

Physics Course Offerings from 1998 –

PH010 Development of Physics Skills (0-1-0) f,w,s .. 1

May be repeated for a maximum of 3 credits. Individualized instruction in physics problem solving and general study skills from professional physics coaches. Benefits students looking for help with demanding college-level physics courses (PH201 through PH310) . Graded on pass/fail basis. Credits do not count toward graduation. Prerequisite: permission of instructor.

PH020 Team Approach to Learning Physics (0-1-0) 1

May be repeated for a maximum of 3 credits. Collaborative approach to the study of physics. Students meet 3 hours per week with 4 to 6 team members who are concurrently taking the same physics course in general physics (PH204 or PH205). Students will work under the direction of a professional physics coach to learn the team approach to problem solving. Benefits students looking for help with demanding courses and who would also like experience in team problem solving. Graded pass/fail. Credits do not count toward graduation. Prerequisite: permission of instructor; corequisite: PH204 or PH205.

PH130 Introductory Astronomy (3-0-0) f 3

Fundamentals of astronomy, including Kepler's and Newton's laws of motion, origin and evolution of the solar system, and an introduction to galactic astronomy, extra-galactic astronomy, cosmology, and modern astronomical instrumentation, including space-based astronomy.

PH181 Introductory Physics Laboratory I (0-0-2) f,w,s,su 1

Principles of classical mechanics investigated using discovery-based laboratories.

PH182 Introductory Physics Laboratory II (0-0-2) f,w,s,su 1

Principles of electricity and magnetism investigated using discovery-based laboratories. Prerequisite: PH181.

PH183 Introductory Physics Laboratory III (0-0-2) f,w,s,su 1

Principles of thermodynamics, waves, optics and modern physics investigated using discovery-based labs. Prerequisite: PH182.

PH201 Elements of Physics I (3-0-0) f,w,su 3

General principles of particle, rigid body, vibrational, and fluid mechanics. Prerequisite: MA131 or MAT111; and PH181.

PH202 Elements of Physics II (3-0-0) w,s,su 3

General principles of electricity, magnetism, heat, mechanical waves, and sound. Prerequisite: PH201 and PH182.

PH203 Elements of Physics III (3-0-0) f,s, 3

General principles of geometrical/physical optics and modern physics. Prerequisite: PH201 and PH183.

- PH204 General Physics I (2-2-0) f,w,s,su** 4
Calculus-based introduction to mechanics, including kinematics of motion in one and two dimensions. Newton's laws, conservation of energy and momentum, rotational motion, simple harmonic motion, and the universal law of gravitation. Prerequisite: PH181; corequisite: MA151.
- PH205 General Physics II (2-2-0) f,w,s,su** 4
Calculus-based introduction to electricity and magnetism, including electric and magnetic fields, Gauss' law, capacitance resistance, magnetic induction, inductance, electromagnetic waves, and geometric optics. Prerequisites: PH182 and PH204; corequisite: MA152.
- PH206 General Physics III (2-2-0) f,w,s,su** 4
Introduction to thermodynamics, including kinetic theory, geometrical optics, wave motion, and the physics of the atom. Prerequisite: PH183, PH205 and MA152.
- PH251 Sophomore Journal Club (0-2-0) f** 1
Discussion of recent research in physics. Prerequisite: sophomore standing.
- PH310 General Physics IV (2-2-0) f,s,su** 4
Concepts of modern physics, including atomic view of matter and radiation, relativity, quantum mechanics, radioactivity, and fission. Prerequisite: PH205.
- PH316 Electronics for Scientists I (0-3-3) f** 4
An introduction and survey of analog electronics with an emphasis on their use in the laboratory. To include linear devices and basic linear circuit analysis for both AC and DC signals, non-linear devices such as diodes, transistors, and integrated circuits such as op-amps, with an emphasis on their use, as well as the connections between components, including basic transmission line theory. Prerequisite: PH205; or permission of the department.
- PH330 Introduction to Remote Sensing (0-3-0) f** 3
Concepts of remote sensing including an introduction to radiation, remote sensing instrumentation including multispectral and hyperspectral sensors, earth resource satellites, and image interpretation and processing. Applications of specific projects in biology, civil engineering, electrical engineering, forestry, geophysics, and physics will be presented. Prerequisites: junior standing in above mentioned departments; or permission of instructor.
- PH332 Theoretical Mechanics I (0-3-0) w** 3
Intermediate-level study of classical mechanics. Topics include the motion of a single particle, the simple harmonic oscillator, and centra-force motion. Prerequisite: PH204; corequisite: MA250.
- PH333 Theoretical Mechanics II (0-3-0) s** 3
Continuation of PH332. Topics include the description of motion in non-inertial reference frames, the motion of systems of particles, rigid body motion, and an introduction to Lagrangian mechanics. Prerequisite: PH332.

