

SELECT UNDERGRADUATE PHYSICS COURSES

Please see <https://go.uvm.edu/physicscourses> for more courses and prerequisites. N1, N2, QD, SU are Catamount Core requirements satisfied by the course.

For a general interest in physics

PHYS 1100. The Physics of Music. 3 Credits.

Basic physical principles underlying the production, transmission and perception of musical sound. Vibrations, waves, acoustics with applications to a wide range of musical topics. N1, QD.

PHYS 1200. Energy and the Environment. 3 Credits.

Forms of energy, sources, uses, and transformations of energy: introductory seminar will place emphasis on environmental issues. Limited algebra and geometry. N1, QD, SU.

PHYS 1251. Conceptual Physics with lab. 4 Credits.

Conceptual survey. Topics selected from mechanics, electricity, magnetism and modern physics. N2, QD.

For students in health & life sciences

PHYS 1400. Elementary Physics I with lab. 4 Credits.

Algebra-based mechanics, osc., waves & thermal physics. N2, QD.

PHYS 1450. Elementary Physics II with lab. 4 Credits.

Algebra-based electricity, magnetism, optics & modern. N2, QD.

For students in engineering

PHYS 1500. Physics for Engineers I with lab. 4 Credits.

Mechanics including oscillations and waves. N2, QD.

PHYS 1550. Physics for Engineers II. 3 Credits.

Electricity, magnetism, electromagnetic waves, optics. N1, QD.

For students in a physics major or minor

First-year level courses.

PHYS 1600. Fundamentals of Physics I with lab. 4 Credits.

Calculus-based introduction to kinematics, dynamics, oscillations, thermal physics. For students in the natural sciences. N2, QD.

PHYS 1650. Fundamentals of Physics II with lab. 4 Credits.

Calculus-based introduction to electricity, magnetism and optics. For students in the natural sciences. N2, QD.

Sophomore level courses.

PHYS 2100. Experimental Physics I with lab. 3 Credits.

Classic physics experiments with a strong emphasis on experimental setup, data collection & analysis, error estimation, & presentation of results.

PHYS 2200. Classical Mechanics. 3 Credits.

Newtonian dynamics of particles and systems of particles, with applications to problems of special importance, such as driven and coupled harmonic oscillators and central field trajectories.

PHYS 2500. Waves and Quanta with lab. 4 Credits.

Classical and electromagnetic waves, relativity, wave-particle phenomenology, wave mechanics, and applications of the Schrodinger equation. N2, QD.

Junior level courses.

PHYS 3150. Computational Physics I. 3 Credits.

Introduction to modern computational techniques focusing on the simulation or solution of the behavior of physical systems. Examples will be drawn from classical, statistical, and quantum mechanics, electromagnetism, and chaos.

PHYS 3165. Integrated Circuit Fabrication. 4 Credits.

Science and technology of integrated circuit fabrication. Interaction of processing with material properties, electrical performance, economy, and manufacturability. Study of unit processes used to make semiconductor chips. Cross-listed with: [EE 3420](#).

PHYS 3300. Electricity & Magnetism. 3 Credits.

Fundamental principles of electricity and magnetism; electrostatic fields, and magnetic fields of steady currents. Electric and magnetic properties of matter and electromagnetic energy.

PHYS 3400. Thermal & Statistical Physics. 3 Credits.

Thermodynamics, kinetic theory, statistical mechanics.

PHYS 3500. Quantum Mechanics I. 3 Credits.

Introduction to nonrelativistic quantum mechanics. Schrodinger equation and applications to simple systems.

PHYS 3550. Nuclear & Elem Particle Physic. 3 Credits.

Introduction to theoretical and experimental aspects of nuclear and elementary particle physics.

PHYS 3650. Intro to Solid State Physics. 3 Credits.

Introduction to crystal structures, reciprocal lattices, lattice vibrations. Thermal properties of solids and free electron theory of metals and semiconductors. Elementary band theory and introduction to electronic transport theory.

