Courses Description for the Master's program in Physics (both tracks; thesis and comprehensive)

Course	Description	Cr.		Prerequisite
Advanced Mathematical Physics 1 **0302701**	Functions of a Complex Variable, Calculus of Variations, Integral Equations, Evaluation of limits for homogeneous systems, Special functions, Evaluation of limits for inhomogeneous systems, Green functions, Sturm–Lowville Theory.	**03**		**Prerequisite** -----------------
Advanced Mathematical Physics 2 **0302702**	Tensors in Euclidean Space, Differential Calculus on Manifolds, Homeomorphism and Diffeomorphism, Poincar´e Duality Characteristic Classes Hodge Theory and the Morse Index, Groups and Group Representations, The Geometry of Fibre Bundles, complex Wiener-Hopf Equations	**03**		**Prerequisite** **0302701**
Computational Physics **0302705**	Basic operation mathematics, Preparing advanced computer programs on a number of physical applications, modeling complex physical problems so that they become capable of algorithmic calculations, programs in numerical integrals to solve problems in linear and non-linear equations, solving problems in uniform and partial differential equations, drawing numerical data, using Linux and UNIX and writing using latex.	**03**		**Prerequisite** -----------------
Advanced Classical Mechanics **0302711**	Central forces between two objects, Variation principles, Conservation theorems and Symmetry properties, Hamiltonian-Euler principle, Coriolis force, Rigid motion and the dynamic rotation motion, Angular momentum and kinetic energy of rotating rigid body motion about a point, Canonical transformations, Oscillations.	**03**		**Prerequisite** -----------------
Astrophysics **0302713**	Introduction to astronomy and astrophysics, telescopes and instrumentation, data collection method, image processing techniques, data analysis tools, observing techniques, specialized observations, research projects.			-----------------
Advanced Electrodynamics 1 **0302721**	Introduction for electrostatic, Boundary-value problems in electrostatics, Multi-Poles, Magneto statics, Maxwell's equations.	**03**		**Prerequisite** -----------------
Advanced Electrodynamics 2 **0302722**	Poynting's theory, continuous and gauge transformations, retreading potentials. Special relativity in the formation of	**03**		**Prerequisite** **0302721**

	4-vector, Lagrange Hamilton formalism of electrodynamics field theory. Energy-momentum operators and derivation of radiation theory.. Lennart Wischert's potentials. The attenuation theory of radiation.			
Advanced Statistical Mechanics **0302741**	The Statistical Basis of Thermodynamics, The classical ideal gas, Phase space of a classical system, Liouville's theorem and its consequences, The micro canonical ensemble, Physical significance of the various statistical quantities in the canonical ensemble, Alternative expressions for the partition function, The classical systems, Formulation of Quantum Statistics, Ideal Bose Systems, Ideal Fermions systems, The statistics of Para magnetism (Pauli), The statistics of diamagnetism(Landau), The statistical mechanics of reaction systems.	03		**Prerequisite** -----------------
Advanced Quantum Mechanics **0302751**	Matrix representations of operators, Schrödinger's equations for central field, Angular momentum, Time-independent perturbation theory, Time-dependent perturbation theory	03		**Prerequisite** -----------------
Atomic and molecular physics **0302752**	Spectra of hydrogen atom and spectra of hydrogen-like ions, spectrum of atoms with More Than One Electron, theory of atomic structure, angular momentum, Spectra of Polyatomic Molecules , Zeeman phenomenon, Paschen-Bach effect, wave function of atoms and molecules and energy calculation, Pauli principle, Spin-Orbit Coupling and Fine Structure, phenomenon Stark, Relativistic Corrections, Molecular Spectroscopy, Oscillation and Spin of Diatomic Molecules, Oscillation of Polyatomic Molecules	03		**Prerequisite** -----------------
Quantum Field Theory 0302753	Classical field theory. Relative fields; symmetric bosons and quantum fields; The Klein–Gordon equation and relative causality. Quantum electromagnetic fields and photons. Fermionic fields: Lorentz symmetry and rotating fields; Dirac equation and its solutions; Second quantization of fermions and particle-gap formulation; Dirac quantum field; Weil and Majorana fields. Symmetries in QFT: continuous symmetries and conserved currents; Spontaneous symmetry breaking and Goldstone bosons; Local symmetry and QED;	03		**Prerequisite** -----------------

