

PHYS - PHYSICS (PHYS)

PHYS 101 Freshman Physics Orientation

Credit 1. 1 Lecture Hour. Critical thinking skills and problem solving in physics: time management and teaming skills. **Prerequisite:** Physics majors; non-majors requires approval of instructor.

PHYS 102 Freshman Physics Orientation II

Credit 1. 1 Lecture Hour. Critical thinking skills and problem solving in physics: time management and teaming skills. For physics majors. Registration by non-majors requires approval of instructor.

PHYS 104 Contemporary Issues in Science - Cosmos, Earth and Humanity

Credits 3. 3 Lecture Hours. Science for citizens; interdisciplinary survey of contemporary issues in the science of our universe or cosmos, Earth and humanity, including the big bang, evolution, genetics, vaccines and drugs; future outlook on humanity, including artificial intelligence, cryptography and cybersecurity; critically analyze science presented in the news, on television and on social media; ethical implications of research. **Cross Listing:** ARSC 104 and BIOL 104.

PHYS 109/ASTR 109 Big Bang and Black Holes

Credits 3. 3 Lecture Hours. Designed to give an intuitive understanding of the Big Bang and Black Holes, without mathematics, and de-mystify them for the non-scientist. **Cross Listing:** ASTR 109/PHYS 109.

PHYS 119/ASTR 119 Big Bang and Black Holes: Laboratory Methods

Credit 1. 2 Lab Hours. Hands-on understanding of the concepts surrounding the Big Bang and Black Holes; emphasis on the evidence-based decision making process, methods and presentation; for non-scientists. Companion course for ASTR 109/PHYS 109/PHYS 109/ASTR 109. **Prerequisite:** ASTR/PHYS 109/ASTR 109 or registration therein. **Cross Listing:** ASTR 119/PHYS 119.

PHYS 123 Physics for Future Presidents

Credits 3. 3 Lecture Hours. Physics needed to be an effective policy maker or world leader but appropriate for any citizen, since all citizens need to understand the world in which they live and work; fundamental principles of physics made comprehensible and usable by those not in science- or math-related fields. **Prerequisite:** Basic math skills; also taught at Galveston campus.

PHYS 125 Soft Matter Physics for Non-physicists

Credits 3. 2 Lecture Hours. 2 Lab Hours. Modern physics in action with hands-on physics experience in simple experiments for non-physics majors; introduction to thermodynamics and soft matter physics; heat, temperature, thermodynamic efficiency, phase transitions, mechanical properties of soft matter, heat transfer mechanisms; physical measurements.

PHYS 148 Introduction to Quantum Mechanics

Credits 3. 3 Lecture Hours. The basic level of concepts of quantum mechanics such as wave-particle duality, complementarity, quantum interference and entanglement, and their applications to fields such as quantum communication and quantum computing. **Prerequisites:** High school physics and calculus.

PHYS 150 Introduction for Programming for Physics

Credits 3. 3 Lecture Hours. Physics-oriented introductory programming; basics of programming and applications of programming for physics; programming in the context of physics, such as variables, expressions, flow control, functions and data visualization, applied to physics topics such as energy minimization, Newtonian dynamics and chaos.

PHYS 201 College Physics

Credits 4. 3 Lecture Hours. 3 Lab Hours. (PHYS 1301 and 1101, 1401) College Physics. Fundamentals of classical mechanics, heat, and sound. Primarily for architecture, education, premedical, pre dental, and preveterinary medical students; also taught at Galveston campus.

PHYS 202 College Physics

Credits 4. 3 Lecture Hours. 3 Lab Hours. (PHYS 1302 and 1102, 1402) College Physics. Continuation of PHYS 201. Fundamentals of classical electricity and light; introduction to contemporary physics. **Prerequisite:** PHYS 201; also taught at Galveston campus.

