**Course Description of the**

**Department of Physics Courses for the Bachlor Degree**

**Phys. 304101 - General Physics (1) (Mechanics) (3 credit hrs.)**

Measurement and system of units, vectors, motion in one and two dimensions, particle dynamics and Newton's laws of motion, work and energy, conservation of energy, dynamics of system of particles, center of mass, conservation of linear momentum, collisions, impulse, rotational kinematics, rotational dynamics, conservation of angular momentum, elasticity, fluids.

**Phys. 304102 - General Physics (2) (Electricity and Magnetism) (3 credit hrs.)** Charge and matter, electric field, gauss's law, electric potential, capacitors and dielectrics, current and resistance, electromotive force and circuits, the magnetic field, ampere's law, faraday's law of induction, Maxwell's equations; magnetic properties of matter, A.C. circuits.

**Phys. 304103 - General Physics Laboratory (1) (Mechanics) (1 credit hrs., 3 exp.)**

Experiments on statics, motion, free fall and projectiles, force and motion, Newton's laws, friction, rotational motion, work, conservation of energy, linear momentum, moment of inertia.

**Phys. 304104 - General Physics Laboratory (2) (1 credit hrs., 3 exp.)**

 **(Electricity and Magnetism)**

Experiments on Galvanometer and its uses, Ohm's law, electric field, electric potential 1, capacitor, Wheatstone bridge, potentiometer, electromotive force, Kirchoff''s laws, RLC-circuits.

**Phys. 304117 – General Physics (3) (Waves and Light) (3 credit hrs.)**

Mechanical oscillations, electromagnetic oscillations, LC Circuits, transverse and longitudinal waves, electromagnetic waves and polarization, interference, diffraction.

**Phys. 304118 - General Physics Laboratory (3) (Waves and Light) (1 credit hrs., 3 exp.)**

Experiments covering the topics discussed in Phys. 207A: Mechanical vibrations, speed of mechanical waves, speed of sound, vector diagram of RLC circuit, resonance in RLC circuit, Geometrical optics, polarization of light, Young double-slit experiment, Franhofer diffraction.

**Phys. 304202 - Methods of Theoretical Physics (1) (3 credit hrs.)**

Vector analysis, curvilinear coordinates, complex numbers, determinants and matrices, first and second order differential equations, Fourier series.

**Phys. 304235 - Electronics (I) (3 credit hrs.)**

D.C Circuits, A.C circuits, Semiconductors, Diode Theory, Diode Circuits and Special Purpose diodes. Bipolar Transistors, Transistor Fundamentals and Transistor Biasing, Voltage amplifier, Power Amplifiers, Field Effect Transistors and Circuits, Op-Amp Theory, Op-Amp circuits and Applications, Oscillators, The 555 Timer

**Phys. 304236 -Electronics Laboratory (1 credit hrs., 3 exp.)**

Experiments on semi-conductors, transistors, voltage regulators and filters, rectifiers, amplifiers, timers, and wave form generators.

**Phys. 304221-Geometrical Optics (3 credit hrs.)**

Reflection and refraction at plane surfaces, mirrors and Lenses, image formation applications, aberrations, (types of aberrations), matrix algebra in optics, prisms (types of prisms) & dispersion of light by prisms, optical fibers (definition and types, applications), Radiometry, photometry, radiance and irradiance, luminescence instrumentation, speed of light measurement by astronomical and terrestrial methods.

**Phys. 304222 - Geometrical Optics Laboratory (1) (1 credit hrs., 3 exp.)**

Experiments on: Focal length measurements of thin lenses and spherical mirrors, the telescope, prisms, transmission and reception using fiber lines, glass optical fibers, irradiation measurements, velocity of light, fabrication of simple optical devices.

 **Phys. 304252 - Modern Physics (1) (3 credit hrs.)**

Theory of special relativity, dual property of light and particles, atomic structure, Schrödinger equation and some application, ideal hydrogen atom.

**Phys. 304253 - Modem Physics (2) (3 credit hrs.)**

This course includes basic concepts about topics in modern physics in the following fields: many electron atoms, molecular structure, solid state, nuclear Physics and elementary particles.

**Phys. 304261 - Thermodynamics (3 credit hrs.)**

Fundamental concepts, equations of state, the First Law of thermodynamics, entropy and the Second Law of thermodynamics, thermodynamic potentials.

**Phys. 304301 - Methods of Theoretical Physics (2) (3 credit hrs.)**

Gamma and Beta Functions, Dirac-delta function, series solution of differential equations, Sturm-Liouville eigenvalue problem, Bessel functions, Legendre functions, spherical harmonics, angular momentum operators, radial equations of the hydrogen atom, harmonic oscillator.

**Phys. 304311 - Classical Mechanics (1) (3 credit hrs.)**

 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.

**Phys. 304302 Intermediate Physics Lab (1) (2 credit hrs., 4 exp.)**

Michelson interferometer, Prism, Young Double Slits, Diffraction Grating. Balmer Series, RC circuits, RLC circuits, Thermal Conductivity, Polarization of Light.

**Phys. 304312 - Classical Mechanics (2) (3 credit hrs.)**

Quick review of statics, Lagrange equations, Hamilton equations, tensor algebra, rotational dynamics of rigid bodies, theory of small oscillations.

**Phys. 304341 - Nuclear Physics (1) (3 credit hrs.)**

Review, Nuclear Properties, nuclear force, nuclear models, nuclear radioactivity, alpha-decay, beta-decay, gamma-decay, nuclear reactions (fission and fusion), applications.

