

# PHYSICS (PHYS)

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## **PHYS 1101. General Physics Laboratory I. 1 Hour.**

Credit 1

**Prerequisite:** MATH 1410 or MATH 1316 or MATH 1420 .

## **PHYS 1102. General Physics Laboratory II. 1 Hour.**

Credit 1 .

## **PHYS 1105. Class Phy & Thermodynamics Lab. 1 Hour.**

Credit 1 .

## **PHYS 1301. General Phy-Mechanics & Heat. 3 Hours.**

A modern treatment is made of the laws and principles of motion. This course is intended for science majors whose degree plan does not require a calculus-based treatment. The PHYS 1101 experimental laboratory course should be taken concurrently.

**Prerequisite:** MATH 1410 or MATH 1316 or MATH 1420 with a grade of C or better.

## **PHYS 1302. Gen Phy-Snd,Lght, Elec, & Mag. 3 Hours.**

The course is a continuation of PHYS 1301, covering the subjects of electricity and magnetism. The course is intended for science majors whose degree plan does not require a calculus-based treatment. The PHYS 1102 experimental laboratory course should be taken concurrently.

**Prerequisite:** PHYS 1301 and MATH 1316 or MATH 1410 or MATH 1420 with a C or better.

## **PHYS 1305. Classical Physics & Thermodynmc. 3 Hours.**

Students study the fundamentals of motion, forces and heat at a conceptual level. The course is intended for students who are not science majors, including those on primary and middle school education tracks.

## **PHYS 1401. Physics Boot Camp. 4 Hours.**

Students engage in a review of the essential survival-level skills of problem analysis required for the first two years of the pre-engineering and physics curricula. The course provides familiarity with the core problem-solving tools required for the first two years of work in these majors. All students considering a physics major should enroll in the Bootcamp during their first semester on campus. A weekly problem recitation session is integrated.

**Prerequisite:** Departmental approval.

## **PHYS 1403. Stars & Galaxies. 4 Hours.**

Students study the universe beyond the solar system. Topics may include the nature of stars, stellar evolution, galaxies, quasars, cosmology, the universe as a whole, and theories about the origin and fate of the universe. Along the way, students are introduced to tools astronomers use to determine such properties as temperatures, compositions, motions, masses, and evolution of astronomical objects. Note: PHYS 1403 and PHYS 1404 may be taken in either order.

## **PHYS 1404. Solar System Astronomy. 4 Hours.**

Students study the solar system as well as other planetary systems. Topics may include the nature of science, apparent motions in the sky, the historical development of the laws governing the solar system, the structure and membership of solar system objects, the formation of the solar system, and extrasolar planets and our understanding of other solar systems. Note: PHYS 1403 and PHYS 1404 may be taken in either order.

## **PHYS 1411. Introduction To Physics I. 4 Hours.**

Students are introduced to the topics of classical mechanics, including linear motion, forces, rotation, and conservation laws. Considerable attention is given to the solution of problems with the emphasis placed on fundamental concepts. Students must register concurrently for the integrated weekly laboratory problem-solving session. Prerequisites MATH 1420 with a C or better.

## **PHYS 1422. Introduction To Physics II. 4 Hours.**

Students are introduced to the topics of electricity and magnetism, including Maxwell's equations, the Lorentz force, and basic electrical circuits. Considerable attention is given to the solution of problems with the emphasis placed on fundamental concepts. Students must register for the integrated weekly laboratory problem-solving session.

**Prerequisite:** PHYS 1411 and MATH 1430 with a C or better.

## **PHYS 2426. Heat, Waves & Modern Physics. 4 Hours.**

An introduction to topics in heat and wave motion including sound and light. The quantitative description of phenomena is emphasized. The laboratory continues as an integral part of the course.

**Prerequisite:** PHYS 1411 and MATH 1420.

## **PHYS 3111. Modern Physics Laboratory I. 1 Hour.**

Laboratory taken in conjunction with PHYS 3391. Students reproduce key experimental outcomes underlying 20th century physics.

**Prerequisite:** Grade of C or better in PHYS 1422.

## **PHYS 3115. Electronic & Circuit Anlys Lab. 1 Hour.**

Laboratory taken in conjunction with PHYS 3395. Students construct and analyze advanced circuits including both classical and digital components.

**Prerequisite:** Minimum grade of C in PHYS 1422.

## **PHYS 3117. Astronomy Laboratory. 1 Hour.**

1 Credit.

**PHYS 3360. Statics And Dynamics. 3 Hours.**

Students study equilibrium, using concepts of force and torque. Vectors, calculus and differential equations are used.

**Prerequisite:** PHYS 1411 and MATH 2440.

**PHYS 3370. Intro To Theoretical Physics. 3 Hours.**

Students are introduced to essential quantitative analysis tools of theoretical physics. The course focuses on physics applications of series (Taylor, Fourier, Laurent), vector differential equations, and complex analysis. Students register concurrently for the PHYS 4110 laboratory, which introduces technologies such as Python (programming), Mathematica (computer algebra), Linux (operating system) and LaTeX (typesetting) commonly used in research applications.

