

# PHYSICS (PHYS)

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## PHYS 10100 Introduction to Physics I (LA)

Principles and concepts of classical physics (algebra-based). Mechanics, including rotational motion and energy and momentum conservation, properties of matter. Three lectures and one recitation/laboratory per week or three two-hour lecture/recitation/laboratory sessions per week. Prerequisites: Math placement score 2 or 1 or completion of MATH 10400, MATH 10800, or MATH 11000 (with a C- or better). (F,Y)  
Attributes: 2A, NS  
4 Credits

## PHYS 10200 Introduction to Physics II (LA)

A continuation from PHYS 10100 of the principles and concepts of classical physics (algebra-based). Standing waves and sound, physical and geometrical optics, electrostatics, magnetism, DC circuits, fluids, heat, and thermodynamics. Three lectures and one recitation/laboratory per week or three two-hour lecture/recitation/laboratory sessions per week. Prerequisite: PHYS 10100. (S,Y)  
Attributes: ABSS  
4 Credits

## PHYS 10400 Physics of Human Movement (LA)

Introductory course in Newtonian mechanics (algebra-based) applied to movement of and within the human body. Covers fundamental principles and concepts of physics including: projectile motion, rotational motion, torque, and energy and momentum conservation. Prerequisite: Math placement in group 2 or 1 or MATH 11000. (F,Y)  
Attributes: 2A, SC, TIII  
3 Credits

## PHYS 11001 Mathematical and Computational Skills for Physics (LA)

Bridges mathematics and computational skills to physical applications and prepares students for future study in Physics and Astronomy. The aim of this course is to develop tools for quantitatively analyzing problems common to courses in the Physics and Astronomy majors. Prerequisites: Math placement group 1 or 1\*. (F,Y)  
1 Credit

## PHYS 11400 Professional Physics and Astronomy Seminar I (NLA)

Introduction to the physics program for all beginning physics majors or those considering the major. Discussions about career opportunities, the various physics degree paths, and strategies for being a successful and engaged physics major. Participation in the physics department seminar required. Pass/Fail only. (F,Y)  
1 Credit

## PHYS 11700 Principles of Physics I: Mechanics (LA)

Intended as the first semester of calculus-based college physics for students majoring in science or mathematics. Topics include vectors, kinematics in one and two dimensions, dynamics, work, energy, momentum, rotational motion. Emphasis is placed on the mathematical analysis of concepts. Three two-hour lecture/recitation/laboratory sessions per week. Prerequisites: MATH 11100 (may be taken concurrently). (F,Y)  
Attributes: 2A, NS  
4 Credits

## PHYS 11800 Principles of Physics II: Electricity and Magnetism (LA)

Intended as the second semester of calculus-based college physics for students majoring in science or mathematics. Topics include static electric fields and Coulomb's law, Gauss's law, electric potential, capacitors, Ohm's law, the magnetic field and Ampere's law, induction and Faraday's law, and elementary circuit theory. Emphasis is placed on mathematical analysis. Three two-hour lecture/recitation/laboratory sessions per week. Prerequisites: PHYS 11700; MATH 11200 (may be taken concurrently). (S,Y)  
Attributes: 2A, NS  
4 Credits

## PHYS 12000 Introductory Applied Physics Laboratory (LA)

A laboratory course designed to develop experimental skills. Focus is on the use of modern electronics and computers to measure and analyze data. Students construct analog and digital circuits and then use them to carry out experiments illustrating physical principles from mechanics and electricity and magnetism. Prerequisite: PHYS 11700. (S,Y)  
Attributes: NS, QL  
3 Credits

## PHYS 14300 Power: Energy Options for a Global Society (LA)

Survey of energy. Topics include energy technologies and energy resources (fossil fuels, nuclear, solar, wind, geothermal, biomass). Students are introduced to electricity, heat production and transfer, heat engines, energy efficiency, and sustainable energy systems. Energy use sectors such as residential, commercial, and transportation are examined. The course begins with a look at energy use in the home and gradually expands to complex subjects such as the electrical grid, national energy policy, deregulation, and international fusion research. The emphasis is on energy literacy and the goal is to provide students with the basic technical principles necessary to design energy projects of their own and to evaluate their costs and benefits. (S,E)  
Attributes: 2A, NS  
3 Credits

