School	
Major	Bachelor of Science in Physics

Major Requirements			
Code	**Title**	**Credits**	**Description**
PHYS430	Thermal Physics I	3	The thermal Physics-I course provides in-depth knowledge of thermodynamics from the macroscopic point of view. Students should be familiar with phase diagrams, kinetic theory, laws of thermodynamics, enthalpy, entropy, cycles, diagrams, chemical potential, and Maxwell equations. Finally, a bridge should be established to relate thermodynamics to statistical mechanics through entropy, and later on by Boltzmann equation in thermal physics-II.
PHYS450	Solid State Physics	3	This course aims to introduce the topic of solid state physics at elementary level in one semester. The course includes an introduction to crystal structure in 2D and 3D Bravais Lattice, and the determination of crystal structure by using x-ray diffraction and Bragg law and VanLaue formulation in the analysis. In addition, it covers the phono dynamics as elastic waves in crystal vibration of monoatomic and diatomic crystals, the modulation of the heat capacity of solid using Einstein and Debye's model, and the modulation of thermal expansion and thermal conductivity. Lastly, at the end of semester a brief description of the free electron theory of Fermi Gas in solid is given with modulation of the electron heat capacity, electrical and thermal conductivity of metals.
PHYS420	Quantum Mechanics	3	This is an introductory course in quantum mechanics. It covers topics related to the basic principles of quantum mechanics such as: - The wave function: Schrodinger equation, statistical interpretation, probability, normalization, momentum, uncertainty principle. - Time-Independent Schrodinger Equation: Stationary States, Infinite square well, Harmonic oscillator, Free particle, Delta function potential, finite square well - The mathematical formalism of quantum mechanics: Hilbert space, Observables, Eigenfunctions of a Hermitian operator, generalized statistical interpretation, Dirac notation.
PHYS490	Physics Seminar	1	This is a one credit course, designed to help Physics students become independent learners.
PHYS380	Electromagnetic Fields and Waves II	3	Electromagnetism has been studied for the past century and is nowadays at the heart of the modern technology. This course divided into three chapters is an introduction to electromagnetism. The topics deal with magnetostatics, magnetism in matter and electrodynamics.
PHYS360	Analytical Mechanics	3	This course aims to provide students with further insight into the principles and behaviour of mechanical systems. We will start with a brief overview of Newtonian Mechanics; followed by a detailed discussion of oscillations. Then we move on to introduce the Lagrangian and Hamiltonian approaches. Central force motion is then analysed using both the Newtonian and the Lagrangian approaches. Finally, motion in non-inertial systems, and coupled oscillators are briefly analysed.
PHYS350L	Physical Optics Lab	1	The course is designed to make the student familiar with both historically important optical experiments and modern optical instruments and methods. This course presents several laws for the students to apply, such as reflection, refraction, mirrors, total internal reflection, formation of images, and simple optical instruments, in addition to physical (wave) optics, including diffraction, interference, polarization, and interferometry.
PHYS350	Physical Optics	3	Optical physics is an introduction to optical science. Topics include geometrical optics, aberration, image formation with lenses and mirrors, wave optics: basic electromagnetism, interference, and Fraunhofer diffraction.

PHYS340L	Atomic Physics Lab	1	This lab will provide students with hands-on experience with some of the experimental foundations of modern physics while also deepening their understanding of the relationships between experiment and theory, primarily in atomic physics. The topics covered are the hydrogen atom spectrum, the dual nature of light and particles, electron absorption, and transition energies between various electronic states of an atom or molecule.
PHYS340	Modern Physics	3	The course aims to demonstrate knowledge of fundamental concepts in modern physics including special relativity and quantum mechanics and will be able to apply this knowledge to solve problems. The topics covered are special theory of relativity, quantum theories of light, particle nature of matter, matter waves, quantum mechanics in one dimension and tunneling phenomena.
PHYS300	Mathematical Physics	3	This course aims to introduce students to mathematical techniques and formalisms used in various branches of physics. It starts with a detailed discussion of vector calculus, including the applications of divergence and Stokes theorems. Then vector spaces are discussed in brief, with an introduction to Hilbert space. The matrix analysis and it applications in physics is introduced. A brief introduction to complex numbers and analysis is then introduced, with the calculus of residues being postponed to the end. Dirac delta function is described in details with applications to various topics in physics. Fourier series and transforms are then studied, followed by some techniques in the solution of partial differential equations.
PHYS470	Advanced Quantum Mechanics	3	This is the second part of an introductory course in quantum mechanics. It covers topics related to the basic principles of quantum mechanics such as: - The mathematical structure of quantum mechanics. - Time-independent Schrödinger equation in three dimensions - The Hydrogen atom - The angular momentum and spin - Identical particles
PHYS480	Thermal Physics II	3	The Thermal Physics-II course is a complement of Thermal Physics-I, coupled with statistical mechanics. Topics include distribution functions, Maxwell Boltzmann, Fermi-Dirac, Bose-Einstein statistics, black-body radiation, partition function, canonical and microcanonical ensembles, and applications.

