subject by the department			

Course Number	Credit hours	Course	Prerequisite
0302485	3	Solid state physics (2)	0302465
Energy bands, semiconductor crystals, impurity conductivity, super lattices, semimetal, thermoelectric effects, superconductivity, Layers of energy theory in metals and semiconductors, Properties of insulating materials and ferroelectrics, Magnetic properties of metals, Optical phenomena in metals.			

Course Number	Credit hours	Course	Prerequisite
0302493	2	Research Project	-----
Research projects as suggested by staff members.			

*:Co-requisite