## PHYS 16000 Physics of Sound (LA)

Physical basis of sound, with an emphasis placed on musical instruments, the human voice, and sound recording and reproduction. Physics concepts are introduced and developed as needed to understand these areas. Open to all students. Prerequisites: Math placement score 2 or 1 or completion of MATH 10400, MATH 10800, or MATH 11000 (with a C- or better). (Y)  
Attributes: 2A, NS  
3 Credits

## PHYS 17100 Earth: Evolution of a Habitable World (LA)

Formation and evolution of planet Earth from the astronomer's perspective: creation of elements, the first rocks, development of oceans, the first atmosphere, formation of the moon, records of climate history, and how life on Earth fits into the context of life in the universe. Examination of Venus and Mars as possible analogs for Earth's evolution (past and future). Other topics include the influence of the sun on Earth's climate, the greenhouse effect, the geologic record of the development of continents, and the asteroid and comet impact hazard. Emphasis is placed on our sources of knowledge, the errors of our measurements, and the attendant model uncertainties in predicting Earth's future. Students may not receive credit for both PHYS 17100 and PHYS 17200. Prerequisites: Math placement score 3 or 2 or 1 or completion of MATH 10000 (with a C- or better). (S,Y)  
Attributes: 2A, NS  
3 Credits

**PHYS 17200 Earth: Evolution of a Habitable World with Lab (LA)**

Formation and evolution of planet Earth from the astronomer's perspective: creation of elements, the first rocks, development of oceans, the first atmosphere, formation of the moon, records of climate history, and how life on Earth fits into the context of life in the universe. Examination of Venus and Mars as possible analogs for Earth's evolution (past and future). Other topics include the influence of the sun on Earth's climate, the greenhouse effect, the geologic record of the development of continents, and the asteroid and comet impact hazard. Emphasis is placed on our sources of knowledge, the errors of our measurements, and the attendant model uncertainties in predicting Earth's future. Students enrolled in this course attend the lecture of PHYS 17100, but also meet for an additional weekly lab. Students may not receive credit for both PHYS 17100 and PHYS 17200. Prerequisites: Math placement in group 3 or 2 or 1 or completion of MATH 10000 (with a C- or better). (S,Y)

Attributes: 2A, NS

4 Credits

**PHYS 21400 Professional Physics and Astronomy Seminar II (NLA)**

Continuation of professional preparation for careers in physics and astronomy. Covers introduction to effective communication skills, effective teamwork strategies, and includes tutorials in software commonly used in physics careers. Students will also engage in a series of discussions about undergraduate research, summer opportunities for research and internships, and careers in physics, and will draft resumes and cover letters. (F,Y)

1 Credit

**PHYS 21700 Principles of Physics III: Waves, Optics and Thermodynamics (LA)**

The third semester of the introductory sequence for science majors. Topics include the first and second laws of thermodynamics, Maxwell distribution, entropy, geometrical optics, interference, diffraction (single and double slits and gratings), optical spectra, and polarization. Prerequisites: PHYS 11800; MATH 11200. (F,Y)

Attributes: NS

4 Credits

**PHYS 21800 Principles of Physics IV: Modern Physics (LA)**

A course aimed at giving students a working knowledge of the concepts of modern physics. Topics include the theory of relativity, interaction of photons with matter, quantum theory, the hydrogen atom, statistical and solid state physics, nuclear physics, and elementary particles.