General Education Requirements

Code	Title	Credits	Description
ENGL251	Communication Skills	3	Workplace Occupational Writing is an advanced interdisciplinary writing course emphasizing workplace and technical communication and editing appropriate to diverse professions. It incorporates practice and study of selected types of discourse employed in professional writing situations, preparing students for different systems of writing in their professional lives. Examples from the writing of workplace professionals are analyzed and used as models to demonstrate the transition from academic to professional writing.
ENGL201	Composition and Research Skills	3	This course builds upon the skills acquired in pre-requisite courses mainly ENGL 151 to further develop students' critical thinking and academic writing competencies. Students will read and respond to a variety of texts from different disciplines and produce a research paper using analytical and critical skills in response to texts.

CULT200	Introduction to Arab - Islamic Civilization	3	ØªÙÙØ«ÙÙ Ø§ÙØØ¶Ø§Ø±Ø© Ø§ÙØ¹Ø±Ø¨ÙØ© Ø§ÙØ¥Ø³ÙØ§ÙÙØ© ÙØ§ØØ¯Ø© ÙÙ Ø£ÙÙ Ø§ÙØØ¶Ø§Ø±Ø§Øª ÙÙ Ø§ÙØªØ§Ø±ÙØ® Ø¨ÙØ§ Ø£ÙØ¬Ø²ØªÙ ÙÙ Ø¥Ø¨Ø¯Ø§Ø¹Ø§Øª Ø¹ÙÙÙÙØ© ÙØ«ÙØ§ÙÙØ© ÙØØ¶Ø§Ø±ÙØ© ØªØ±ÙØª Ø£Ø«Ø±ÙØ§ Ø§ÙØ¹Ø¸ÙÙ ÙÙ ØªØ§Ø±ÙØ® Ø§ÙØ¨Ø´Ø±ÙØ©. ØªÙØ´ÙÙÙ ÙØ°Ù Ø§ÙÙØ§Ø¯Ø© Ø§ÙØ¯Ø±Ø§Ø³ÙØ© ÙÙØ¯ÙØ©Ù Ø£Ø³Ø§Ø³ÙØ© ÙÙØªØ¹Ø±Ù ÙÙÙ Ø¹Ø±Ø¨Ù Ø¹ÙÙÙ ØªØ§Ø±ÙØ® ØØ¶Ø§Ø±ØªÙØ ÙØ§ ÙÙÙÙØªØ®Ø± Ø¨ÙØ§ ÙØØ³Ø¨Ø Ø¨ÙÙ ÙÙÙØ¬Ø¹Ù ÙÙÙÙÙØ§ ØØ§ÙØ²ÙØ§ ÙØ³ØªÙÙØ¶ Ø¨ÙÙ ÙØ§Ø¨ÙÙÙÙØ§ØªÙ ÙÙÙØ¯Ø±Ø§ØªÙ Ø§ÙØ¹ÙÙÙØ© Ø§ÙÙØ§ÙÙØ© ÙØ¥Ø¹Ø§Ø¯Ø© Ø§ÙØ§Ø³ØªÙÙØ§Ø¶ Ø§ÙØØ¶Ø§Ø±Ù. ÙØªØØ±Ù Ø§ÙÙØ§Ø¶Ù ÙÙÙÙØ§ Ø¯ÙÙ Ø´Ø¹ÙØ±Ù ÙØ§Ø¹Ù ÙÙÙÙØ§Ø Ø¹ÙÙ Ø£ÙÙ ÙØ°Ø§ Ø§ÙÙÙÙÙØ±ÙØ± Ø§ÙØ¯Ø±Ø§Ø³Ù ÙØØ§ÙÙÙ Ø£ÙÙÙ ÙØ³ØªØ«ÙØ± Ø§ÙÙÙØ¹Ù Ø§ÙØØ¶Ø§Ø±Ù ÙØ§ÙØ«ÙØ§ÙÙ Ø¹ÙØ¯ Ø§ÙØ·ÙØ§Ø¨ Ø§ÙØ¹Ø±Ø¨Ø ÙÙÙØ³ØªÙÙØ¯ ÙÙÙ ÙØ°Ø§ Ø§ÙÙØ®Ø²ÙÙ ÙÙÙØµÙÙØ¹ Ø£ÙÙÙÙÙØ§ Ø¬Ø¯ÙØ¯ÙØ§ ÙÙÙÙØ³ØªÙØ¨Ù.