PHYS 3700. Intro Biological Physics. 3 Credits.

General survey course in biological physics. Introduction to biological building blocks and macromolecular structure, thermostatics of biological systems, random walks, polymers, elasticity and mechanics of filaments and membranes, physics of water and molecular solvation, brownian motion and diffusion.

PHYS 3800. Intro to Cosmology. 3 Credits.

Topics related to the expanding Universe: space-time curvature, Friedmann equation, Black-body radiation, early history of the Universe, Cosmic Microwave Background, Dark Matter, Structure formation, the Cosmological constant problem, Cosmic Inflation and the early Universe, and General Relativity.

Senior level courses.

PHYS 4100. Experimental Physics II with lab. 3 Credits.

Experiments in classical and modern physics.

PHYS 4300. Electromagnetism. 3 Credits.

Introduction to time dependent electromagnetic fields. Maxwell's equations. Electromagnetic waves and radiation.

PHYS 4500. Applications of Quantum Mechanics. 3 Credits.

Applications of Quantum Mechanics including Quantum Statistical Mechanics, Time-Independent and Time-Dependent Perturbation Theory, WKB Approximation, Variational Principle and Scattering.

Special topics and variable credit courses.

PHYS 2995. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

PHYS 3991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member for which academic credit is awarded. Offered at department discretion.

PHYS 3994. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant for which credit is awarded. Offered at department discretion.

PHYS 4996. Honors. 1-6 Credits.

College honors thesis or other department/program honors, under the supervision of a faculty member. Offered at department discretion.

A GUIDE FOR PHYSICS AT UVM



The University of Vermont

A Guide for Physics Majors and Minors

UVM Physics (physics.uvm.edu) offers courses that develop and refine skills that are of a broad interest to practitioners in a wide variety of fields and disciplines. A physics major or minor indicates that you have the ability to solve a wide variety of problems and that you are comfortable in a technical setting. It tells employers that you have breadth to your technical background. Students who major in physics usually have a very broad scientific interest in a multitude of different fields. If your post-UVM plans involve professional schools such as medical school, law school or MBA programs, the problem-solving skills that come with a physics degree will get you noticed!

Physics is the discipline that describes how Nature behaves and uses observations of the world around us to make this description possible. A student of physics will be able to take a real world problem, break it apart into its components, translate each into a mathematical expression, manipulate that expression to get new results, and then translate the mathematical results back into a statement of physical reality. This skill is important for a wide variety of careers in the sciences, engineering, economics and the social sciences. Many majors require their students to take at least an elementary course in physics if only so the students can hone their skills in analytical thinking.

Academic Requirements

Bachelor of Science, Bachelor of Arts in Physics

The department offers both a Bachelors of Science (B.S.) and a Bachelors of Arts (B.A.) degree. The B.A. allows students to acquire a broad liberal arts education whereas the B.S. has a traditional Physics focus, with classes dedicated to specific topics in the field. Both degree options prepare students for graduate school or employment in industry. Students pursuing the B.S. may opt for a focus in Electrical Engineering. This leaves them prepared to sit the Fundamentals Exam (FE) for engineering and be very attractive prospects for entry-level applied science positions.

Accelerated Masters Program

The Accelerated Masters Program allows students to receive an M.S. in Physics in one year, following their B.S. degree by allowing students to apply some of their undergraduate course work towards the completion of their M.S. degree. This program is open by invitation only; students are considered for the AMP during their junior year.

Honors and Awards

University Honors such as *cum laude*, *magna cum laude*, and *summa cum laude* awarded, respectively, to the top 10%, 4%, and 1% students of each graduating class.

College Honors involves an independent research project within the Department of Physics that is directed by a faculty member. The research project, which requires 6 credits of independent research, culminates in an Honors Thesis. The student receives 6 credits of HONORS-PHYSICS on their transcript as well as receiving recognition at Honors Day in May. Eligible students are invited by the department to participate in this program. Interested students should inquire about possible research opportunities at the end of their junior year.

