

PHYS Physics

PHYS 1010 The Physics Of Sports

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

Fundamental concepts, laws, and theories of physics as they relate to a variety of sports, including volleyball, soccer, tennis, golf, and more. For non-science majors interested in the concepts underlying the mechanics of the skills and movements involved in a variety of physical activities. Includes in-class demonstrations and activities.

Prerequisite(s): A minimum grade of "C" in MATH 1111.

PHYS 1111K Introductory Physics I

4 Credit Hours. 0,4 Lecture Hours. 0,3 Lab Hours.

An introductory course which will include mechanics (kinematics, dynamics, work and energy, momentum and collisions, and rotational motion and statics), and may also include thermodynamics and waves. Elementary algebra and trigonometry will be used. Laboratory exercises supplement the lecture material.

Prerequisite(s): A minimum grade of "C" or better in MATH 1113 or MATH 1112.

PHYS 1112K Introductory Physics II

4 Credit Hours. 3 Lecture Hours. 3 Lab Hours.

An introductory course which will include electrostatics, electric current and circuits, and electromagnetism, and may also include optics and modern physics. Elementary algebra and trigonometry will be used. Laboratory exercises supplement the lecture material.

Prerequisite(s): A minimum grade of "C" or better in PHYS 1111K.

PHYS 1135 How Things Work

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

This is a non-mathematical course designed for liberal arts students. Fifty-one objects in our everyday world are examined to answer the question "How do they work?". As a result concepts of physics that everyone uses daily are revealed in an interesting and understandable manner.

PHYS 1149 Environmental Physics

4 Credit Hours. 0,4 Lecture Hours. 0 Lab Hours.

A general course on the physical basis of environmental science. Emphasis is placed on the identification and effective amelioration of both natural and man-made hazards to the earth's biosphere. Topics include greenhouse effects, ozone, acid rain, energy production and water disposal, radiation hazards, noise pollution and disruptive natural phenomena.

PHYS 2211K Principles of Physics I

4 Credit Hours. 3 Lecture Hours. 3 Lab Hours.

An introductory course which will include material from mechanics, thermodynamics and waves. Elementary differential calculus will be used. This course has a laboratory component that requires a lab kit.

Prerequisite(s): Prior or concurrent enrollment in MATH 1441.

PHYS 2212K Principles of Physics II

4 Credit Hours. 3 Lecture Hours. 3 Lab Hours.

An introductory course which will include electrostatics, electric current and circuits, and electromagnetism, and may also include optics and modern physics. Elementary calculus will be used. Laboratory exercises supplement the lecture material.

Prerequisite(s): A minimum grade of "C" in PHYS 2211K.

PHYS 3130 Sound Waves and Acoustics

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

A study of the production, transformation, reflection, absorption, and general effects of vibration and sound.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 3131 Optics

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

Geometric, physical, and quantum optics in which the general principles of wave optics and several optical devices are studied. Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

Cross Listing(s): ASTR 3131.

PHYS 3149 Methods of Theoretical Physics

4 Credit Hours. 0,3 Lecture Hours. 0,2 Lab Hours.

Presents a discussion of methods for solving the equations that arise in all of the major areas of physics.

Prerequisite(s): Prior or concurrent enrollment in MATH 3230 and a minimum grade of "C" in PHYS 2212K.

PHYS 3520 Problem Solving in Physics

2 Credit Hours. 2 Lecture Hours. 0 Lab Hours.

Improves the ability of Physics majors to rapidly consolidate and inter-relate knowledge of their physics courses by familiarization with the techniques of rapid characterization and solution of problems and by in-class practice of rapid problem-solving.

Prerequisite(s): PHYS 3537.

PHYS 3536 Modern Physics I

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

Historical development of modern physics including topics on special theory of relativity, early models of the atom, atomic radiations and interaction of electrons with matter.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 3537 Modern Physics II

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

A continuation of modern physics topics including atomic and molecular physics and nuclear physics.

Prerequisite(s): PHYS 3536.

PHYS 3539 Introduction to Biophysics

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

The physics of living organisms with emphasis on physical support, movement, sensory perception and the physical properties of plant and animal processors at the molecular and organismic levels of organization. Permission of instructor required.