**Prerequisite:** PHYS 1422 and MATH 2440 with a grade of C or better.

**PHYS 3391. Modern Physics I. 3 Hours.**

Students explore the historical breakdown of classical physics that occurred at the beginning of the 20th century, presaging the introduction of Relativity Theory and Quantum Mechanics. Significant treatment of probability and statistics is integral to the understanding of these topics. The PHYS 3111 laboratory must be taken concurrently. PHYS 3111 must be taken concurrently.

**Prerequisite:** Minimum grade of C in MATH 2440 and PHYS 1422.

**PHYS 3395. Electronics & Circuit Analysis. 3 Hours.**

Students study advanced circuit analysis, including analog and digital integrated circuits, selected discrete components, and applications to various digital and analog systems. The PHYS 3115 laboratory must be taken concurrently.

**Prerequisite:** Grade of C or better in PHYS 1422.

**PHYS 3397. Astronomy. 3 Hours.**

Students study the solar system, sun, stars, and stellar systems, their motions, structure, energy sources and evolution, star clusters, interstellar matter, galaxies, and cosmology. The PHYS 3117 laboratory must be taken concurrently.

**Prerequisite:** PHYS 3117 must be taken concurrently.

**PHYS 3398. Astronomy-Honors. 3 Hours.**

**PHYS 4110. Adv Undergrad Laboratory I. 1 Hour.**

This laboratory course provides additional, in-depth hands-on experience designed to complement course work.

**PHYS 4113. Light And Optics. 1 Hour.**

Laboratory taken in conjunction with PHYS 4333. Students reproduce key experimental outcomes with lensing, reflection, interference and diffraction. Credit 1.

**PHYS 4331. Physics For Forensic Sciences. 3 Hours.**

Forensic science makes use of a number of physical techniques. Students are provided with an understanding of the physics used in forensic science that enhances the standard introductory physics course. Topics covered may include interior and exterior ballistics, optics, stress and strain, elementary fluid mechanics.

**PHYS 4333. Light And Optics. 3 Hours.**

The wave theory of light is emphasized. Phenomena such as interference, diffraction and polarization are treated with quantitative detail. The PHYS 4113 laboratory must be taken concurrently.

**Prerequisite:** PHYS 1422 with a C or better.

**PHYS 4366. Intro Quantum Mechanics. 3 Hours.**

The subject of quantum mechanics describes the wave nature of matter, which is relevant at atomic scales. Topics may include the harmonic oscillator, potentials, symmetries, rotation and spin, the hydrogen atom, and atomic spectra.

**Prerequisite:** PHYS 3391, MATH 3376 and MATH 3391 with a grade of C or better.

**PHYS 4367. Intro To Solid State Physics. 3 Hours.**

Students are introduced to the concepts of crystal structure, crystal diffraction, reciprocal lattices, crystal binding, phonons, the free electron Fermi gas, semi-conductors, energy bands, Fermi surfaces, point defects, and optical properties of crystals.

**Prerequisite:** Minimum grade of C in PHYS 3391.

**PHYS 4368. Electricity And Magnetism. 3 Hours.**

Students engage in a more advanced treatment of the classical theory of Electricity and Magnetism which extends the material covered in PHYS 1422. Maxwell's equations are studied in integral and differential form. Topics may include electro- and magneto-statics and dynamics, potentials, fields, waves, and applications to materials.

**Prerequisite:** Minimum grade of C in MATH 3376 and PHYS 1422.

**PHYS 4370. Classical Mechanics. 3 Hours.**

Students engage in a more advanced treatment of the classical theory of Mechanics which extends the material covered in PHYS 1411. Newton's second law is treated as a differential equation to study kinematics, oscillations, and conservation laws. Lagrangian dynamics are introduced, along with generalized coordinates. Additional topics may include orbital motion, rigid bodies, coupled systems, and effective potentials.

**Prerequisite:** MATH 3376.

**PHYS 4371. Thermodynamics & Statistical Mech. 3 Hours.**

Students study the statistical basis of the behavior of materials at finite temperatures and densities, deriving basic concepts of classical thermodynamics, including the first and second laws, properties of gases, entropy, and thermodynamic functions from their origins in statistical mechanics.

**Prerequisite:** PHYS 3391 and MATH 3376.

**PHYS 4395. Undergraduate Research. 3 Hours.**

Students conduct original research under the direct supervision of a faculty member. Projects may be supervised by non-physics faculty with departmental approval. Each student is expected to demonstrate initiative in planning, performing, and reporting work done on the selected topic. The course may be repeated for up to a total of 6 credit hours with departmental approval. The course may be repeated for an additional three semester hours credit with consent of Department Chair. This course should be taken in addition to hours required for physics major or minor and may be taken for Academic Distinction Credit. See Academic Distinction Program in this catalog.

**Prerequisite:** Consent of Department Chair.

**PHYS 4396. Selected Topics In Physics. 3 Hours.**

Students study various advanced topics of contemporary interest in physics. The course is offered upon demand, and content is dependent upon faculty availability and student interest. May be repeated for additional credit with distinct course content. May be repeated for additional credit.

**Prerequisite:** Consent of the instructor.

**PHYS 4398. Senior Thesis. 3 Hours.**

This is a directed elective for senior students majoring in physics seeking additional experience in a sophisticated research project. This research is conducted under the supervision of a member of the physics faculty and the results is presented in an organized written form of suitable length with appropriate attention to scholarly norms, including citation of prior works.