

# Engineering Physics

Physicists are concerned with an extremely broad range of natural phenomena extending from the submicroscopic world of elementary particles to the vast reaches of the cosmos and the origins of the universe, from the simplest of everyday activities to the behavior of matter at the furthest extremes in energy, temperature, distance, and time.

The defining characteristic of physics is the quest for the underlying logic—the theoretical structure that unifies and explains all the different phenomena that are studied experimentally. Experiments and theoretical work alike are motivated primarily by this quest. As a by-product, physicists have pioneered many of the basic ideas on which our modern technology rests, such as transistors and lasers, and perhaps someday fusion energy.

## Pursuing Engineering Physics at Ohio State

The most important preparation for a major in engineering physics is strong high school science and math. Students should have had some calculus or be prepared to begin calculus upon arrival.

Students who come to Ohio State to study engineering that have a minimum ACT Math score of 24 or SAT Math score of 560 will be directly enrolled as pre-engineering students in the College of Engineering. Students directly enrolled in the College of Engineering may pre-select an engineering major, or if they wish to spend the first year examining the engineering options, they may enroll in engineering undecided. In either case, these students will be enrolled in a pre-major sequence of courses, including math, chemistry, physics, engineering basics, and English, which provide the fundamental background for all engineering disciplines.

Those not eligible to directly enroll in engineering may enroll in the Science and Technology Exploration Program that is part of our Exploration Program described further at [exploration.osu.edu](http://exploration.osu.edu).

The Department of Physics wants to become involved with students as soon as they know that they intend to become engineering physics majors, which can be as early as their first arrival at Ohio State. Those who intend to major in engineering physics or are interested in exploring that option should visit the Undergraduate Studies Office, Department of Physics, room 1040K Physics Research Building, or call the vice chair for Undergraduate Studies, (614) 292-8523.

## Program Educational Objectives

- Provide students with the opportunity to master the fundamental areas of physics: classical mechanics, electromagnetism, quantum mechanics, and thermodynamics
- Provide students with the opportunity to develop a strong background in one of the following fields of engineering: aeronautical and astronautical engineering, chemical and biomolecular engineering, computer and information science, electrical engineering, industrial and systems engineering, and nuclear engineering

- Allow students to develop problem-solving skills and the ability to analyze physical systems and to understand the theoretical framework which applies to them
- Provide students with a basic mastery of experimental science, including an understanding of data reduction and error analysis
- Teach students to communicate effectively both orally and in writing
- Provide students with the opportunity to develop a basic knowledge of and facility with computing

## Physics Requirements

There are two different options for obtaining a physics degree at Ohio State: a Bachelor of Science in Physics (through the College of the Arts & Sciences) or a Bachelor of Science in Engineering Physics (through the College of Engineering). Within each option there is a set of standard college requirements plus math and physics requirements that are roughly the same for both options. A student who is interested in studying physics should consider carefully which program to choose. The courses of study are very similar and prepare students for a variety of outcomes including graduate school in physics, astronomy, math, or engineering; professional school; and employment as engineers, programmers, teachers, technicians, and scientists. Students interested in finding more information on the Physics major can visit [www-afa.adm.ohio-state.edu/u-majors/pdf/physics.pdf](http://www-afa.adm.ohio-state.edu/u-majors/pdf/physics.pdf).

Students in the engineering physics major choose which area (or concentration) of engineering on which they want to focus. Students are required to take at least 30 credit hours of technical electives in the engineering concentration of their choice.

Engineering concentrations currently available for engineering physics majors:

- Aeronautical and Astronautical Engineering
- Chemical and Biomolecular Engineering
- Computer and Information Science
- Electrical and Computer Engineering
- Industrial and Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Nuclear Engineering

## Co-Curricular Opportunities

Ohio State offers many opportunities for students to learn and grow outside of the classroom. These range from cooperative education (co-op) and internships, study abroad programs, and research experiences to involvement in student organizations.

The Department of Physics encourages all of its students to become involved in research with a faculty member on one of many active research programs. This is an excellent opportunity to learn about and become involved in cutting edge physics research and discoveries. Areas of research include astrophysics, nuclear and elementary particle physics, string theory, solid state physics,

**For more information, check these web sites:**

**Engineering Physics:** [physics.ohio-state.edu/undergrad](http://physics.ohio-state.edu/undergrad)  
**College of Engineering:** [engineering.osu.edu](http://engineering.osu.edu)  
**Ohio State:** [osu.edu](http://osu.edu)

**Admissions:** [undergrad.osu.edu](http://undergrad.osu.edu)  
**Multicultural Center:** [multiculturalcenter.osu.edu](http://multiculturalcenter.osu.edu)  
**First Year Experience Program:** [fye.osu.edu](http://fye.osu.edu)