PHYS 205 Concepts of Physics

Credits 4. 3 Lecture Hours. 3 Lab Hours. General survey physics course for K-8 preservice teachers integrating physics content and laboratory activities relevant to physics-related subject matter included in the current Texas and national standards for elementary school science; includes aspects of mechanics, waves, electricity, magnetism and modern physics. **Prerequisite:** Major in interdisciplinary studies or interdisciplinary technology or approval of instructor.

PHYS 206 Newtonian Mechanics for Engineering and Science

Credits 3. 3 Lecture Hours. (PHYS 2325, PHYS 2425*) Newtonian Mechanics for Engineering and Science. Calculus-based introductory Newtonian mechanics; laws of physical motion for solution of science and engineering problems. **Prerequisites:** Grade of C or better in MATH 151 or MATH 171, or equivalent; also taught at Galveston and Qatar campuses.

PHYS 207 Electricity and Magnetism for Engineering and Science

Credits 3. 3 Lecture Hours. (PHYS 2326, PHYS 2426*) Electricity and Magnetism for Engineering and Science. Calculus-based electricity and magnetism; electromagnetic phenomena; basic laws of electricity and magnetism; science and engineering problems involving charges, electromagnetic fields, and electrical circuits. **Prerequisites:** Grade of C or better in PHYS 206; grade of C or better in MATH 152 or MATH 172 or equivalent; also taught at Galveston and Qatar campuses.

PHYS 216/ENGR 216 Experimental Physics and Engineering Lab II - Mechanics

Credits 2. 1 Lecture Hour. 3 Lab Hours. Description and application of laws of physical motion to the solution of science and engineering problems; using sensing, control and actuation for experimental verification of physics concepts while solving engineering problems. **Prerequisites:** Grade of C or better in MATH 151 or MATH 171 or equivalent; grade of C or better in ENGR 102; grade of C or better and concurrent enrollment in PHYS 206; also taught at Galveston campus. **Cross Listing:** ENGR 216/PHYS 216.

PHYS 217/ENGR 217 Experimental Physics and Engineering Lab III - Electricity and Magnetism

Credits 2. 1 Lecture Hour. 3 Lab Hours. Electromagnetism and electromechanical systems; use of sensing, control and actuation to demonstrate key physical relationships through the transducer relationships linking pressure, temperature and other physical stimuli to changes in electric and magnetic fields. **Prerequisites:** Grade of C or better in MATH 152 or MATH 172, or equivalent; grade of C or better in PHYS 206 or equivalent; grade of C or better in PHYS 216/ENGR 216 or ENGR 216/PHYS 216; grade of C or better and concurrent enrollment in PHYS 207; also taught at Galveston campus. **Cross Listing:** ENGR 217/PHYS 217.

PHYS 221 Optics and Thermal Physics

Credits 3. 3 Lecture Hours. Wave motion and sound, geometrical and physical optics, kinetic theory of gases, laws of thermodynamics. **Prerequisites:** PHYS 207 or PHYS 208, or concurrent enrollment; MATH 221, MATH 251, or MATH 253, or concurrent enrollment; MATH 308 or concurrent enrollment; also taught at Qatar campus.

PHYS 222 Modern Physics for Engineers

Credits 3. 3 Lecture Hours. Atomic, quantum, relativity and solid state physics. **Prerequisites:** PHYS 207 or PHYS 208; MATH 308 or concurrent enrollment; also taught at Qatar campus.

PHYS 225 Electronic Circuits and Applications

Credits 3. 1 Lecture Hour. 4 Lab Hours. Linear circuit theory and applications of solid-state diodes, bipolar and field-effect transistors, operational amplifiers and digital systems. **Prerequisites:** PHYS 207 and PHYS 227, or PHYS 208; MATH 308.

PHYS 226 Physics of Motion Laboratory for the Sciences

Credit 1. 2 Lab Hours. (PHYS 2125, PHYS 2425*) Physics of Motion Laboratory for the Sciences. The first semester laboratory to accompany a two-semester course sequence in introductory physics; topics include material covered in a typical calculus-based introductory physics course on the principles of mechanics and motion. **Prerequisites:** MATH 151 or MATH 171; concurrent enrollment in PHYS 206; also taught at Galveston campus.

