

Department of Physics

Chairperson:	Isber, Samih T.
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Associate Professors:	Antar, Ghassan Y.; Christidis, Theodore C.
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Lecturers:	^P Bodakian, Berjouhi H.; ^P Ghamlouche, Hasan J.; ^P Roumieh, Mohammad A.; ^P Said, Aurore J.

BS in Physics

Mission Statement

The program leading to the Bachelor of Science emphasizes the fundamental concepts and principles of physics and their roles in a variety of disciplines, in a liberal arts setting. The educational focus of the Physics Department is to provide the students with high quality instruction in theoretical and experimental Physics. Consequently, theoretical courses, together with computer modeling experience and a comprehensive set of laboratory experiments, introduce the students to various methods of inquiry and research in physics. The emphasis is not only on subject instruction, but also on the development of communication and teamwork skills, as well as critical and analytical thinking. The program is designed to graduate well-rounded, free-thinking individuals with inquisitive minds who are well prepared for further study in basic and applied research and are capable of pursuing professional careers in a variety of diverse fields.

The Department of Physics offers courses at the undergraduate level leading to a bachelor's degree in physics.

The requirements for a BS in Physics are 90 credits for students entering at the sophomore level. The distributions of these courses are as follows:

Department Requirements

- 36 credits in Natural Sciences (24 credits required Physics courses; 6 credits elective Physics courses; 6 credits required Physics Lab courses).
37 credits if PHYS 228 is chosen as an elective.
- 12 credits in Quantitative Thought (9 credits in Math; 3 credits in CMPS 200 or EECE 230).
- 15 credits in free electives.

- PHYS 103** **Physics for the Life Sciences** **3.0; 3 cr.**
Units and dimensions, scalars and vectors, kinematics in one and two dimensions, dynamics, work and energy, collisions, gravitation, and rotational motion. *Each semester. Students shall receive credit for only one of PHYS 101 or PHYS 103.*
- PHYS 200** **Understanding the Universe** **3.0; 3 cr.**
An introductory course in astronomy. Basic astronomical tools, properties of the earth, solar system, sun, electromagnetic radiation, properties and evolution of stars, and the Milky Way galaxy. *Annually. Students cannot receive credit for PHYS 200 and PHYS 204 or 205 or 210 or 211 or 212.*
- PHYS 204** **Classical Physics for Life Sciences** **3.0; 3 cr.**
Fluids, heat and heat engines, gas dynamics, wave phenomena, and sound and light. *Prerequisite: PHYS 103 (or equivalent). Annually.*
- PHYS 204L** **Classical Physics for Life Sciences Laboratory** **0.2; 1 cr.**
Techniques of laboratory work, surface tension, coefficient of viscosity, gas thermometer, Boyle's law, adiabatic compression of gases, mechanical equivalent of heat, waves on a stretched string, standing waves in air columns, geometrical optics I: reflection and refraction, geometrical optics II: mirrors and lenses, Michelson interferometer, and interference and diffraction. *Pre- or co-requisite: PHYS 204. Annually.*
- PHYS 205** **Modern Physics for Life Sciences** **3.0; 3 cr.**
Electricity: electric field and electric potential, electric current and circuits, and capacitance. Magnetism: magnetic field, magnetic materials, electromagnetic induction, electromagnetism applied to biological systems, introduction to special relativity, atoms and atomic structure, nuclei, and radioactivity. *Prerequisite: PHYS 103 (or equivalent). Annually.*
- PHYS 205L** **Modern Physics for Life Sciences Laboratory** **0.2; 1 cr.**
Electric field mapping, capacitance and dielectric constants, basic oscilloscope operations, Wheatstone bridge, RC and RL circuits, measurements of magnetic induction fields, measurement of the charge to mass ratio of electrons, RC and RLC-circuits, Ohm's law, Planck's constant, atomic spectroscopy, and classical scattering. *Pre- or co-requisite: PHYS 205. Annually.*
- PHYS 210** **Introductory Physics II** **3.1; 3 cr.**
Review of classical mechanics, fluid statics, fluid dynamics, temperature, heat and first law of thermodynamics, kinetic theory of gases, heat engines, entropy and second law of thermodynamics, general properties of waves, sound waves and resonances, light and optics, interference, diffraction, and polarization. *Pre- or co-requisite: MATH 201. Each semester.*
- PHYS 210L** **Introductory Physics Laboratory II** **0.2; 1 cr.**
Surface tension, gas thermometer, mechanical equivalent of heat, Boyle's law, adiabatic compression of gases, measurement of gamma for air and fluid gas, standing waves on a stretched string, standing waves in air columns, geometrical optics: law of refraction and prism, mirrors and lenses, interference and diffraction, the spectrometer, and polarization. *Pre- or co-requisite: PHYS 210. Each semester.*
- PHYS 211** **Electricity and Magnetism** **3.0; 3 cr.**
Electrostatics, current, resistance, Ohm's law, Kirchhoff's laws, RC circuits, magnetostatic theory, Ampere's law, Biot-Savart law, Faraday's law, LR circuit, RLC circuits, and a qualitative discussion of Maxwell's equations. *Pre- or co-requisite: MATH 201. Each semester.*
- PHYS 211L** **Electricity and Magnetism Laboratory** **0.2; 1 cr.**
Electric fields, capacitance and dielectric constant measurements, construction and calibration of ammeter and a voltmeter, electrical circuits, Wheatstone bridge, potentiometer, Thomson's experiment, measurement of the force between two parallel current-carrying conductors, measurement of magnetic induction fields, basic oscilloscope operations, RL, RC, and RLC circuits. *Pre- or co-requisite: PHYS 211. Each semester.*

