

# PHY: PHYSICS AND ENGINEERING

*College of the Sciences and Mathematics*

## Courses

### **PHY 100. Elements of Physical Science. 3 Credits.**

A study of motion, energy, light, and some aspects of modern physics.

Gen Ed Attribute: Science Distributive Requirement.

Distance education offering may be available.

Typically offered in Fall & Spring.

### **PHY 105. Structure of the Universe. 3 Credits.**

A survey of phenomena and objects in the universe from the very smallest distance scales to the grandest in the cosmos. Includes a historical consideration of the developments of modern theories of the physical world.

Gen Ed Attribute: Science Distributive Requirement.

Typically offered in Fall & Spring.

### **PHY 115. Engineering Graphics I. 1 Credit.**

Use and preparation of engineering drawings. Topics include the use of instruments, linework, geometric construction, lettering, four types of projections, dimensioning, and sections.

Typically offered in Fall.

### **PHY 116. Engineering Graphics II. 1 Credit.**

A continuation of PHY 115, to include topics such as layout, detail, and assembly drawings, developments, auxiliary drawings, various types of drafting, machine tool processes, and computer drafting.

Pre / Co requisites: PHY 116 requires prerequisite of PHY 115.

Typically offered in Spring.

### **PHY 123. Food, Fire, and Physics: The Science of Cooking. 3 Credits.**

An exploration of food and cooking from a physical science perspective. Principles of soft matter physics (e.g. phase diagram, intermolecular forces, viscosity, diffusion, self-assembly, polymer physics) are discussed and used to gain insight into food and cooking.

Gen Ed Attribute: Science Distributive Requirement.

Typically offered in Fall & Spring.

### **PHY 125. Theology and Science: Enemies or Partners. 3 Credits.**

An inquiry into the relationship of theology to the natural sciences. Team taught by both a physicist and a philosopher, the course investigates how ideas of God have been affected by advances in physics and biology.

Gen Ed Attribute for Students Admitted Prior to Fall 2020: Humanities Distributive Requirement, Science Distributive Requirement.

*Gen Ed Attribute for Students Admitted Fall 2020 and After: None.*

Typically offered in Spring.

Cross listed courses PHI 125, PHY 125.

### **PHY 130. General Physics I. 4 Credits.**

An introductory, noncalculus, physics course. Mechanics of solids and fluids, wave motion, heat and temperature, thermodynamics, and kinetic theory.

Gen Ed Attribute: Science Distributive Requirement.

Typically offered in Fall, Spring & Summer.

### **PHY 140. General Physics II. 4 Credits.**

An extension of PHY 130. Electricity and magnetism, geometrical and physical optics, and modern physics.

Pre / Co requisites: PHY 140 requires a prerequisite of PHY 130.

Typically offered in Fall, Spring & Summer.

### **PHY 170. Physics I. 4 Credits.**

An introductory laboratory-based course. Includes mechanics, waves, heat, and thermodynamics. The laboratory emphasizes error analysis, the writing of technical reports, and data analysis using computers. A laboratory section must be added along with the lecture and discussion.

Pre / Co requisites: PHY 170 requires a prerequisite of MAT 161 OR a prerequisite of MAT 143 or MAT 145 and a corequisite of MAT 161.

Gen Ed Attribute: Science Distributive Requirement.

Typically offered in Fall & Spring.

### **PHY 180. Physics II. 4 Credits.**

A continuation of PHY 170. Includes electricity and magnetism, geometrical and physical optics, electronics, and modern physics.

Pre / Co requisites: PHY 180 requires a prerequisite of PHY 170 and corequisite of MAT 162.

Typically offered in Fall & Spring.

### **PHY 205. Cellular and Molecular Biophysics. 3 Credits.**

This course draws on concepts and tools from physics, biology, and chemistry to understand how energy is transformed into order in living systems. This will require students to consider the roles evolution, polymer physics, and chemistry have played in shaping the machinery of life. This course is aimed at students from physics, biology, and chemistry who are interested in stretching themselves beyond disciplinary boundaries.

Pre / Co requisites: PHY 205 requires prerequisites of PHY 130 or PHY 170, CHE 103, and one of MAT 143, MAT 145, or MAT 161; and a corequisite of PHY 140 or PHY 180.

Gen Ed Attribute: Interdisciplinary Requirement, Speaking Emphasis.

Typically offered in Spring.

### **PHY 240. Introduction to Modern Physics. 3 Credits.**

An atomic view of electricity and radiation, atomic theory, special relativity theory, X-rays, radioactivity, nuclear fission, and introductory quantum mechanics.

Pre / Co requisites: PHY 240 requires prerequisites of PHY 140 or PHY 180 and MAT 162.

Typically offered in Spring.

### **PHY 260. Engineering Statics. 3 Credits.**

Composition and resolution of forces, equivalent force systems, equilibrium of particles and rigid bodies, centroids and center of gravity, analysis of simple structures, internal forces in beams, friction, moments and products in inertia, and methods of virtual work.

Pre / Co requisites: PHY 260 requires prerequisites of PHY 130 or PHY 170 and MAT 162.

Typically offered in Spring.

### **PHY 275. Computational Physics. 3 Credits.**

This is an introductory course on the basic ideas and programming skills of computational physics, with a seven-week introduction to programming given at the beginning of the course. Students will develop their own computer software to solve problems in mechanics, electrostatics, magnetism, quantum mechanics, chaos and other areas.

Pre / Co requisites: PHY 275 requires a prerequisite of MAT 162 and a corequisite of PHY 180.

Typically offered in Spring.

### **PHY 300. Mechanics. 3 Credits.**

Particle kinematics, dynamics, energy, and momentum considerations; oscillations; central force motion; accelerated reference frames; rigid body mechanics; Lagrangian mechanics.

