Course description presented by the Physics Department for Master's degree

(0303600) Mathematical Physics **3 Credit hours**

This course includes Homogeneous boundary value problem, special functions, inhomogeneous problem, Green's functions, integral equations, complex variable techniques, evaluation of integrals, dispersions' relations, calculus of variations, group theory.

(0303601) Electrodynamics **3 Credit hours**

Electrostatics, Laplace and Poisson's equations, Green's theorem, method of images, boundary value problem in Cartesian, spherical and cylindrical coordinates, spherical harmonics, Bessel's functions, multipoles and multipoles expansion, electrostatics of macroscopic materials, dielectrics, magneto-statics, vector potential, magnetic moments, Maxwell's equations of time-varying fields, energy and momentum conservation, plane electromagnetic waves.

(0303602) Classical Mechanics **3 Credit hours**

This courseincludes Survey of the elementary principles, variation principles and Lagrange's equations, the two body central force problem, the kinematics of rigid body, rigid body equations of motion, Hamilton equations of motion, Canonical transformations, small oscillations.

(0303603) Quantum Mechanics **3 Credit hours**

Review of the basic concepts of wave mechanics, addition of angular momentum, scattering, dynamics of two level systems, linear vector space. Quantum dynamics, rotations and other symmetry operations, bound state perturbation theory, time dependent perturbation theory, scattering

(0303604) Statistical Mechanics **3 Credit hours**

The statistical basis of thermodynamics, elements of ensemble theory, canonical and grand canonical ensembles, formulation of quantum statistics, theory of simple gases, ideal Bose systems ,ideal Fermi systems , statistical mechanics of interacting systems.

(0303605) Solid State Physics **3 Credit hours**

Electron energy bands in crystalline solids, crystal symmetry and Brillion zones, approximate methods of calculation, electrons and holes under applied fields, lattice dynamics and thermal conductivity, electron-lattice interaction, transport phenomena in metals and semiconductors, crystal impurities, transitions between energy bands.

(0303606) Atomic and Molecular Physics **3 Credit hours**

Relativistic correction to non-relativistic atomic spectra, coupling scheme, polarizability, radioactive transitions, atomic collisions, molecular structure, Raman effect, resonance experiments, crossover in atomic levels ,optical pumping, atomic and molecular radiation.

(0303607) Nuclear Physics **3 Credit hours**

Nucleon-nucleon scattering, nuclear structure and nuclear volume, multipole moments, shell model, collective states, instrumentation and methods in nuclear physics.

(0303608) Plasma Physics **3 Credit hours**

Plasma oscillations, interaction of electromagnetic fields with plasma, wave propagation in magneto ionic media, plasma sheath, radiation of electric sources in compressive and in compressive plasma, electro-acoustic waves, magneto-hydrodynamics.

(0303609) Theory of Relativity **3 Credit hours**

This courseincludes the basic rules of the theory of general relativity, the extended Riemann curvature calculation elements-extended domain equations christofle, tests, special solutions, expanding to cosmology.

(0303610) Computational Physics **3 Credit hours**

Linux operating system includes: install and maintenance, programmed and advanced tools, such as corticosteroid UAC and bridge or Pearl, dynamics of particles and dynamics of quantum particles, and Random movements. Find the smallest values widely using the gradient and gradient-reference, transportation, miscellaneous applications matrix methods might include the following topics selected from mechanics, nonlinear systems, Electrodynamics, Statistical and quantum mechanics, nuclear physics, and intense situation.

(0303611) Elementary Particle Physics **3 Credit hours**

This course includes introduction to elementary particles, the Dirac equation, and quarks model replication, theories of strong and weak electromagnetic interactions, the standard model, and the great unification.

(0303612) Environmental Physics **3 Credit hours**

This courseincludes an introduction to the basics of physics and its applications in the environment, including topics such as: energy and its transformations, motors, energy efficiency, use and energy transformations in vehicles and buildings, the atmosphere and climate, atmospheric chemistry, atmospheric physics, climate system dynamics, ways Scans used to identify local environmental indicators and cosmic Ocean bottoms, physics, physics of water ice, and land cover, remote sensing..

(0303613) Radioactive Material Physics **3 Credit hours**

This courseincludes properties of radiation, nuclear reactions, radioisotope applications in research and industry, and measurement of radiation screening, appropriate protective measures, and ways to measure them, permanently nucleus, binding energy, nuclear models, and statistical physics in measuring radioactive activism.

(0303614) Quantum Field Theory **3 Credit hours**

Canonical field quantization, systematic derivations of Feynman diagrams, renormalization with application to quantum electrodynamics, dispersion relations, Mandelstam representation, analytic properties of Feynman diagrams.

(0303615) Properties of Materials **3 Credit hours**

Transformations, Symmetry Elements and Point Groups; Thermodynamics and Magnetoelectric Effect; Pyroelectricity; Dielectric Properties; Mechanical Properties; Thermal Expansion; Piezoelectricity; Magnetic Phenomena; Electrical Resistivity; Thermal Conductivity; Diffusion and Ionic Conductivity; Thermomagnetic Phenomena; Thermoelectricity.

(0303616) Quantum Optics **3 Credit hours**

This course includes the electromagnetic field quantization, interaction of quantized fields with atomic systems, lasers, nonlinear visuals, Visual fields associated with partial theories represent cases associated with applications of optics in optical communication systems.

(0303617) Nano-Physics **3 Credit hours**

This course is introduction to principles and applications of nanotechnology. Discuss the characteristics of emerging nanotechnology, Atomic and molecular self-assembly and concepts from bottom to top and top to bottom, and about the nanoscale systems, including quantum dots and carbon nanotubes Graphene.

(0303618) Special Topics in Physics **3 Credit hours**

In this course students learn how to carry out different stages of scientific research starting from the formulation of research idea and finishing by a write up and presentation of a technical report. The course is in the form of lectures taught by faculty in which various types of research in the advanced fields. As a part of the course, students will undertake at least one small research projects under the supervision of faculty members to learn how to define the problem and complete the literature review using various resources.

(0303619) Advanced Astrophysics

Advanced Astrophysics refers to processes or systems which involve relativistic phenomena, Gamma-Ray emission, X-ray emission, non-thermal particle acceleration, jet flows, strong magnetic fields, ionized plasmas, compact objects, accretion flows, the origin and the cosmology of the early universe, phenomena in the Universe; topics such as Black Holes, Gamma Ray Bursts and Active Galactic Nuclei.