- PHYS 212** **Modern Physics** **3.0; 3 cr.**
Special theory of relativity, introductory quantum mechanics, atomic physics, nuclear physics, and introduction to elementary particles and cosmology. *Pre- or co-requisite: MATH 201. Each semester. Students cannot receive credit for both PHYS 212 and CHEM 218.*
- PHYS 217** **Mechanics** **3.0; 3 cr.**
Kinematics of particles motion, Newtonian formulation of mechanics, integration of Newtonian equations of motion, Lagrangian formulation of mechanics, Hamilton dynamics, central forces, linear oscillations, nonlinear oscillations and chaos, collisions, noninertial systems, coupled oscillations, and motion of rigid bodies. *Prerequisite: MATH 202. Annually.*
- PHYS 220** **Electromagnetic Theory** **3.0; 3 cr.**
Electrostatics: electric potential, Gauss' law, Poisson's and Laplace's equations, boundary conditions, electric currents, Faraday's law, Lenz's law, mutual inductance. Maxwell's equations, and propagation of electromagnetic waves. *Prerequisite: MATH 202. Annually.*
- PHYS 221L** **Junior Laboratory** **0.4; 2 cr.**
A course of experiments selected from the topics of diffraction, e/m ratio, magnetic field, RL, RC, RLC circuits, ohmic and non-ohmic devices, atomic spectroscopy, Milikan's experiment, Frank-Hertz experiment, speed of sound, gravitational acceleration, Planck's constant, and physical optics. *Prerequisite: Junior standing. Annually.*
- PHYS 222** **Computational Physics** **0.3; 3 cr.**
Basics of numerical analysis: quadrature, solutions of algebraic and transcendental equations, methods for solving systems of linear equations, methods for solving differential equation, and scholastic methods. Applications: planetary motion, simple models of stars, nonlinear dynamics and chaos, potentials and fields, waves, random systems, computational fluid dynamics, statistical mechanics (phase transitions, Ising model), molecular dynamics, and quantum mechanics. *Prerequisites: MATH 201 and MATH 202. Annually.*
- PHYS 223** **Physical Optics** **3.0; 3 cr.**
Wave theory of light, Maxwell's equations, superposition and polarization, interference, interferometers, diffraction, coherence, lasers, and holography. *Annually.*
- PHYS 225** **Introduction to Astronomy and Astrophysics** **3.0; 3 cr.**
Observation and instruments, photometry and magnitudes, radiation mechanisms, celestial mechanics, stellar spectra and structure, stellar evolution, Milky Way, galaxies, cosmology. *Pre or co-requisites: MATH 201, MATH 202, and PHYS 210. Annually.*
- PHYS 226** **Solid State Physics** **3.0; 3 cr.**
Electrons in one-dimensional periodic lattice, vibrations in one-dimensional periodic lattice, geometrical description of crystals, free-electron theory in metals, excitons, plasmons, polarons, lattice dynamics, semi-conductors, magnetic ordering, superconductivity, and electron gas in a magnetic field. *Prerequisites: PHYS 235 and PHYS 236. Annually.*
- PHYS 228** **Electronics** **3.0; 3 cr.**
DC linear circuits, capacitors, inductors and transients, periodic waveforms, diodes, power supplies, operational amplifier, logic gates, timers, multiplexers, flip-flops, and counting circuits. *Annually. Fall semester. Students may not get credit for this course unless they pass PHYS 228L.*
- PHYS 228L** **Electronics Laboratory** **0.3; 1 cr.**
DC measurements, periodic waveforms, power supplies, transients, frequency and period measurements, operational amplifiers, and some digital circuits. *Pre- or co-requisite: PHYS 228. Each semester.*

36 Credits in Physics

Modes of Analysis	English and Arabic (9)	Humanities (12)	Social Sciences (6)	Natural Sciences (36)	Quantitative Thought (12)
LectureCourses (9+12+6+30 +12)	<ol style="list-style-type: none"> Required Arabic courses: ARAB 201A or any General Education Arabic communication skills (3) Required English courses (6): ENGL 203(3), 204(3) 	Required credits in the humanities: 12 credits including 6 credits from CVSP (see CVSP requirements under Civilization Sequence Program)	Two courses: The Department recommends that at least one of them is a level-200 Economics course	<ol style="list-style-type: none"> Required physics courses (24): PHYS 210(3), 212(3), 217(3), 220(3), 222(3), 226(3), 235(3), 236(3) Two elective physics courses (6): PHYS 228 + 228L (3+1)¹, 223(3), 231(3), 232(3), 249(3), or other selected topics in physics One natural science must be an approved General Education course from outside the major 	Required mathematics and technology courses (12 or 13): MATH 201(3), 202(3), 212(3), CMPS 200(3), or EECE 230(3)
Seminar (1)				PHYS 248(1)	
Laboratory (6)				Required Physics Labs: PHYS 210L(1), 221L(2), 257L(3)	
Research Project				The following courses may include a research project: PHYS 222, 226, 231, 232, 235, 236, 249	

¹ Students may not get credit for this course unless they pass PHYS 228L