PHYS 3542 Analog Electronics

4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.

A course in intermediate electronics with emphasis on topics of interest to students in physics. Discusses electronic instruments, transducers, diodes and power supplies. Amplifier behavior, the operational amplifier and wave shaping circuits are covered in detail. Discrete electronic devices are also discussed.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 3543 Digital Electronics

4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.

Presents the concepts and application of digital electronics. Digital logic concepts and techniques are presented. Flip-flops and counting circuits are studied extensively resulting in a discussion of digital instrument development. The principles of operation, general architecture and some applications of the microprocessor (the Intel 8085) are discussed.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 3558 Introduction to General Relativity

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

An introduction to the metric description of different spacetimes that describe flat and various curved geometries so as to derive the laws of mechanics for planets, stars, black holes, etc. The course also introduces a very simple model of the expanding universe and briefly introduces cosmology.

Prerequisite(s): PHYS 3537.

Cross Listing(s): ASTR 3558.

PHYS 3790 Teaching Internship in Physics**1-2 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

The internship allows students to investigate teaching practices in physics. The student will participate in an introductory workshop immediately prior to the start of the semester, intern in a PHYS 1113 and/or PHYS 1114 laboratory, and meet with the faculty mentor one hour each week throughout the semester. 1 credit hour per laboratory section in which the student interns.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K. Cross Listing(s): ASTR 3558.

PHYS 4131 Quantum Optics**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Involves theories related to laser spectroscopy, nonlinear optics, laser pulse propagation, laser cooling and various effects in laser spectroscopy related to quantum interference.

Prerequisite(s): A minimum grade of "C" in PHYS 3536.

PHYS 4232 Properties of Materials**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Introduction to the properties of semiconductors, magnetic materials and superconductors. Particular emphasis will be placed on semiconductors with regard to developing an understanding of light emitting diodes, diode lasers and quantum well devices.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 4332 Principles of Lasers**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

An introduction to the basic principles of laser oscillation, construction and operation of the most common laser systems, based on the rate equation and laser cavity theory. This course also provides practical experience in the use of many laser systems and in laser radiation safety.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 4421 Advanced Physics Lab I**2 Credit Hours. 0 Lecture Hours. 6 Lab Hours.**

A laboratory course where the student will learn classical laboratory techniques, computer data acquisition, statistical analysis of data and proper reporting of results.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K.

PHYS 4422 Advanced Physics Lab II**2 Credit Hours. 0 Lecture Hours. 6 Lab Hours.**

This is a laboratory course where students will learn how to critically read scientific literature, develop a research proposal, conduct experimental physics research, and present a research project.

Prerequisite(s): PHYS 4421.

PHYS 4790 Internship in Physics**1-6 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

The internship allows physics majors to work in a professional setting related to their chosen concentration. Students can earn between one and six credits for internships approved by their academic advisor and the Physics Internship Director. Students must complete a minimum of 5 hours of on-site work per week for each credit hour earned. Students must maintain contact with the Physics Internship Director through the course of the internship work, and must give an oral presentation at the end of the semester. Internship credits can be used for elective credit only and may not substitute for specific degree requirements. Requires permission of Physics Internship Director.

PHYS 5090 Selected Topics in Physics**2-5 Credit Hours. 0-5 Lecture Hours. 0-6 Lab Hours.**

A course allowing for investigation of selected topics in Physics; it will be taught on a one-time basis. Lecture only course can be for two, three, or five credit hours. For laboratory courses, one credit hour will be given for every three hours spent working in lab.

Prerequisite(s): A minimum grade of "C" in PHYS 1112K or PHYS 2212K.

Cross Listing(s): ASTR 5090, ASTR 5090G, PHYS 5090G.

PHYS 5090G Selected Topics in Physics**2-4 Credit Hours. 0-5 Lecture Hours. 0-6 Lab Hours.**

A course allowing for investigation of selected topics in Physics; it will be taught on a one-time basis. Lecture only course can be for two, three, or five credit hours. For laboratory courses, one credit hour will be given for every three hours spent working in lab. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): A minimum grade of "C" in PHYS 1112K or PHYS 2212K. Cross Listing(s): ASTR 5090, ASTR 5090G, PHYS 5090.