CSCI200	Introduction to Computers	3	The course aims at making students competent in computer-related skills. It is supposed to develop basic computer interface knowledge by providing an overview of managing folders and files, opening a start menu, and hands-on practice on typical software applications such as Word, Excel, and PowerPoint. The student will learn how to use the new features of Microsoft Office 2017, mainly Word documents, Excel spreadsheets, and PowerPoint presentations. Moreover, the course aligns with the Cisco Networking AcademyÂ® Get Connected course, which helps students understand how to connect to the Internet.
ARAB200	Arabic Language and Literature	3	ØªØªØ£ÙÙ ÙØ§Ø¯Ø© Ø§ÙÙØºØ© Ø§ÙØ¹Ø±Ø¨ÙØ© ÙØ¢Ø¯Ø§Ø¨ÙØ§ ÙØºÙØ± Ø§ÙÙØªØ®ØµØµÙÙ ÙÙ Ø«ÙØ§Ø«Ø© Ø£ÙØ³Ø§ÙØ Ø£ØØ¯ÙØ§ ÙØªÙØ§ÙÙ Ø¯Ø±ÙØ³Ø§Ù Ø£Ø³Ø§Ø³ÙØ© ÙÙ Ø§ÙÙØÙ ÙØ§ÙØµØ±Ù ÙØ§ÙØ¨ÙØ§ØºØ©. ÙØ§ÙÙØ«Ø§ÙÙ ÙØªÙØ§ÙÙ ÙØ¨Ø§ØØ«Ù ÙÙ Ø§ÙØ£Ø¯Ø¨ ÙØ§ÙØªØÙÙÙ. Ø£ÙØ§ Ø§ÙÙØ³Ù Ø§ÙØ«Ø§ÙØ« ÙÙØ¹Ø§ÙØ¬ Ø¨Ø¹Ø¶ ØªÙÙÙØ§Øª Ø§ÙØªØ¹Ø¨ÙØ± ÙØ§ÙØªÙØ§ØµÙ.

Core Requirements			
Code	**Title**	**Credits**	**Description**
PHYS330	Electromagnetic Fields and Waves I	3	This course provides an overview of electromagnetic fields at the intermediate level. It provides the basic tools for finding the electric fields and electric potential due to charge distribution including the use of Gauss's law. Topics that are discussed also include: electrostatic work and energy of discrete and continuous charge distribution, electric field and potential in the presence of conductors including capacitors, finding the electric potential by solving Laplace equation and by using method of images, describing the field and potential from a single dipole, and applying it to describe the polarization vector, displacement vector, and the linear dielectric constant of dielectric materials.
PHYS250L	Thermodynamic and Waves Lab	1	The main goal of this course is to demonstrate the techniques used to carry out experimental physics related to thermodynamics and wave motion. Students will learn about Hook's law, a simple pendulum, simple harmonic motion, Archimedes' principle, the density of an unknown liquid, the viscosity of a liquid, the frequency of a tuning fork, the specific heat of metals, and the calorie equivalent.

