

ENGINEERING PHYSICS

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<http://physics.case.edu/undergraduate-programs/undergrad-degree-programs/bsdegree-engrphys/>
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The Engineering Physics major allows students with strong interests in both physics and engineering to concentrate their studies in the common areas of these disciplines. The Engineering Physics major prepares students to pursue careers in industry, either directly after undergraduate studies, or following graduate study in engineering or physics. Many employers value the unique problem-solving approach of physics, especially in industrial research and development. Its engineering science and design components prepare students to work as professional engineers.

Students majoring in engineering physics complete the Engineering Core as well as a rigorous course of study in physics. Students select a concentration area from an engineering discipline and must complete a sequence of at least four courses in this discipline. In addition, a senior research project under the guidance of a faculty member is required. The project includes a written report and participation in the senior seminar and symposium.

The Bachelor of Science in Engineering degree program with a major in Engineering Physics is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

Mission

The mission of the Engineering Physics program is to prepare students for careers in engineering where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while providing a firm foundation for the pursuit of graduate studies in either engineering or physics. The Engineering Physics program will develop sufficient depth in both engineering and physics skills to produce engineers who can relate fundamental physics to practical engineering problems and will possess the versatility to address new problems in our rapidly changing technological base. The program will provide a curriculum and environment to develop interdisciplinary collaboration, ethical and professional outlooks, communication skills, and the tools and desire for life-long learning.

Program Educational Objectives

1. Graduates of the Engineering Physics program will apply their strong problem-solving skills as physicists along with an understanding of the approach, methods, and requirements of engineering and engineering design for a successful career in advancing technology.
2. Graduates of the Engineering Physics program will use their strong skills in problem-solving, research experience and knowledge in physics and engineering as successful graduate students and researchers in highly ranked graduate programs.

Student Outcomes

As preparation for achieving the above program educational objectives, the Bachelor of Science in Engineering degree program with a major in Engineering Physics is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs
- an ability to function in multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively

Bachelor of Science in Engineering Required Courses: Major in Engineering Physics

In addition to engineering general education requirements (<http://bulletin.case.edu/undergraduatestudies/csdegree/>) and university general education requirements (<http://bulletin.case.edu/undergraduatestudies/degreeprograms/>), the major requires the following courses:

Major Required Courses

PHYS 208	Instrumentation and Signal Analysis Laboratory	4
PHYS 221	Introduction to Modern Physics	3
PHYS 250	Computational Methods in Physics	3
PHYS 310	Classical Mechanics	3
PHYS 313	Thermodynamics and Statistical Mechanics	3
PHYS 317	Engineering Physics Laboratory I	3
PHYS 318	Engineering Physics Laboratory II	4
PHYS 324	Electricity and Magnetism I	3
PHYS 325	Electricity and Magnetism II	3
PHYS 331	Introduction to Quantum Mechanics I	3
PHYS 352	Senior Physics Project Seminar ^a	1
PHYS 353	Senior Engineering Physics Project ^a	2

and one of the following courses (Applications of Quantum Mechanics):

ECSE 321	Semiconductor Electronic Devices	
PHYS 315	Introduction to Solid State Physics	
PHYS 327	Laser Physics	
PHYS 332	Introduction to Quantum Mechanics II	

Breadth Elective Sequence 38-39

- a Two semester course. Students may elect to satisfy the SAGES capstone requirement by completing one of the SAGES capstone courses in another department in the Case School of Engineering in place of PHYS 352 and PHYS 353. Students selecting this option must also complete a 3-credit hour technical elective satisfied by any 200 level or above course in the Case School of Engineering.

Engineering Physics Concentration

Engineering Physics majors must complete a sequence of at least four upper-level courses in an engineering concentration. Students should seek advice from those engineering representatives listed below to select the courses consistent with scheduling, student preparation, and student interest. Both the program representative and the student's adviser must approve the sequence. Following approval, students must submit the paperwork to undergraduate studies to ensure credit for the sequence toward graduation.

Biomedical Engineering (Contact: Prof. Dustin Tyler)
Civil and Environmental Engineering (Contact: Prof. Xiong (Bill) Yu)
Electrical, Computer, and Systems Engineering (Contact: Prof. Pedram Mohseni)
Macromolecular Science and Engineering (Contact: Prof. Gary Wnek)
Mechanical and Aerospace Engineering (Contact: Prof. Paul Barnhart)
Materials Science and Engineering (Contact: Prof. Frank Ernst)

Bachelor of Science in Engineering

Suggested Program of Study: Major in Engineering Physics

The following is a suggested program of study. Current students should always consult their advisers and their individual graduation requirement plans as tracked in SIS (<http://case.edu/sis/>).