Prerequisites: PHYS 21700. (S,Y)

Attributes: ENRE, NS

4 Credits

**PHYS 22500 DC and AC Circuits (LA)**

Experiments on DC and AC circuits, with emphasis placed both on test instruments and accurate measurements, and on mathematical analysis and theory (including the use of complex numbers for AC theory). Circuits include steady state and transient RC and RL, and series and parallel RLC. Prerequisites: PHYS 11800; PHYS 12000. (F,Y)

Attributes: ENRE, NS

3 Credits

**PHYS 24300 Sustainable Energy: Powering the World (LA)**

Survey of energy. Topics include solar, wind, geothermal, electricity, fossil fuels, heat transfer, and the economic and environmental opportunities created by energy efficiency and sustainable energy systems. The course culminates with a final Energy Design Project. Cross-listed as ENVS 24300. Students may not earn credit for both ENVS 24300 and PHYS 24300. Prerequisite: Math placement score 2 or 1 or completion of MATH 10400, MATH 10800, or MATH 11000 (with a C- or better). (S,Y)

Attributes: NS, QL, SC, TQSF

4 Credits

**PHYS 28000 Learning Assistant Practicum in Physics (NLA)**

This course prepares our undergraduate Learning Assistants with the foundations of pedagogy necessary to assist our introductory physics students with their coursework. Additionally, this course provides procedural support for the Learning Assistants by strengthening students' pedagogical content knowledge. Prerequisites: B or higher in PHYS 10100, PHYS 10200, PHYS 10400, PHYS 11700, PHYS 11800, PHYS 16000, ASTR 17400, or ASTR 17500. (F,S)

1 Credit

**PHYS 29400 Introductory Independent Study: Physics (LA)**

One-semester course in which a student may pursue a topic of interest in physics. Offered on demand only. May be repeated up to a total of six credits. Prerequisites: Sophomore standing or above; permission of instructor.

0.5-3 Credits

**PHYS 29900-29910 Introductory Physics Research (LA)**

Original research participation with a faculty member in a specialized field. Prerequisites: Sophomore standing or above; permission of instructor. Six credit limit. (F-S,Y)

0.5-3 Credits

**PHYS 30100 Mathematical Methods of Physics (LA)**

Algebra of complex numbers and complex functions, vector calculus, introduction to linear algebra, ordinary differential equations, Fourier and Legendre series, and partial differential equations with applications to selected physics topics. There will be several exercises using computer analysis. Prerequisites: COMP 17100; MATH 21100; PHYS 21800. (F,Y)

Attributes: NS

3 Credits

**PHYS 30500 Electromagnetism (LA)**

An intermediate course in electricity and magnetism that builds on the foundation received in PHYS 11800. Topics include electric and magnetic fields, Gauss's law, electric potential, circuits, Ampere's law, Faraday's law, and Maxwell's equations. There will be several exercises using computer analysis. It is highly recommended that MATH 21200 Calculus IV be taken prior to this course. Prerequisites: COMP 17100; MATH 21100; PHYS 21700. (F,Y)

Attributes: NS

3 Credits

**PHYS 31100 Classical Mechanics (LA)**

Intermediate mechanics, including statics and dynamics of particles and rigid bodies, central forces, planetary motion, and Lagrange's equations. Extensive computer analysis. Culminates in a computational simulation of a physical system based on the equations of motion. Prerequisites: Either PHYS 30100 or the combination of PHYS 21800, MATH 21400, and MATH 23100. (S,Y)

Attributes: NS

3 Credits

**PHYS 31400 Professional Physics and Astronomy Seminar III (NLA)**

Continuation of professional preparation for careers in physics and astronomy. Students will practice both written and oral communication skills and model effective teamwork strategies. Students will also engage in a series of discussions about careers in physics, and how to maximize opportunities in the junior and senior years to be competitive in the job market. Prerequisites: PHYS 21400. (F,Y)

1 Credit

**PHYS 32000 Thermodynamics (LA)**

Topics include laws of thermodynamics with applications, thermodynamic functions and potentials, kinetic theory, real and idealized systems, and intermolecular processes. Prerequisites: PHYS 21700. (S,Y)

Attributes: NS

3 Credits

**PHYS 32600 Analog Electronics (LA)**

A laboratory course on electronics covering the origination, amplification, processing, and digital conversion of analog signals. Experiments involve bipolar transistors, operational amplifiers, active and passive filters, oscillators, and analog-to-digital and digital-to-analog converters. Emphasis is placed on the basic theory underlying the circuits and devices and on general lab techniques. Prerequisites: PHYS 22500. (S,E)