## Curriculum Sample

This is a sample list of classes that a student will take to pursue a degree in Engineering Physics. Since university students need more than specific education in a narrow field, they also will take classes to complete the General Education Curriculum (GEC). The GEC will allow students to develop the fundamental skills essential to collegiate success across major programs. Course work options satisfying the GEC often come from a variety of academic areas of study allowing students to tailor their GEC toward their interests. Note: This sample represents one of several possible paths to a degree in Engineering Physics. Consult the Department of Physics Undergraduate web site, [physics.ohio-state.edu/undergrad](http://physics.ohio-state.edu/undergrad) for details on each specific track.

### Freshmen Year:

Engineering survey	1
Introductory Engineering	6
Calculus & Analytic Geometry I, II, III	15
Introductory Physics* I, II, III	15
Computer Programming	4
GEC courses	10
<b>Total hours</b>	<b>51</b>

### Sophomore Year:

Calculus & Analytic Geometry IV	5
Differential Equations	4
Vector Analysis	3
Dynamics of Particles & Waves I, II, II	12
Physics Seminar	1
Data Analysis Physics Lab	4
General Chemistry	10
GEC courses	9
<b>Total hours</b>	<b>48</b>

### Junior Year:

Linear Algebra	3
Introductory Electronics Lab	4
Fields & Waves I, II	8
Quantum Mechanics I, II, III	12
Physics Elective	4
Technical Electives	15
GEC course	5
<b>Total hours</b>	<b>51</b>

### Senior Year:

Senior Writing Course (Physics)	3
Statistical Physics I	4
Advanced Physics Lab	4
Technical Electives	15
GEC courses	15
<b>Total hours</b>	<b>41</b>

\* Well-qualified students are encouraged to start the honors version of the introductory physics sequence autumn quarter of their first year.

superconductivity, and low temperature physics. In addition, undergraduate physics student organizations have many activities, including hosting guest physicists who speak about their research.

## Honors & Scholars Programs

The department supports an active honors program, starting with the honors sequence Physics H131, H132, H133, which must be started in the autumn quarter and is recommended for well-qualified entering freshmen. The honors program culminates in research experience in a faculty member's area of specialization.

## Career Prospects in Physics

In today's fast-changing society a physicist may play a number of important roles—sometimes simultaneously. As workers in basic research, physicists may help expand the frontiers of knowledge of the physical universe; as teachers in high schools, colleges, or universities, physicists may help transmit to others knowledge and appreciation of that universe and of the scientist's ways of investigating and understanding it.

In an industrial laboratory or government agency, graduates may deal with the application of fundamental knowledge to the development of solutions for a variety of practical problems or manage large scientific or technical programs. In collaboration with colleagues in other disciplines, physicists may help address problems spanning a number of important areas of current public concern such as energy usage, radiation hazards, and environmental issues.

Recent graduates in engineering physics have been employed at salaries in the range of \$40,000 to \$55,000.

## More About Engineering Physics

The Department of Physics distinctions

Distinguished faculty and staff:

- OSU Alumni Award for Distinguished Teaching (1997, 1999, 2000, 2001, 2003, 2004, 2005, 2007, 2008, 2009)
- OSU Distinguished Undergraduate Research Mentor Award (2007, 2008)
- many National Science Foundation Young investigator awards, Sloan Research Fellows, American Association for the Advancement of Science (AAAS) Fellows, and American Physical Society (APS) Fellows.
- Distinguished Scholar Award (2007)
- Faculty Award for Distinguished Service (2008)
- OSU Distinguished Staff Award (2009)

Distinguished students:

- 12 Goldwater Scholarship recipients in the past 10 years
- 11 National Science Foundation (NSF) Fellowship recipients in the past 10 years
- 2007 Rhodes Scholar
- Two 2009 Gates-Cambridge Scholarship Finalists
- 1st, 2nd, 3rd, and 4th place winners of the Denman Research Forum

Recent graduates of the physics program have gone on to study physics, engineering, and astronomy at top universities such as Harvard University, Stanford University, University of Pennsylvania, University of Oxford, University of Hawaii, and University of Chicago.

**Revised July 2009.** For the most up-to-date information on the engineering physics major visit [physics.ohio-state.edu/undergrad](http://physics.ohio-state.edu/undergrad).

## Contact information:

Undergraduate Program Coordinator | Department of Physics  
Office of Undergraduate Studies | 1040K Physics Research Building  
191 West Woodruff Avenue | Columbus, Ohio 43210-1168 | (614) 292-8523