PHYS250	Thermodynamic and Waves	3	This course is designed to provide an introduction to thermodynamics, fluids and waves. Students will familiarize themselves with the concepts of simple harmonic motion, wave motion and superposition of waves. Then, both fluid statics and fluid dynamics will be discussed. In the last part on thermodynamics, the notions of temperature, heat and calorimetry will be introduced followed by the ideal gas law.
PHYS280L	Electricity and Magnetism Lab	1	To provide an overview of electromagnetism, students will familiarize themselves with the concepts of electrical fields, the electric field of continuous charge distribution, Gauss Law, electrical potential difference, electrical potential energy, capacitance and dielectrics, current, resistance, Kirchhoff's laws, magnetic fields, Ampere's Law, sources of magnetic fields, Faraday's law, and inductance.
MATH375	Numerical Methods for Scientists & Engineers	3	This course is a study of mathematical techniques used to find numerical solutions to the mathematically formulated problems that do not have exact analytical solutions. This course includes the following computational techniques: root-finding techniques, interpolation and polynomial approximation, numerical differentiation and integration, extrapolation techniques and numerical schemes for solving initial-value problems for first and higher order ordinary differential equations. In computer practical, laboratory sessions involve the implementation of the above numerical methods in practice using MATLAB.
PHYS280	Electricity and Magnetism	3	This course provides an overview of electromagnetism. Students will familiarize themselves with the concepts of electrical fields, Gauss Law, electrical potential difference, electrical potential energy, current, Kirchhoff's laws, DC circuits, magnetic fields, Ampere's Law, Faraday's law. Finally, all topics studied will be summarized by Maxwell's equations. Modern applications of the material will be discussed, and important problem solving strategies and skills will be developed.
PHYS210	Mechanics	3	The scope of this course is to provide a basic understanding of mechanics for science students. I offer an introduction to linear motion in one and two dimensions, laws of motion, work and energy of a system, linear and angular momentum, and circular angular motion.
MATH270	Ordinary Differential Equations	3	This course provides an introduction to ordinary differential equations and their applications. The contents of this course include first order equations, separable, exact, and linear equations, second and higher order differential equations, systems of differential equations, series solutions, and Laplace transformation.
MATH225	Linear Algebra with Applications	3	This course provides an introduction to linear algebra topics. Emphasis is placed on the development of abstract concepts and applications for vectors, systems of equations, matrices, determinants, vector spaces, multi-dimensional linear transformations, eigenvectors, eigenvalues, diagonalization and orthogonality. The concepts of linear algebra are extremely useful in physics, economics and social sciences, natural sciences, and engineering.
MATH220	Calculus III	3	The course consists of two parts: Multivariable calculus and vector calculus. The multivariable calculus is the extension of calculus in one variable to calculus in more than one variable: (quadric surfaces, partial differentiation, multiple integration). Vector calculus applies calculus to the concept of vector fields.
CSCI250	Introduction to Programming	3	This course introduces the basic concepts and principles of structured programming in Java. It starts with an introduction to Java showing its syntax and the structure of a program in Java then teaches simple data types, control structures, methods, arrays, and strings.

CSCI250L	Introduction to Programming Lab	1	This course is a co-requisite for the Introduction to Programming course (CSCI250). The students apply in the lab the fundamentals of programming explained in CSCI250 by solving lab exercises. In this lab, students solve programming problems by using primary data types, selection and repetition structures, methods and arrays. This lab is an opportunity for the students to have direct help when needed from the instructor, but it is not sufficient for practice; students should practice with more exercises on their own.
CHEM200	General Chemistry	3	This course is a first semester course, intended for students who desire to acquire the basic principles in chemistry. The emphasis of the course will be on the fundamental principles of general chemistry, which include terminology, qualitative concepts and quantitative skills. The general topics included in this course are: Quantum Theory of the Atom; Electrons and Periodicity; Bonding; Molecular Geometry; Hybridization; Acid/base Chemistry; Kinetics and reactions mechanism and Solubility and Complex ion equilibria.
MATH210	Calculus II	3	This is the second course in the Calculus sequence. The course material includes logarithmic, exponential, and trigonometric functions, their inverses and their derivatives, integration techniques, improper integrals, sequences, infinite series, tests of convergence, alternating series, power series, polar coordinates and its application.
MATH305	Programming Languages for Scientist	3	This course on scientific programming has been designed to introduce the students to the world of numerical implementation using the programming Languages MATLAB.