Attributes: ENRE, NS

3 Credits

**PHYS 34000 Linking Science Learning to Science Teaching (LA)**

This course reviews the science education literature and discusses successful approaches to helping K12 and college students learn science. The course provides an opportunity for students thinking about careers in teaching science, or serving as a science teaching assistant in graduate school, to consider research-based best practices for helping students learn science. Prerequisite: QL designated course; Junior standing or above. (F,Y)

Attributes: NS

1 Credit

**PHYS 36000 Advanced Physics Laboratory (LA)**

An advanced laboratory course in which students are expected to conduct four or five investigations in areas such as mechanics, optics, thermodynamics, and electricity and magnetism. Emphasis is placed on the development of good laboratory techniques and data-taking procedures. Students are expected to become familiar with modern developments in instrumentation, formal report writing (in LaTeX), and the statistical basis for data and uncertainty analysis. Includes both independent work and work in teams. Prerequisites: COMP 17100; PHYS 21800; PHYS 22500; PHYS 31400 (may be taken concurrently). (S,Y)

Attributes: ENRE, NS

3 Credits

**PHYS 36100 Applied Physics Design Laboratory (LA)**

An advanced laboratory course in which students will learn how to apply the engineering design process to identify a design need, consider the associated requirements and constraints of the project, brainstorm design solutions, analyze the proposed solutions to identify the strongest option, build a prototype, and iterate through stages of testing and improvement until a viable end product is produced. Students work as part of a design team with individual responsibilities and will practice presenting their design through "pitches" and customer presentations. All students will complete post-design reflections. Prerequisite: COMP 17100; PHYS 21800; PHYS 22500; PHYS 31400. (F,Y)

3 Credits

**PHYS 39400 Intermediate Independent Study: Physics (LA)**

One-semester course in which a student may pursue a topic of interest in physics. Offered on demand only. May be repeated for a total of six credits. Prerequisites: PHYS 21800; Junior standing or above; permission of instructor. (IRR)

0.5-3 Credits

**PHYS 39800 Senior Thesis Proposal (LA)**

Provides opportunity for physics majors to prepare a written proposal in preparation for senior thesis research. Emphasis placed on describing the problem, methodology, equipment, and data analysis needed to successfully complete the research project. Completed proposals are submitted to each student's research advisor for review and approval.

Corequisites: PHYS 49900. (S,Y)

Attributes: NS

1 Credit

**PHYS 39900-39910 Intermediate Physics Research (LA)**

Original research participation with a faculty member in a specialized field. Intended for students with prior experience from PHYS 29900-29910. Prerequisites: Permission of instructor. Six credit limit. (F-S,Y)

0.5-3 Credits

**PHYS 41400 Professional Physics and Astronomy Seminar Capstone (LA)**

Provides opportunities for students to explore connections between the integrative core curriculum, the physics major, other learning experiences while at Ithaca College or abroad, and future goals. Students will develop a written reflection and engage in career preparation activities.

Prerequisite: Physics majors; senior standing. (F,Y)

Attributes: CP, NS

1 Credit

**PHYS 42100 Quantum Mechanics (LA)**

Emphasis is placed on understanding the nature of quantum theory and how it differs from classical ideas. Topics include the uncertainty principle, the Schrödinger equation and solutions to various potentials, angular momentum, and the one-electron atom. Prerequisites: Either PHYS 30100 or a combination of PHYS 21800, MATH 21400, and MATH 23100. (F,Y)

Attributes: NS

3 Credits

**PHYS 44000 Inquiry and the Nature of Science for the Science Teacher (LA)**

Considers issues pertaining to the nature and practice of science, especially as they relate to science education. Explores aspects that distinguish scientific inquiry from other forms of inquiry. Examines safety issues of teaching science in a classroom, and teaching science in the context of the community. Cross-listed with CHEM 44000 and PHYS 44000. Students can receive credit for only one of: BIOL 44000, PHYS 44000, CHEM 44000. Prerequisites: EDUC 34000 and junior standing. (IRR)

Attributes: NS

3 Credits

**PHYS 45500 Electrodynamics (LA)**

Building on the foundation gained in PHYS 30500, this course completes the mathematical treatment of electromagnetic fields, including: electric and magnetic fields in matter, energy and momentum of EM fields, EM waves, EM potential theory, EM radiation, and special relativity.