Pre / Co requisites: PHY 300 requires prerequisites of PHY 140 or PHY 180 and MAT 162.

Typically offered in Fall.

### **PHY 310. Intermediate Physics Lab: Experimental Methods & Scientific Communication. 3 Credits.**

A lecture and laboratory course designed to familiarize students with experimental physics and scientific communication. Students conduct experiments, analyze data, and come to evidence-based conclusions. In addition, explicit instruction occurs on writing and presenting in the discipline of physics. Students write a scientific report on an experiment and present their findings to the department.

Pre / Co requisites: PHY 310 requires prerequisites of PHY 240 and PHY 275.

Gen Ed Attribute: Speaking Emphasis, Writing Emphasis.

Typically offered in Fall & Spring.

### **PHY 330. Electronics I. 3 Credits.**

Emphasis is divided between theory and experiment. The course begins with a brief review of resistive and RC voltage dividers. Electronic circuits studied include basic operational amplifiers, timers, instrumentation amplifiers, logic circuits, flip flops, counters, and timers.

Pre / Co requisites: PHY 330 requires prerequisites of MAT 161 and PHY 140 or PHY 180.

Typically offered in Spring.

### **PHY 350. Heat and Thermodynamics. 3 Credits.**

Equations of state, first and second laws of thermodynamics, ideal and real gases, entropy, and statistical mechanics.

Pre / Co requisites: PHY 350 requires prerequisites of PHY 275, PHY 240, and MAT 261.

Typically offered in Spring.

**PHY 370. Mathematical Physics. 3 Credits.**

Selected topics in mathematics applied to problems in physics, ordinary differential equations, vector calculus, Fourier analysis, matrix algebra, and eigenvalue problems.

Pre / Co requisites: PHY 370 requires prerequisites of PHY 275, PHY 180, MAT 261, MAT 315 or (MAT 311 and MAT 343), or instructor permission.

Typically offered in Fall.

**PHY 390. Fundamentals of Astrophysics. 3 Credits.**

An advanced physics course that deals with a broad range of topics in modern astrophysics.

Topics include, but are not limited to, astronomical measurements, celestial mechanics, radiative transfer theory, stellar structure, and both newtonian and relativistic cosmology.

Pre / Co requisites: PHY 390 requires prerequisites of PHY 275 and PHY 240.

Typically offered in Spring.

**PHY 410. Optics. 3 Credits.**

Geometrical and physical optics. Reflection and refraction at surfaces, lenses, interference and diffraction, and polarization.

Pre / Co requisites: PHY 410 requires prerequisites of MAT 261, MAT 315, and PHY 275.

Typically offered in Fall.

**PHY 420. Quantum Mechanics I. 3 Credits.**

An introductory course in quantum mechanics. Topics covered include the Schrödinger equation, stationary states, time evolution, position and momentum space wave functions, bound states, scattering states, spin and orbital angular momentum, hydrogenic atoms, and entanglement. Additional topics may include perturbation theory, conserved quantities, particle statistics, and quantum information.

Pre / Co requisites: PHY 420 requires a prerequisite of PHY 240 and a corequisite of PHY 370.

Typically offered in Fall.

**PHY 425. Quantum Mechanics II. 3 Credits.**

This course is the second-semester quantum mechanics course. The following fundamental topics will be covered: Time-independent Perturbation Theory, the Variational Principle, the WKB approximation, time-dependent Perturbation Theory, and advanced topics.

Pre / Co requisites: PHY 425 requires a prerequisite of PHY 420.

Typically offered in Spring.

**PHY 430. Electricity and Magnetism I. 3 Credits.**

Electrostatics of point charges and extended charge distributions, fields in dielectrics, and magnetic fields due to steady currents. Ampere's Law and induced emfs. Topics in electromagnetic waves as time permits.

Pre / Co requisites: PHY 430 requires prerequisites of PHY 300 and MAT 343 or PHY 370.

Typically offered in Fall.

**PHY 435. Electricity and Magnetism II. 3 Credits.**

This course covers the applications of Maxwell's equations. Specific topics include: conservation laws, electromagnetic waves, guided waves, gauge transformations, retarded potentials, radiation from point charges and dipoles, and transformations of the electromagnetic field.

Pre / Co requisites: PHY 435 requires a prerequisite of PHY 430.

Typically offered in Spring.

**PHY 455. Advanced Physics Lab: Experimental Methods & Scientific Communication. 3 Credits.**

This course is a continuation of PHY 310, a lecture and laboratory course designed to familiarize students with modern physics laboratory equipment and practices through a series of experiments. Students write three research papers and give one research talk describing the experiments and their results in a style consistent with scientific conventions.

Pre / Co requisites: PHY 455 requires a prerequisite of PHY 310.

Gen Ed Attribute: Speaking Emphasis, Writing Emphasis.

Typically offered in Spring.

**PHY 480. Special Topics in Physics. 1-3 Credits.**

Topics of special interest to be presented once or twice. Enrollment requirements to be specified by the instructor. Course may be repeated by student for credit any number of times when different topics are presented.

Typically offered in Spring.

Repeatable for Credit.

**PHY 481. Special Topics with Lab. 3 Credits.**

Topics of special interest to be presented with a laboratory component. Enrollment requirements to be specified by the instructor. Course may be repeated by student for credit up to three times when different topics are presented.

Consent: Permission of the Department required to add.

Typically offered in Fall & Spring.

Repeatable for Credit.

**PHY 490. Introduction to Research. 1-9 Credits.**

Specific problems in consultation with the faculty adviser.

Consent: Permission of the Department required to add.

Typically offered in Fall.

Repeatable for Credit.