PH337 Electronics for Scientists II (0-3-3) w 4

A continuation of PH316 with an emphasis on digital electronics and their use in the laboratory. Topics include binary arithmetic, boolean logic, basic logic gates, flip-flops, counters, clocks, registers, and large-scale integrated circuits, such as microcontrollers and microprocessors. Analog to digital and digital to analog conversion, basic parallel and serial digital communication techniques, and other topics related to the use of these devices in the laboratory will also be covered. Prerequisite: PH316 or permission of the department.

PH345 Thermodynamics and Statistical Mechanics (0-4-0) s 4

First and second laws of thermodynamics, phase equilibrium, and thermodynamic potentials. Microscopic formulation of the laws of thermodynamics including the statistical development of the concept of entropy. The Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions are introduced and related to physical problems. Prerequisite: PH206 or PH310.

PH360 Geometrical and Physical Optics (0-3-3) s 4

The treatment of mirrors and lenses using geometrical optic techniques and a study of interference, diffraction, and polarization. Prerequisites: PH206; corequisite: MA310.

PH401 Special Relativity Theory (0-3-0) w ('98) 3

Introduction to special relativity theory from its historical and experimental origin, including its conceptual development in kinematics, dynamics, and electromagnetism. Prerequisite: junior standing, permission of instructor.

PH405 Qualitative Methods in Problem Solving (0-1-0) f 1

Methods of problem solving including scaling, numerical estimation, and dimensional analysis. Problems may be taken from standardized exams. Prerequisite: senior standing.

PH411 Senior Laboratory/Project (0-0-6) f 2

Advanced laboratory techniques emphasized in a series of experiments in classical and modern physics. Prerequisites: PH337.

PH412 Senior Laboratory/Project (0-0-6) w 2

Introduction to research under the guidance of a faculty member. In addition, creative problem solving will be assessed via a student-initiated project. Prerequisites: PH411.

PH413 Senior Laboratory/Project (0-0-6) s 2

Continuation of research under the guidance of a faculty member, culminating in a written report and presentation of results at an undergraduate research forum. Prerequisites: PH412.

PH417 Nuclear Radiation Measurements (0-2-3) f 3

Instrument and measurement theory, combined with laboratory practice in the use of all available types of apparatus, for the detection and characterization of nuclear radiation. Sampling techniques are considered and error analysis is applied to develop skills in interpretation of results. Prerequisite: PH310 or PH420; or permission of instructor.