PHYS 5151 Classical Mechanics**5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

Provides physics majors and student of applied mathematics and engineering with the fundamentals of analytical mechanics.

Prerequisite(s): Prior or concurrent enrollment in MATH 3230 and a minimum grade of "C" in PHYS 2212K.

Cross Listing(s): PHYS 5151G.

PHYS 5151G Classical Mechanics**5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

Provides physics majors and students of applied mathematics and engineering with the fundamentals of analytical mechanics. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K and completion of MATH 3230.

Cross Listing(s): PHYS 5151.

PHYS 5152 Classical E and M Theory**5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

Provides physics majors and students of applied mathematics and engineering with the fundamentals of electromagnetic field theory.

Prerequisite(s): PHYS 5151.

Cross Listing(s): PHYS 5152G.

PHYS 5152G Classical E and M Theory**5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

Provides physics majors and students of applied mathematics and engineering with the fundamentals of electromagnetic field theory. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): Completion of PHYS 5151.

Cross Listing(s): PHYS 5152.

PHYS 5530 Thermal Physics**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course in classical thermodynamics and kinetic theory.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K; and completion of MATH 2243.

Cross Listing(s): PHYS 5530G.

PHYS 5530G Thermal Physics**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course in classical thermodynamics and kinetic theory. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): A minimum grade of "C" in PHYS 2212K and completion of MATH 2243..

Cross Listing(s): PHYS 5530.

PHYS 5536 Studies in Physics for Secondary Teachers**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Designed to acquaint the student with some of the problems encountered in high school physics presentations.

Prerequisite(s): MATH 1113.

Cross Listing(s): PHYS 5536G.

PHYS 5536G Studies in Physics for Secondary Teachers**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Designed to acquaint the student with some of the problems encountered in high school physics presentations. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): Completion of MATH 1113.**Cross Listing(s):** PHYS 5536.**PHYS 5557 Quantum Mechanics****5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

A study of the basic postulates of quantum mechanics with solutions to Schrodinger's wave equation for simple applications: the techniques of calculating position, energy and momentum with operators and the elements of perturbation theory with application to atomic spectra.

Prerequisite(s): PHYS 3536, PHYS 3537, and MATH 3230.**Cross Listing(s):** PHYS 5557G.**PHYS 5557G Quantum Mechanics****5 Credit Hours. 5 Lecture Hours. 0 Lab Hours.**

A study of the basic postulates of quantum mechanics with solutions to Schrodinger's wave equation for simple applications: the techniques of calculating position, energy and momentum with operators and the elements of perturbation theory with application to atomic spectra.

Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

Prerequisite(s): Completion of PHYS 3536, PHYS 3537, and MATH 3230.**Cross Listing(s):** PHYS 5557.**PHYS 5890 Physics Research Experience****1-4 Credit Hours. 0,3 Lecture Hours. 0 Lab Hours.**

An independent physics research experience in which a student will investigate a research question under the direction of a faculty member. Students will be expected to maintain a laboratory notebook, prepare a written summary of the research, and give an oral presentation at the end of the experience. Permission of instructor is required. **Cross Listing(s):** PHYS 5890G, ASTR 5890, ASTR 5890G.

PHYS 5890G Physics Research Experience**1-4 Credit Hours. 0-3 Lecture Hours. 0 Lab Hours.**

An independent physics research experience in which a student will investigate a research question under the direction of a faculty member. Students will be expected to maintain a laboratory notebook, prepare a written summary of the research, and give an oral presentation at the end of the experience. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Permission of instructor required.

Cross Listing(s): ASTR 5890, ASTR 5890G, PHYS 5890.**PHYS 6131 Solid State Materials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Introduction to the physical and chemical properties of solids. Topics may include: periodic structure, symmetry of crystals, diffraction, reciprocal lattice, chemical bonding, lattice dynamics, phonons, thermal properties, and free electron gas. Bloch theorem, band structure, nearly free electron approximation, tight binding method, Fermi surface, semiconductors, electrons, holes, impurities, optical properties, excitons, and magnetism will be introduced.

