ENGINEERING PHYSICS, BSE

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More Information: http://physics.case.edu/undergraduate-programs/undergrad-degree-programs/bsdegree-engrphys/

Degree: Bachelor of Science in Engineering (BSE)
Major: Engineering Physics

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, under the commission's General Criteria with no applicable program criteria.

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 challenges 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 competence in 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.

Learning 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 identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Co-op and Internship Programs

Opportunities are available for students to alternate studies with work in industry or government as a co-op student, which involves paid full-time employment over seven months (one semester and one summer). Students may work in one or two co-ops, beginning in the third year of study. Co-ops provide students the opportunity to gain valuable hands-on experience in their field by completing a significant engineering project while receiving professional mentoring. During a co-op placement, students do not pay tuition but maintain their full-time student status while earning a salary. Alternatively or additionally, students may obtain employment as summer interns.

Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics section of the General Bulletin.

Accelerated Master's Programs

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Undergraduate Academics section of the General Bulletin.

Program Requirements

Students seeking to complete this major and degree program must meet the general requirements for bachelor's degrees and the Unified General Education Requirements. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

Required Courses

Code	Title	Credit Hours
Required Mathematics, Science and Engineering Courses		
MATH 121	Calculus for Science and Engineering I	4
MATH 122	Calculus for Science and Engineering II	4
or MATH 124	Calculus II	
MATH 223	Calculus for Science and Engineering III	3
or MATH 227	Calculus III	
MATH 224	Elementary Differential Equations	3
or MATH 228	Differential Equations	
PHYS 121	General Physics I - Mechanics	4
or PHYS 123	Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism	4
or PHYS 124	Physics and Frontiers II - Electricity and Magnetism	
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
ENGR 145	Chemistry of Materials	4
ENGR 200	Statics and Strength of Materials	3
ENGR 210	Introduction to Circuits and Instrumentation	4
ECHE 225	Thermal and Fluid Sciences	4
ENGR 399	Impact of Engineering on Society	3
Total Credit Hours		**47**

Code	Title	Credit Hours
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 303	Advanced Laboratory Physics Seminar	1
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 & PHYS 353	Senior Physics Project Seminar and Senior Engineering Physics Project [c]	6
Applied Quantum Mechanics Course:		*3-4*
Choose one of the following:		
ECSE 321	Semiconductor Electronic Devices	
PHYS 315	Introduction to Solid State Physics	
PHYS 327	Laser Physics	
PHYS 332	Introduction to Quantum Mechanics II	
Engineering Concentration Courses [a]		*12*
Engineering Design Course [b]		
Choose one of the following:		
EBME 380	Biomedical Engineering Design Experience	
ECSE 398	Senior Engineering Design Projects	
ECHE 399	Chemical Engineering Design Project	
ECIV 398	Civil Engineering Senior Project	
EMAC 378	Polymer Engineer Design Product	
EMAE 360	Design and Manufacturing II	
EMAE 398	Senior Project	
EMSE 379	Design for Lifetime Performance	
CSDS 395	Senior Project in Computer Science	
CSDS 398	Senior Project in Data Science	
Total Credit Hours		**54**

a 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).

b The Engineering Design requirement is satisfied by completing one of the courses listed. The course might be **a)** completed as one of the four required Engineering Concentration courses or **b)** completed as a capstone course.

c In place of PHYS 352 and PHYS 353, the capstone requirement can be satisfied by completing a capstone course offered in Case School of Engineering. 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 Concentrations

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
- Chemical and Biomolecular Engineering
- Civil and Environmental Engineering
- Computer and Data Sciences
- Electrical, Computer, and Systems Engineering
- Macromolecular Science and Engineering
- Mechanical and Aerospace Engineering
- Materials Science and Engineering

Sample Plan of Study

The following is a suggested program of study. Current students should always consult their advisers and their individual graduation requirement plans as tracked in Stellic.

First Year

Fall		Credit Hours
CHEM 111	Principles of Chemistry for Engineers	4

MATH 121	Calculus for Science and Engineering I [a]	4
PHYS 121	General Physics I - Mechanics [b]	4
Academic Inquiry Seminar, Breadth, or Elective course [c]		3
	Credit Hours	**15**
Spring		
MATH 122	Calculus for Science and Engineering II [a]	4
PHYS 122	General Physics II - Electricity and Magnetism [b]	4
ENGR 145	Chemistry of Materials	4
ENGR 130	Foundations of Engineering and Programming	3
Academic Inquiry Seminar, Breadth, or Elective course [c]		3
	Credit Hours	**18**
Second Year		
Fall		
MATH 223	Calculus for Science and Engineering III	3
PHYS 221	Introduction to Modern Physics	3
ENGR 200	Statics and Strength of Materials	3
ENGR 210	Introduction to Circuits and Instrumentation	4
Breadth, or Elective course [c]		3
	Credit Hours	**16**
Spring		
MATH 224	Elementary Differential Equations	3
PHYS 208	Instrumentation and Signal Analysis Laboratory	4
PHYS 250	Computational Methods in Physics	3
PHYS 310	Classical Mechanics	3
ECHE 225	Thermal and Fluid Sciences	4
	Credit Hours	**17**
Third Year		
Fall		
PHYS 313	Thermodynamics and Statistical Mechanics	3
PHYS 303	Advanced Laboratory Physics Seminar	1
PHYS 317	Engineering Physics Laboratory I	3
PHYS 331	Introduction to Quantum Mechanics I	3
Breadth, or Elective course [c]		3
Concentration Course		3
	Credit Hours	**16**
Spring		
PHYS 318	Engineering Physics Laboratory II	4
PHYS 324	Electricity and Magnetism I	3
ENGR 399	Impact of Engineering on Society	3
Breadth, or Elective course [c]		3
Concentration Course		3
	Credit Hours	**16**
Fourth Year		
Fall		
PHYS 325	Electricity and Magnetism II	3
PHYS 352	Senior Physics Project Seminar [d]	1
PHYS 353	Senior Engineering Physics Project [d]	2
Breadth, or Elective course [c]		3
Concentration Course		3
Elective		3
	Credit Hours	**15**
Spring		
PHYS 352	Senior Physics Project Seminar [d]	1
PHYS 353	Senior Engineering Physics Project [d]	2
Breadth, or Elective course [c]		3
Applied Quantum Mechanics course		3
Engineering Design Course		3
Elective		3
	Credit Hours	**15**
	Total Credit Hours	**128**

a Selected students may be invited to take MATH 124, MATH 227 or MATH 228 in place of MATH 121, MATH 122, MATH 223 or MATH 224.

b Selected students may be invited to take PHYS 123 or PHYS 124 in place of PHYS 121 or PHYS 122.

c Unified General Education Requirement.

d In place of PHYS 352 and PHYS 353, the capstone requirement can be satisfied by completing a capstone course offered in Case School of Engineering. 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.