**Phys. 304343 - Health Physics (3 credit hrs.)**

Review of the sources of radiation, basic dosimetry, and hazards of ionizing radiation, Radiation safety guides and codes in the environment, industry, medical and nuclear facilities, Techniques for the detection, use, and safe handling of radiation sources, Radiation protection and shielding: monitoring of sources, planning of facilities, waste management, and radiation protection for the public, radiation detection and counting statistics. Radiation laws and regulating agencies,

**Phys. 304351 - Quantum Mechanics (1) (3 credit hrs.)**

Wave packets and the uncertainty relations, Schrödinger equation, eigenfunctions and eigenvalues, potentials in one-dimension, structure of wave mechanics, operator methods in Q.M., Schrödinger equation, in three dimensions, angular momentum, Ideal hydrogen atom.

**Phys. 304354 - Quantum Mechanics (2) (3 credit hrs.)**

Review of ideal hydrogen atom, Interaction of electrons with magnetic fields, operators and spin using matrices, addition of angular momentum and spin, theories of time-independent approximation methods, real hydrogen atom, helium atom, scattering theory, theories of time-dependent approximation methods.

**Phys. 304333 - Electromagnetic Theory (1) (3 credit hrs.)**

Quick review of vector analysis and electrostatics, solution of electrostatic problems in vacuum and in dielectric media, electrostatic energy, magnetic field of steady currents, magnetic properties of matter.

**Phys. 304334 - Electromagnetic Theory (2) (3 credit hrs.)**

Electromagnetic induction, magnetic energy, Maxwell's equations, propagation of electromagnetic waves, polarization, reflection and refraction of EM waves, wave guides, radiation emission.

**Phys. 304462 - Statistical Mechanics (3 credit hrs.)**

Maxwell-Boltzmann statistics and its applications, Bose-Einstein statistics, Fermi-Dirac statistics, statistical concepts of temperature and entropy, thermodynamics of gases, application of statistical thermodynamics, the canonical ensemble, the grand canonical ensemble .

**Phys. 304411 - Methods of Theoretical Physics (3) (3 credit hrs.)**

Tensors, group theory, hyper geometric function, integral transforms, complex variables, calculus of variations.

**Phys. 304202 - Astronomy (1) (3 credit hrs.)**

Nature of astronomy, historical background, Light and electromagnetic radiation, Telescopes and observatories, The solar system (The Sun, The earth and its moon, Other planets).

**Phys. 304236 - Electronics (II) Digital electronics (3 credit hrs.)**

Introduction, Digital Logic, combinational Logic, Applications of combinational Logic, Integrated circuits, Technologies, sequential Logic, Synchronous Logic, Memory and Storage, Interfacing.

**Phys. 304304 – Astrophysics (3 credit hrs.)**

Atomic and nuclear spectra, gas laws, radiation laws, stellar luminosity, line profiles, spectral classes, stellar interior, stellar structure, star formation, stellar evolution, transport process in star.

**Phys. 304342 Radiation Biophysics (3 credit hrs.)**

Effects of radiation on living cells and organisms (cytoxcity, mutagenecity, and carcenogesis), theories and models of cell survival, survival curve and its significance, modification of radiation response, delayed effects and dose-effect relationship, genetic effects of ionizing radiation, direct and indirect effects.

**Phys. 304433 - Elementary Particle Physics (3 credit hrs.)**

General review about the nature of the elementary particles and forces in nature, addition of angular momentum, relativistic kinematics, conservation laws and symmetry principles, intrinsic quantum numbers, nucleons interaction with mesons, classification of elementary particles, quark model and its applications.

**Phys. 304306 - Introduction to Biomedical Physics (3 credit hrs.)**

Biomechanics. Biofluid mechanics. sound and hearing. light and vision. Heat and temperature, electricity and magnetism in the body. Biomagnetism. The use of ionizing and non ionizing radiation in diagnosis and therapy. radiation safety.

**Phys. 304381 - Biomedical Optical Spectroscopy (3 credit hrs)**

The theoretical and experimental principles underlying the application of optical spectroscopy in medical and biological physics. Use of lasers and fiber optics in medicine for diagnosis and therapy.

**Phys. 304411 - Biophysics (3 credit hrs.)**

Molecular structure of biomolecules. properties and function of proteins, nucleic acids, lipids and membranes. Energetics and dynamics of biological systems. Physical aspects of selected systems including: Vision, nerve transmission, photosynthesis, enzyme mechanism, and cellular diffusion. Introduction to spectroscopic methods for monitoring reactions and determining structure including light absorption or scattering, fluorescence, NMR, and x-ray diffraction.

**Phys. 304471 - Solid State Physics (1) (3 credit hrs.)**

Crystal structure and binding, diffraction in crystals, reciprocal lattice and vibrations, photons and specific heat, free electron model.

**Phys. 304487 Image Processing and Analysis**  **(3 credit hrs.)**

Introduction to digital Image representation, digital image fundamentals, image transforms: Discrete Fourier Transform & Fast Fourier Transform, Hotelling Transform  & Hough Transform.  Image Enhancement; smoothing, sharpening, & model based enhancement. Image Restoration, Image encoding, and image segmentation. Introduction to 3D Visualization.

**Phys. 304481 - Physical Optics (3 credit hrs.)**

Brief history of optics, mathematics of wave motion, electromagnetic theory of light, Fresnel coefficients, optics of thin films, polarization, nature of polarized light, polarizer's, diachronism, birefringence, retarders, faraday rotation, Kerr effect, optical activity, john matrices, interference of two beams, interference of more than two beams, Mich. interferometer, Fabry-Perot interferometer, diffraction, theory of diffraction, diffraction from slits and apertures, diffraction gratings.

**Phys. 304491 - Seminar (1 credit hrs.)**

**Phys. 304493- Special Topics in medical physics (3 credit hrs.)**