PHYS 227 Electricity and Magnetism Laboratory for the Sciences

Credit 1. 2 Lab Hours. (PHYS 2126, PHYS 2426*) Electricity and Magnetism Laboratory for the Sciences. The second semester laboratory to accompany a two-semester course sequence in introductory physics; topics include material covered in a typical calculus-based introductory physics course on the principles of electricity and magnetism. **Prerequisites:** MATH 152 or MATH 172; PHYS 206 or PHYS 218; concurrent enrollment in PHYS 207; also taught at Galveston campus.

PHYS 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Special work in laboratory or theory to meet individual requirements in cases not covered by regular curriculum; intended for use as lower-level credit. **Prerequisite:** Approval of instructor.

PHYS 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 6 Lab Hours. Selected topics in an identified area of physics. May be repeated for credit. **Prerequisite:** Approval of instructor.

PHYS 291 Research

Credits 0 to 4. 0 to 4 Other Hours. Research conducted under the direction of faculty member in physics. May be repeated 2 times for credit. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

PHYS 302 Advanced Mechanics I

Credits 3. 3 Lecture Hours. Classical mechanics of particles and rigid bodies; review of Newtonian mechanics and foundations of Lagrangian and Hamiltonian formalism. **Prerequisite:** PHYS 309 and PHYS 331; PHYS 332 or concurrent enrollment, or approval of instructor.

PHYS 303 Advanced Mechanics II

Credits 3. 3 Lecture Hours. Applications of Lagrangian and Hamiltonian methods to selected problems of classical mechanics. **Prerequisite:** PHYS 302.

PHYS 304 Advanced Electricity and Magnetism I

Credits 3. 3 Lecture Hours. Electrostatics; dielectrics; electrical current and circuits; magnetic fields and materials; induction; Maxwell's equations. **Prerequisites:** PHYS 331; PHYS 332 or concurrent enrollment, or approval of instructor.

PHYS 305 Advanced Electricity and Magnetism II

Credits 3. 3 Lecture Hours. Radiation and optics. Electromagnetic waves; radiation; reflection and refraction; interference; diffraction; special relativity applied to electrodynamics. **Prerequisite:** PHYS 304.

PHYS 309 Modern Physics

Credits 3. 3 Lecture Hours. Special relativity; concepts of waves and particles; introductory quantum mechanics. **Prerequisite:** PHYS 221; MATH 308; also taught at Qatar campus.

PHYS 327 Experimental Physics I

Credits 2. 1 Lecture Hour. 2 Lab Hours. Laboratory experiments in modern physics and physical optics with an introduction to current, state-of-the-art recording techniques. **Prerequisites:** PHYS 225; PHYS 309.

PHYS 328 Experimental Physics II

Credit 1. 1 Lecture Hour. 1 Lab Hour. Laboratory experiments in modern physics and physical optics with an introduction to current, state-of-the-art recording techniques. **Prerequisites:** PHYS 327 or concurrent enrollment.

PHYS 331 Theoretical Methods for Physicists I

Credits 3. 3 Lecture Hours. Applications involving vectors; vector and additional methods for advanced electricity and magnetism; relationship and solutions of classical wave equation, heat equation, and Schrodinger equation; harmonic motion on finite or periodic lattice and in continuum; tensor and matrix notation in classical mechanics and electricity and magnetism. **Prerequisite:** PHYS 221 and MATH 308; or approval of instructor.

PHYS 332 Theoretical Methods for Physicists II

Credits 3. 3 Lecture Hours. Methods to solve the important equations of theoretical physics, emphasizing the effects of boundary conditions and quantization on their solutions and restricted to the essential physical symmetries associated with free space, spheres, cylinders, and rectangles; if time permits, introduction to symmetries in physics and to asymptotic methods. **Prerequisites:** PHYS 331; physics majors.