Prerequisites: PHYS 30500. (IRR)

Attributes: NS

3 Credits

**PHYS 47000-47001 Selected Topics in Advanced Physics (LA)**

An advanced course in which students apply their physics skills to advanced topics. Current topics will be chosen based on faculty and student interests and may include environmental science, geophysics, and physics topics such as atomic, condensed matter, nuclear, and optical physics. This course may be repeated for credit for selected topics on different subjects. Prerequisites: PHYS 21800. (Y)

Attributes: NS

1.5-3 Credits

**PHYS 48900 Review of Undergraduate Physics (LA)**

Review of all the major topics in the physics curriculum, both at the introductory and advanced level. Instruction and practice in taking standardized multiple choice exams, including the Physics GRE. Course culminates in a comprehensive examination. Prerequisites: PHYS 21800; senior standing; Physics majors only. (S,Y)

1 Credit

**PHYS 49300 Senior Project Proposal (LA)**

First half of the capstone experience in which students design, conduct, and report on a senior project. The final project can be a research paper, theory project, computational project, engineering project, or experimental project. Emphasis placed on independent work. Culminates in a formal written proposal. Prerequisites: PHYS 36000 or PHYS 32600 (may be taken concurrently); WRTG 10600 or equivalent; open only to physics majors. (F,Y)

Attributes: WI

1 Credit

**PHYS 49301 Senior Design Team I (LA)**

First half of the capstone experience in which students create and begin to implement a solution to a design challenge. Students will pitch a design solution (both orally and in writing) then work in teams to further develop and begin implementing their proposed solution. Students will learn about project management and resources available to organize tasks. Progress reports will provide students with opportunity for reflection and writing practice. The course will culminate in a team demonstration of the in-process design prototype. Prerequisites: PHYS 31400; PHYS 36100. (F,Y)

2 Credits

**PHYS 49500 Senior Project (LA)**

Second half of the capstone experience in which students complete a senior project, culminating in a formal written project report. Emphasis placed on independent work. Prerequisite: PHYS 49300; WRTG 10600 or equivalent; open only to physics majors. (S,Y)

Attributes: NS, WI

2 Credits

**PHYS 49501 Senior Design Team II (LA)**

Second half of the capstone experience in which students complete and present their solution to a design challenge. Students will reinforce project management, communication, and teamwork skills. Progress reports will provide students with opportunities for reflection and writing practice. Students will complete a design report describing their iterative design process and ultimate solution to their design challenge. The course will culminate in a team demonstration of the final design solution. Prerequisites: PHYS 49301. (S,Y)

2 Credits

**PHYS 49600 Internship in Physics (NLA)**

Designed to offer applications of physics concepts in a setting appropriate to students' interest and training. Internships are arranged individually at the student's request with an instructor and a sponsoring agency and with departmental approval. Students must follow the guidelines of the School of Humanities and Sciences and complete the H&S internship application. Prerequisites: Permission of instructor. 1- (IRR)

1-12 Credits

**PHYS 49700 Senior Thesis I (LA)**

Capstone experience in which seniors prepare, summarize, present and defend their own basic or applied research in physics in a formal written thesis. Emphasis on development of the first draft of the senior thesis. Prerequisite: WRTG 10600 or ICSM 108xx or ICSM 118xx; PHYS 39800, concurrent enrollment in PHYS 49900-PHYS 49910; open only to physics majors. (F,Y)

Attributes: NS, WI

1 Credit

**PHYS 49800 Senior Thesis II (LA)**

Capstone experience in which seniors prepare, summarize, and present, their own basic or applied research in physics in a formal written thesis. Completion of final draft of the senior thesis, and presentation of thesis research required. Corequisites: PHYS 49900. Prerequisites: PHYS 49700. (S,Y)

Attributes: NS, WI

1 Credit

**PHYS 49900-49910 Advanced Physics Research (LA)**

Original research participation with a faculty member in a specialized field. Intended for students with prior experience from PHYS 39900-39910. Prerequisites: Permission of instructor. Six credit limit. (F-S,Y)

0.5-3 Credits