PH418 Intermediate Optics (0-3-3) f	4
In-depth study of physical optics, including interference, diffraction, and polarization. Also includes the physics of color. Prerequisites: PH360, and MA310.	
PH420 Quantum Mechanics I (0-3-0) f	3
Introduction to the foundations of modern physics that culminated in the quantum theory. Also includes the development of Schrodinger's wave mechanics. Prerequisite: PH206 or PH310, and MA310.	
PH421 Quantum Mechanics II (0-3-0) w	3
Continuation of the development of Schrodinger's wave mechanics including orbital and spin angular momenta, and magnetic interactions with applications to the hydrogen atom and multi-electron atoms. Prerequisite: PH420.	
PH422 Quantum Mechanics III (0-3-0) s	3
Continuation of the applications of quantum theory to multielectron atoms, molecules, and solids, including an introduction to quantum statistical physics. Prerequisite: PH421.	
PH426 Electricity and Magnetism I (0-4-0) w	4
Intermediate study of the basic theory of electricity, including a detailed study of electrostatic field theory. Prerequisites: PH205, MA310, and PH332.	
PH427 Electricity and Magnetism II (0-4-0) s	4
Continuation of PH426, including magnetostatics, Maxwell's equations, and electromagnetic wave theory. Prerequisite: PH426.	
PH430 Stellar Astrophysics (0-3-0) w ('98)	3
Topics include an overview of observational astrophysics, stellar structure, atomic properties of matter, radiation and energy transport in stellar interiors, and stellar evolution to the Main Sequence. Prerequisites: PH130, PH206, and MA310; or graduate standing.	
PH432 Galactic Astrophysics (0-3-0) w ('99)	3
Topics include evolution away from the Main Sequence, including deviations from hydrostatic equilibrium and final stages of stellar evolution, the interstellar medium hydrodynamics of star formation, galaxies and galactic formation. Prerequisites: PH130, PH206, and MA310; or graduate standing.	
PH431 Nuclear Power Systems Design (0-3-0) s	3
Nuclear reactor physics combined with related discussions of power conversion concepts and design calculations. Includes the relationship of power to the time- and space-dependent fission heat source and the heat removal characteristics of the reactor core. Prerequisite: PH310 or PH420; or permission of instructor.	
PH440 Intermediate Theroetical Mechanics (0-3-0) f	3
Continuation of PH333. Topics include variational methods in physics, Lagrangian and	

Hamiltonian mechanics, theory of vibrations, and special relativity. Prerequisites: PH333.

PH444 Introduction to Nuclear Physics (0-3-0) s 3

Ground state properties of stable nuclei of atoms. Includes modes of disintegration of unstable nuclei and elementary theories of alpha, beta, and gamma decay. Prerequisite: PH420 or CH313.

PH451 Senior Physics Colloquium (0-3-0) f 1

PH452 Senior Physics Colloquium (0-3-0) w 1

PH453 Senior Physics Colloquium (0-3-0) s 1

Discussion of current literature and recent advances in the field of physics under the supervision of department staff. Oral and written presentations are required as is attendance at the departmental colloquium. Prerequisites: senior standing and permission of instructor.

PH470 Solid-state Physics (0-3-0) w 3

Crystal structures, X-ray diffraction, phonons, free electron theory of metals, and rudiments of band theory. Prerequisites: CH102; and PH206 or PH310; and MA310.

PH480 Computers in Physics – Introduction (1-0-6) f 4

Review of basic numerical methods relevant for computer applications in physics. Individual programming is required for numerical studies of classical physics problems. Various stochastic computation methods in physics are introduced. Prerequisites: CS110 or CS121; MA310, and senior standing.

PH481 Computers in Physics – Experiment and Analysis (1-0-6) w 4

How computers are used for data acquisition, data treatment and analysis, graphics display, and controlling experiments. Develops skills necessary to interface and automate instruments and systems. Prerequisite: CS110 or CS121; and PH337.

PH482 Computers in Physics – Theory (1-0-6) s 4

Role of computer simulation in physics with emphasis on methodologies, data and error analysis, approximations, and potential pitfalls. Methodologies may include Monte Carlo simulation, molecular dynamics, Hartree-Fock and Density Functional Theory. Prerequisites: PH480; and PH310 or PH420; or permission of instructor.

PH490 Special Problems in Physics f,w,s var to 12

Selected additional topics in physics based on interests of faculty and students. Anticipated topics include stellar astrophysics, galactic astrophysics, introduction to materials physics, introduction to atmospheric physics, and introduction to the physics of fluids. Interested students should contact the Physics Department. Prerequisites: junior or senior standing; and permission of instructor.

Notes:

Stellar and Galactic Astrophysics were added in 1998, though reference to them in PH490 was not removed until later.

Prerequisites from other departments:

MA131 – Trigonometry

MAT111 – Technical Mathematics I (Algebra and Trigonometry)

MA151 – Calculus and Analytic Geometry II

MA152 – Calculus and Analytic Geometry III

MA250 – Calculus and Analytic Geometry IV

MA310 – Introduction to Ordinary Differential Equations

CH102 – General Chemistry II

CH313 – Physical Chemistry III

CS110 – Introduction to Programming

CS121 – Introduction to Computer Science I