PHYS 401 Computational Physics

Credits 3. 3 Lecture Hours. Introduction to computational and simulational techniques widely used in physics applications and research, including trajectory integration, wave motion analysis, molecular dynamics, Monte Carlo methods, statistical mechanics of spin systems, phase transitions, quantum evolution, bound state problems, and variational methods. **Prerequisites:** PHYS 332; knowledge of a high level language.

PHYS 408 Thermodynamics and Statistical Mechanics

Credits 4. 4 Lecture Hours. Statistical method, macroscopic thermodynamics, kinetic theory, black body radiation, Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. **Prerequisite:** PHYS 412.

PHYS 412 Quantum Mechanics I

Credits 3. 3 Lecture Hours. Postulates of wave mechanics; wave packets; harmonic oscillator; central field problem; hydrogen atom; approximation methods. **Prerequisites:** PHYS 302; PHYS 309; PHYS 332; junior or senior classification.

PHYS 414 Quantum Mechanics II

Credits 3. 3 Lecture Hours. Continuation of PHYS 412. Electron spin; addition of angular momenta; atomic structure; time dependent perturbations; collision theory; application of quantum mechanics to atomic, solid state, nuclear or high energy physics. **Prerequisite:** PHYS 412.

PHYS 415 Nuclear and Particle Physics

Credits 3. 3 Lecture Hours. Matter at the smallest scales and fundamental interactions between them; physics of atomic nuclei; physics of hadrons, quarks, leptons; fundamental strong and weak interactions; gauge bosons; state-of-the-art nuclear and particle physics; how knowledge was obtained; experimental confirmation of theoretical ideas; modern tools and instruments; foundations of nuclear technology; future perspectives. **Prerequisites:** Grade of C or better in PHYS 309.

PHYS 416 Physics of the Solid State

Credits 3. 3 Lecture Hours. A survey of solid state physics; an introduction to crystal structures and the physics of electrons, lattice vibrations and photons; applications to semiconductors; magnetism; superconductivity; physics of nanostructures; brief introduction to selected current topics in condensed matter physics. **Prerequisites:** PHYS 304 and PHYS 412.

PHYS 418 High Energy Physics

Credits 3. 3 Lecture Hours. A broad spectrum of elementary particle physics along with historical and recent publication, covering symmetry in quarks and leptons, fundamental interactions, relativistic kinematics, Feynman diagrams, Dirac equation, cross-sections for particle reactions, unification of fundamental forces, accelerators and detectors and other current topics. **Prerequisite:** Grade of C or better in PHYS 309 or equivalent.

PHYS 419 Physics of Optoelectronic Devices

Credits 3. 3 Lecture Hours. Basic concepts of light-matter interaction, optics of semiconductors, nanostructures with quantum confinement and their interaction with light; physical principles of selected state-of-the-art optoelectronic devices; emerging concepts and technologies; examples of modern, state-of-the-art devices and emerging technologies. **Prerequisites:** Grade of C or better in PHYS 309 or PHYS 222; grade of C or better in PHYS 414.

PHYS 425 Physics Laboratory

Credits 2. 6 Lab Hours. Experiments in nuclear, atomic, and molecular physics using modern instrumentation and equipment of current research. **Prerequisite:** PHYS 327 or equivalent.

PHYS 426 Physics Laboratory

Credits 2. 6 Lab Hours. Experiments in solid state and nuclear physics. Modern instrumentation and current research equipment are employed. **Prerequisite:** PHYS 327 or equivalent.

PHYS 485 Directed Studies

Credits 1 to 12. 1 to 12 Other Hours. Special work in laboratory or theory to meet individual requirements in cases not covered by regular curriculum. **Prerequisite:** Approval of instructor; also taught at Galveston campus.

PHYS 489 Special Topics in...

Credits 1 to 4. 1 to 4 Other Hours. Selected topics in an identified field of physics. May be repeated for credit. **Prerequisite:** Approval of instructor; also taught at Qatar campus.

PHYS 491 Research

Credits 0 to 4. 0 to 4 Other Hours. Research conducted under the direction of faculty member in physics. May be repeated for credit.

Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.

Prerequisites: Junior or senior classification and approval of instructor; also taught at Qatar campus.