Albert D. Crowell Award - for outstanding undergraduate experimental research in physics. The Crowell award is awarded to students that have exceptional ability to participate in experimental work under the direction of a faculty member.

David W. Juenker Prize - for outstanding senior physics major. The Juenker prize is awarded to those who have performed outstanding service to the department and their fellow majors as well as to those who have achieved an outstanding academic record. Recent recipients have gone on to graduate schools (often after completing their Master's degree at UVM) like M.I.T., Stanford, Cornell, RPI, and the University of Illinois at Champaign-Urbana.

Research

Undergraduate students have the opportunity to conduct a research project under the direction of a faculty member. Such projects can be carried out as part of their honors work to receive College Honors, or as a Special Topics course. Recent undergraduate honors research projects include:

Jared C. Benson, "*Temperature Dependent Charge Transport Characteristics of Ferroelectric Organic Field Effect Transistors*"

Michael V. Arnold, "*Optical and Electronic Investigation of Hydrogen-Bonded Organic Semiconductor Quinacridone*"

Renee Beneeski, "*Critical Films on Graphene Substrates*"

Alice Dennett Blake, "*The Entanglement Entropy and Quantum Sticking of a Cold Atom*"

Hannah Ace, "*Plasmaspheric dynamics studied using a three-dimensional machine learning-based plasma density model in the inner magnetosphere and the ionosphere*"

Typical Bachelor of Science in Physics Course Scheduling

Year 1:

Fall: PHYS 1600; MATH 1234; CHEM 1400; CS 1210; CEMS 1500.
Spring: PHYS 1650; MATH 1248; CHEM 1450

Year 2:

Fall: PHYS 2100; PHYS 2500; MATH 2248
Spring: PHYS 2200, PHYS elective; MATH 2544 or 2522

Year 3:

Fall: PHYS 3300; PHYS elective; MATH 3230
Spring: PHYS 4100, PHYS 3400 and/or PHYS electives;

Year 4:

Fall: PHYS 3500 and/or PHYS elective;
Spring: PHYS 3400 or PHYS elective; PHYS 4500/4300

Major and Minor Requirements

Check UVM Catalogue for most up to date information.

Bachelor of Science

- Physics: PHYS 1600, 1650, PHYS 2500, PHYS 2100, PHYS 4100, PHYS 2200, PHYS 3300, PHYS 3400, PHYS 3500; PHYS 4300 or PHYS 4500; PHYS 3400, six intermediate credits, and six more credits from intermediate courses, internships, and/or research.
- Mathematics: MATH 1234, MATH 1248, MATH 2248; MATH 3201 or MATH 3230; MATH 2544.
- Chemistry: CHEM 1400 and one additional course in Chemistry (CHEM 1450 recommended).
- Computer Science: CS 1210.
- CEMS 1500.

Bachelor of Arts

- Physics Department Requirements: PHYS 1600, 1650 (or PHYS 1500 and PHYS 1550 with PHYS 1560), PHYS 2200, PHYS 2500, PHYS 2100 or PHYS 4100, PHYS 3300, PHYS 3500; nine additional credits of approved physics electives at intermediate level (three of which may be research or internships).
- Mathematics: Mathematics through MATH 2248 and three hours of approved mathematics electives above 2248.
- An additional laboratory science is strongly recommended.

Minor in Physics

- PHYS 1600, 1650 (or PHYS 1500 and PHYS 1550 with PHYS 1560), PHYS 2500; three additional hours at the intermediate level. Note: Mathematics through 2248 is needed for 2500.

Minor in Astronomy

Sixteen hours in Astronomy including ASTR 1400; three courses selected from ASTR 2160, 2100, 2140, 2120; three additional intermediate credits in ASTR.