Medical Physics **0302760**	Imaging standards, ionizing radiation and radiation safety, radioactivity, radiotherapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.	03		**Prerequisite** -----------------
Advanced Solid State Physics **0302771**	Crystal structure, reciprocal lattice vectors, symmetry and fundamental types of lattice, Brillouin Zone, Miller indices, Determination of crystal structure by using XRD-diffraction, Thermodynamics properties for Fermions and Bosons due to weak interaction, Nearly free electron model, wave function of electron in periodic potential, Bloch theory, construction of Fermi surfaces, Spin-angular coupling , Tight binding method of energy bands.	03		**Prerequisite** -----------------
Material Physics **0302772**	Crystal structures, optical properties of organic and inorganic compounds, effect of heat and external electric field frequency on the electrical conductivity properties of organic and inorganic materials, training in the use of X-ray diffraction, topographic surface imaging and infrared spectroscopic analysis to know the composition of the material, mechanical properties of the material such as stress and ductility Using computer simulation in studying the composition of matter, studying some applications such as photovoltaic rectifier, types of transistors and solar cells.	03		**Prerequisite** -----------------
Semiconductor Physics **0302773**	The p-n Junction Diode, The Bipolar Transistor, Fundamentals of the Metal-Oxide-Semiconductor Field-Effect Transistor, The Schottky Barrier Diode, Metal-Insulator-Semiconductor Contacts, Metal-Insulator-Semiconductor Ohmic Contacts, The Basic MOSFET Operation, Channel Length Modulation, Photodetectors: illumination and Conversion efficiency , p-n photodiode, Thin films, Potential well, Light Emitting Diodes, Laser physics for semiconductor.	03		**Prerequisite** -----------------
Advance Nuclear Physics **0302781**	Nuclear structure, Nuclear properties, Nuclear forces, Nuclear Models, Ground-state properties of nuclei: the shell model, The magnetic dipole moment of the nucleus, The electric quadrupole moment of the nucleus, Electron scattering by the nuclear charge distribution, Fermi gas model, Radiation activity: Radioactive decay, Alpha decay,	03		**Prerequisite** -----------------

	Beta Decay, Fermi theory, The reaction of the radiation of the with matter(alpha, Beta, Gama), Nuclear energy and the stability of nuclear, Fusion and Fission reactions.			
Radiation Physics 0302782	Study of the basic mathematical and physics principles necessary to understand the interaction of matter with radiation, study of basic quantities and units used in radiation physics, study of applications in the field of radiation protection and calculation of radiation doses, examples of chemical and biological effects of radiation, gap theory in radiation protection, Spectra processing devices and methods for their measurement	03		**Prerequisite** -----------------
Elementary Particles Physics 0302783	Historical introduction to elementary particles, elementary particle dynamics, relativistic kinematics, symmetries, bound states, Feynman diagrams, quantum electrodynamics, electrodynamics of quarks and hadrons, quantum dynamics, weak interactions, gauge theories. (GAUGES)	03		**Prerequisite** -----------------
Methods Of Experimental Physics 0302790	A review of the most important techniques used in research experiments that are consistent with experimental research topics that are of interest to the Department of Physics and are consistent with the master's program, skills used in analyzing practical results for topics in semiconductor physics, methods of writing practical scientific research.	03		**Prerequisite** -----------------
Methodology Of Research In Physics 0302791	Interpretation and prediction: interpretation and expression of observations, induction and statistical and logical possibilities, experimental method: steps of the experimental method, set of concepts in science, measurement and quantitative concepts, extended quantities, time and length, derived quantities and quantitative language, structure of space, place in relativity, determinism and freedom Will, theories, non-empirical laws, derivation of empirical laws from theoretical laws, analytical in the language of observation and the language of theory, non-probability in quantum physics	03		**Prerequisite**

Special Topics In Physics		03		**Prerequisite**

0302793	This course is formulated based on the knowledge needs of the current theoretical and experimental research projects in the physics department			-----------------
Comprehensive Exam				
0302798				
Thesis (in progress)		00		**Prerequisite**
0302000				-----------------
Thesis		09		**Prerequisite**
0302799				-----------------