First Year	Units	
	Fall	Spring
Principles of Chemistry for Engineers (CHEM 111)**	4	
Calculus for Science and Engineering I (MATH 121)** ^a	4	
General Physics I - Mechanics (PHYS 121)** ^b	4	
SAGES First Seminar*	4	
PHED Physical Education Activities*		
Calculus for Science and Engineering II (MATH 122)** ^a		4
General Physics II - Electricity and Magnetism (PHYS 122)** ^b		4
Elementary Computer Programming (ENGR 131)** ^c		3
Chemistry of Materials (ENGR 145)**		4
SAGES University Seminar*		3
PHED Physical Education Activities*		
Year Total:	16	18

Second Year	Units	
	Fall	Spring
Calculus for Science and Engineering III (MATH 223)**	3	
Introduction to Modern Physics (PHYS 221)	3	
Statics and Strength of Materials (ENGR 200)**	3	
Introduction to Circuits and Instrumentation (ENGR 210)**	4	
SAGES University Seminar*	3	
Elementary Differential Equations (MATH 224)**		3

Instrumentation and Signal Analysis Laboratory (PHYS 208)	4	
Computational Methods in Physics (PHYS 250)	3	
Classical Mechanics (PHYS 310)	3	
Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)**	4	
Year Total:	16	17

Third Year	Units	
	Fall	Spring
Thermodynamics and Statistical Mechanics (PHYS 313)	3	
Engineering Physics Laboratory I (PHYS 317)	3	
Advanced Laboratory Physics Seminar (PHYS 303)	1	
Introduction to Quantum Mechanics I (PHYS 331)	3	
Engineering Concentration ^d	3	
Breadth elective**	3	
Engineering Physics Laboratory II (PHYS 318)		4
Electricity and Magnetism I (PHYS 324)		3
Professional Communication for Engineers (ENGL 398)		3
& Professional Communication for Engineers (ENGR 398)**		
Breadth elective**		3
Engineering Concentration ^d		3
Year Total:	16	16

Fourth Year	Units	
	Fall	Spring
Electricity and Magnetism II (PHYS 325)	3	
Senior Physics Project Seminar (PHYS 352) ^f	1	
Senior Engineering Physics Project (PHYS 353) ^f	2	
Engineering Concentration ^d	3	
Breadth elective**	3	
Elective	3	
Senior Physics Project Seminar (PHYS 352) ^f		1
Senior Engineering Physics Project (PHYS 353) ^f		2
Applied Quantum Mechanics ^e		3
Engineering Concentration ^d		3
Breadth elective**		3
Elective		3
Year Total:	15	15

Total Units in Sequence: 129

Hours required for graduation: 129

- * University general education requirement
 ** Engineering general education requirement
 a Selected students may be invited to take MATH 124 Calculus II, MATH 227 Calculus III or MATH 228 Differential Equations in place of MATH 121 Calculus for Science and Engineering I, MATH 122 Calculus for Science and Engineering II, MATH 223 Calculus for Science and Engineering III or MATH 224 Elementary Differential Equations.

- b Selected students may be invited to take PHYS 123 Physics and Frontiers I - Mechanics or PHYS 124 Physics and Frontiers II - Electricity and Magnetism in place of PHYS 121 General Physics I - Mechanics or PHYS 122 General Physics II - Electricity and Magnetism.
- c Students may also choose to fulfill this requirement with CSDS 132 Introduction to Programming in Java.
- d Engineering Physics Concentration courses are flexible, but must be in a specific engineering discipline or study area and be approved by an advisor. Possible concentration areas include: Biomedical Engineering (Biomedical Systems and Analysis, Devices and Instrumentation, Biomaterials); Chemical and Biomolecular Engineering; Civil and Environmental Engineering (Solid Mechanics, Structural Engineering, Geotechnical Engineering, Environmental Engineering); Electrical, Computer, and Systems Engineering (Solid State, Computer Science, Computer Engineering-Software, Computer Engineering-Hardware, Systems and Control); Macromolecular Science and Engineering; Materials Science and Engineering; Mechanical and Aerospace Engineering (Aerospace, Mechanics). One of the Engineering Physics concentration courses must provide an engineering design experience which can be satisfied by completing one of the following courses - EBME 380, ECHE 399, ECIV 398, EECS 398, EMAC 378, EMAE 360, EMAE 398 or EMSE 379.
- e Students may choose to fulfill this requirement in their third year:
- PHYS 315 Introduction to Solid State Physics
 - PHYS 332 Introduction to Quantum Mechanics II
 - PHYS 327 Laser Physics/PHYS 427 Laser Physics
 - ECSE 321 Semiconductor Electronic Devices
- f Students may elect to satisfy the SAGES capstone requirement by completing one of the SAGES capstone courses in the Case School of Engineering in place of PHYS 352 and PHYS 353. Students selecting this option must also complete a 3-credit hour technical elective satisfied by any 200 level or above course in the Case School of Engineering.