Prerequisite(s): A minimum grade of "C" in MATH 2242.**PHYS 6132 Applied Optics****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course offers an introduction to laboratory optics, optical principles, and optical devices and systems. The course covers a wide range of topics, including: polarization properties of light, reflection and refraction, coherence and interference, Fraunhofer and Fresnel diffraction, holography, imaging and transforming properties of lenses, spatial filtering, and two-lens coherent optical processor. In addition, this course covers: optical properties of materials, lasers, electro-optic, acousto-optic and liquid-crystal light modulators, optical detectors, optical waveguides and fiber-optic communication systems. Students engage in extensive oral and written communication exercises.

Prerequisite(s): A minimum grade of "C" in MATH 2242.**PHYS 6133 Photonics, Plasmonics and Metamaterials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

The course offers an introduction into theory and models related to photonics and electronics of photonic crystals, plasmonic metal nanostructures, metal-dielectric metamaterials and metasurfaces, localized scatterers and emitters. Students will improve their overall understanding of how these methods and models apply to practical systems related to spectroscopy, imaging, excitation and control over condensed, chemical and biological nano- and microstructures. The course covers a broad range of topics including: dielectric properties of materials in relation to their electronic structure, propagation and emission of radiation in strongly inhomogeneous and anisotropic materials, introduction into plasmonics, properties of photonic crystals and metamaterials, Mie theory of light scattering and near-fields at micro and nanoparticles, optical forces and tweezers, energy and momentum transfer in light-matter interactions and others.

PHYS 6231 Thin-Film Coating**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will cover the physics and chemistry of thin film coating. Topics covered will include thermal, optical, electric, and mechanical properties of multilayer metallic coatings and coating manufacturing techniques. Special topics will be given by experts from local coating industry.

Prerequisite(s): A minimum grade of "C" in PHYS 6237.**PHYS 6237 Applied Quantum Mechanics****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course is designed to review Schrodinger's theory of quantum mechanics for application in modern devices and systems. Topics covered are quantum statistics, multi-electron atoms, molecules, one and two dimension system, and neon particle system. Calculation techniques introduced are matrix diagonalization, perturbation theory, variational method, time-dependent perturbation theory to apply to optical absorption, and nonlinear optical properties of materials.

PHYS 6730 Master of Science in Physical Science Internship**3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course is the required internship for the Masters of Science in Physics Science degree. Students will apply their skills and knowledge to a current problem in a professional setting, either on campus or at the site of a participating sponsor.

PHYS 7090 Selected Topics in Physics**1-6 Credit Hours. 0-6 Lecture Hours. 0-6 Lab Hours.**

A course allowing for investigation of selected topics in Physics.

**PHYS 7330 Principles and Practice of Pre-clinical Drug Development
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course introduces key issues and aspects of developing a new small molecule or biological drug, with focus on the guidelines from regulatory agencies on the data required for the Investigational New Drug (IND) application. Major issues in Pharmacology, Toxicology, Safety Pharmacology, Pharmacokinetics and Chemistry, Manufacturing and Control (CMC) sections of the IND submission process are described. Practices of laboratory animal efficacy models, pharmacokinetics models, toxicology study protocols, master batch record generation and the concepts of Good Laboratory Practice (GLP)/Good Manufacturing Practices (GMP) will be covered, with particular emphasis on the Code of Federal Regulations Title 21 part 58, 210 and 211.

Prerequisite(s): A minimum grade of "C" in CHEM 5333.

PHYS 7630 Graduate Seminar

3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.

This course will consist of formal seminars and informal sessions on current topics of interest to the program as presented by visiting lecturers, local researchers, and students. All MS-APS students must attend a set number of seminars each term they are enrolled in the program.

Thesis track students in their final semester will prepare a comprehensive presentation on their thesis research as well as submit a report reviewing the topics covered during the seminar series.

PHYS 7999 Thesis

1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.

Results of an individual, independent research project will be presented as a thesis in partial fulfillment of the Master of Science in Physical Science degree. The thesis requires defense of the design, execution, analysis, and interpretation of the research project.