PHYSICS (PHYS)

PHYS 1101. General Physics Laboratory I. 1 Hour. [TCCN: PHYS 1101]
Laboratory taken in conjunction with PHYS 1301.
Prerequisite: MATH 1410 or MATH 1316 or MATH 1420 .

PHYS 1102. General Physics Laboratory II. 1 Hour. [TCCN: PHYS 1102]
Laboratory taken in conjunction with PHYS 1302.

PHYS 1105. Classical Physics and Thermodynamics Lab. 1 Hour. [TCCN: PHYS 1105]
Laboratory taken in conjunction with PHYS 1305.

PHYS 1301. General Physics-Mechanics and Heat. 3 Hours. [TCCN: PHYS 1301]
A modern treatment is made of the laws and principles of motion, force, momentum, energy, and rotation. 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.

PHYS 1302. General Physics-Sound, Light, Electricity, and Magnetism. 3 Hours. [TCCN: PHYS 1302]
The course is a continuation of PHYS 1301, covering the subjects of electricity and magnetism, including circuits applications. 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.

PHYS 1305. Classical Physics and Thermodynamics. 3 Hours. [TCCN: PHYS 1305]
Students study the fundamentals of motion, forces, energy, 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 mathematical and problem solving skills required for the first two years of the physics, pre-engineering, and certain engineering-technology degree plans. Applications focus on the context of physics and engineering examples, starting from first principles. All students considering a physics or pre-engineering major should enroll in the Bootcamp during their first semester on campus. A weekly group problem solving practice session is integrated.

PHYS 1403. Stars & Galaxies. 4 Hours. [TCCN: PHYS 1403]
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. 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. Course Equivalents: PHYS 1312 .

PHYS 1404. Solar System Astronomy. 4 Hours. [TCCN: PHYS 1404]
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. Course Equivalents: PHYS 1311 .

PHYS 1411. Introduction To Physics I. 4 Hours. [TCCN: PHYS 2425]
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. Calculus I (MATH 1420) may be taken concurrently by students who have completed Physics Bootcamp (PHYS 1401).
Prerequisite: MATH 1420.

PHYS 1422. Introduction To Physics II. 4 Hours. [TCCN: PHYS 2426]
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. Completion of Calculus II (MATH 1430) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 1411 and MATH 1430.

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: PHYS 1422.

PHYS 3115. Electronics and Circuit Analysis Lab. 1 Hour.
Laboratory taken in conjunction with PHYS 3395. Students construct and analyze advanced circuits including both classical and semiconductor-based components.
Prerequisite: PHYS 1422 .

PHYS 3117. Astronomy Laboratory. 1 Hour.
Laboratory taken in conjunction with PHYS 3397. 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. Completion of Calculus II (MATH 1430) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 1411 and MATH 2440.

PHYS 3370. Introduction to Theoretical Physics. 3 Hours.
Students study the essential techniques of mathematical analysis required for the latter two years of the physics degree plan. The course focuses on physics applications of series (Taylor, Fourier, Laurent), vector calculus, generalized coordinates, differential equations, special functions, and complex analysis. Students register concurrently for the PHYS 4110 laboratory. Completion of Calculus III (MATH 2440) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 1422 and MATH 2440.

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. Completion of Calculus III (MATH 2440) is recommended, though it may be taken concurrently. PHYS 3111 must be taken concurrently.
Prerequisite: MATH 2440 and PHYS 1422.

PHYS 3395. Electronics & Circuit Analysis. 3 Hours.
Students study advanced circuit analysis, including analog filters, digital integrated circuits such as op-amps, selected discrete components such as diodes and transistors, and applications to various digital and analog systems. The PHYS 3115 laboratory must be taken concurrently. Completion of Calculus III (MATH 2440) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 1422 .

PHYS 3397. Astronomy. 3 Hours.
Students continue their study of 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. Advanced Undergraduate Laboratory I. 1 Hour.
Laboratory taken in conjunction with PHYS 3370. Students are introduced to methods of analysis (e.g. statistical distributions, likelihoods, and error propagation) and technologies (e.g. programming with Python, symbolic algebra and visualization with Mathematica, typesetting with LaTeX, and the Linux operating system) commonly used in graduate study and research applications.

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, reflection, transmission, and polarization are treated with quantitative detail. The PHYS 4113 laboratory must be taken concurrently. Completion of Calculus III (MATH 2440) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 1422 .

PHYS 4366. Introduction to 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. Completion of Differential Equations (MATH 3376) is recommended, though it may be taken concurrently.
Prerequisite: PHYS 3391 and MATH 3376 with a grade of C or better.

PHYS 4367. Introduction to Solid State Physics. 3 Hours.
Students are introduced to the concepts of crystal structure, diffraction, reciprocal lattices, binding, phonons, the free electron Fermi gas, semi-conductors, energy bands, Fermi surfaces, point defects, and optical properties of crystals. Completion of Differential Equations (MATH 3376) is recommended, though it may be taken concurrently.
Prerequisite: 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. Completion of Differential Equations (MATH 3376) is recommended, though it may be taken concurrently.
Prerequisite: 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. Completion of Calculus III (MATH 2440) is recommended, though it may be taken concurrently.
Prerequisite: MATH 3376.

PHYS 4371. Thermodynamics and Statistical Mechanics. 3 Hours.
Students study foundational concepts of classical thermodynamics, including the first and second laws, properties of gases, entropy, and thermodynamic functions. These concepts are formally connected to and derived from their origins in statistical mechanics. Completion of Differential Equations (MATH 3376) is recommended, though it may be taken concurrently.
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.
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.
Prerequisite: Consent of the instructor.

PHYS 4398. Senior Thesis. 3 Hours.
This is a directed elective for upper-division students majoring in Physics and/or minoring in Astronomy who seek to couple original research or guided independent study with an exercise in technical writing. Research activities in the fundamental or applied sciences, including science education, and/or a topically similar literature review, are supervised by a member of the Physics and Astronomy faculty. Findings are presented in an organized written form of suitable length with appropriate attention to scholarly norms, e.g. in the handling of data and citation of prior works.
Prerequisite: Approval of the Supervising Faculty Member.