ENGINEERING PHYSICS - BACHELOR OF SCIENCE (BSEP)

During the freshman and sophomore years, students receive a broad introduction to physics, chemistry, applied mathematics and mathematical methods in physics. Starting in the sophomore year, students take electrodynamics, quantum mechanics, classical mechanics, mathematical methods, thermodynamics and statistical mechanics, and advanced mathematics. In addition, there is a core of four laboratory courses that students take. Laboratory courses emphasize student-developed and student-designed independent projects in which students use the knowledge acquired to build apparatus of their own choosing. One of the capstone lab courses, PHYS 4430 , provides students with hands-on experience with optical spectroscopy, nuclear magnetic resonance, scanning tunneling microscopy, and laser cooling and trapping of atoms, among other experiments. The other capstone course, PHYS 4700, provides students an opportunity to gain professional and technical quantum science skills and experience through participation in real-world projects in collaboration with industry leaders and academic investigators.

The program encourages the formation of student research collaborations with faculty in the pursuit of senior thesis projects. Recent projects include research in pulsed laser deposition of high-temperature superconductors, electron diffraction studies of protein structure, and lattice distortion theory of colossal magnetoresistance materials.

Students who plan to become registered professional engineers should check the requirements for registration in their state before choosing their engineering major.

Note: Students may not earn a bachelor's degree in physics from the College of Arts & Sciences as well as a bachelor's degree in engineering physics from the College of Engineering & Applied Science. Furthermore, the physics minor may not be earned with either of these two baccalaureate programs.

Requirements

Program Requirements

In order to earn a bachelor's degree in engineering physics, students must complete the curriculum in the undergraduate major program, as outlined below. For up-to-date program requirements, visit the Bachelor of Science in Engineering Physics (https://www.colorado.edu/physics/academics/undergraduate-students/bachelor-science-engineering-physics/) webpage.

Students may not earn a BS in Engineering Physics + BA in Physics.

Note: Some variations may be possible; students are advised to see their engineering physics academic advisor.

In addition, students must meet the general undergraduate degree requirements of the College of Engineering and Applied Science (https://www.colorado.edu/engineering-advising/get-your-degree/graduation-requirements/).

Required Courses and Credits

Code	Title	Credit Hours
Required Courses		
PHYS 1115	General Physics 1 for Majors	4
or PHYS 1110	General Physics 1	
PHYS 1125	General Physics 2 for Majors	4
or PHYS 1120	General Physics 2	
PHYS 1140	Experimental Physics 1	1
PHYS 2150	Experimental Physics 2	1
PHYS 2170	Foundations of Modern Physics	3
PHYS 2210	Classical Mechanics and Mathematical Methods 1	3
PHYS 3210	Classical Mechanics and Mathematical Methods 2	3
PHYS 3220	Quantum Mechanics 1	3
PHYS 3310	Principles of Electricity and Magnetism 1	3
PHYS 3320	Principles of Electricity and Magnetism 2	3
PHYS 3330	Electronics for the Physical Sciences	2
PHYS 4230	Thermodynamics and Statistical Mechanics	3
PHYS 4410	Quantum Mechanics 2	3
Upper-Division Physics Electives		
Complete one of the three options listed in the next table.		9
Required Chemistry Courses		
CHEM 1113	General Chemistry 1	4
or CHEN 1211	Accelerated Chemistry for Engineers	
CHEM 1114	Laboratory in General Chemistry 1	1
or CHEM 1221	Engineering General Chemistry Lab	
CHEM 1133	General Chemistry 2 [3]	4
CHEM 1134	Laboratory in General Chemistry 2 [3]	1
Required Mathematics Courses		
APPM 1350	Calculus 1 for Engineers	4
or MATH 1300	Calculus 1	
or APPM 1345	Calculus 1 with Algebra, Part B	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
Upper-division mathematics or applied mathematics course.		3
Required Engineering Courses		**25**
Choose one of the following computer science courses:		
CSCI 1300	Computer Science 1: Starting Computing	
PHYS 2600	Introduction to Programming and Scientific Computing	
Choose one additional course from the following computer science courses:		
CSCI 1300	Computer Science 1: Starting Computing	

PHYS 2600	Introduction to Programming and Scientific Computing	
AREN 1027	Engineering Drawing	
MCEN 1025	Computer-Aided Design and Fabrication	
Second CSCI course at the 2000 level or above.		
Choose 17 to 19 credits in courses other than those listed as required above. Must be offered by CEAS departments. [1]		
Humanities, Social Sciences and Writing		
Complete the College's Humanities, Social Sciences and Writing requirements. [2]		18
Free Electives		
Choose at least 11 credit hours of free electives to meet the minimum 128 credit hours required for the BS degree.		11
Total Credit Hours		**128**

1. Choose from the following subject codes: APPM, AREN, ASEN, ATLS, BMEN, CHEN, COEN, CSCI, CVEN, ECEN, EMEN, ENEN, EVEN, GEEN, IDEN, MCEN or STAT. *Excluded*: ASEN 3036, ASEN 3046, CHEN 1211 and any other courses otherwise approved for Humanities and Social Sciences credit.
2. Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (http://www.colorado.edu/engineering/academics/policies/hss/).
3. CHEM 1133/1134 or advisor-approved natural science course

Upper-Division Physics Electives

The selection of course offerings changes each semester. See the Engineering Physics Advising Guide (https://www.colorado.edu/physics/academics/undergraduate-students/bachelor-science-engineering-physics/) for an up-to-date selection.

Code	Title	Credit Hours
Research/Lab Electives [1,2]		**3-6**
PHYS 4430	Advanced Laboratory	
or PHYS 5430	Advanced Laboratory	
PHYS 4610	Physics Honors [2]	
PHYS 4620	Physics Honors [2]	
PHYS 4630	Physics Honors [2]	
PHYS 4700	Quantum Forge I	
PHYS 4710	Quantum Forge II	
PHYS 4840	Independent Study [2]	
Other Upper-Division Physics Electives		**3-6**
PHYS 3070	Energy and the Environment	
PHYS 3090	Introduction to Quantum Computing	
PHYS 4150	Plasma Physics	
PHYS 4340	Introduction to Solid State Physics	
PHYS 4420	Nuclear and Particle Physics	
PHYS 4450	History and Philosophy of Physics	
PHYS 4460	Teaching and Learning Physics	
PHYS 4510	Optics	
PHYS 4550	Cells, Molecules and Tissues: A Biophysical Approach	
PHYS 4560	Introduction to Biophysics	
PHYS 4810	Special Topics in Physics	
Any PHYS graduate-level courses (5000 level or above), with permission of instructor.		
Total Credit Hours		**9**

1. Students may satisfy the research/lab electives with documentation of accomplishments as an intern with a research group in the Physics Department or suitable cognate department. Approval by an Engineering Physics faculty advisor is required and should be obtained in advance. Students pursuing this option must take 9 credit hours of upper-division physics electives.
2. Students may count a maximum of 6 credit hours from a combination of PHYS 4610/PHYS 4620/PHYS 4630 and PHYS 4840 as physics electives.

Sample Four-Year Plan of Study

Below is a suggested schedule only. For a complete description of the engineering physics course requirements, visit the Department of Physics (http://www.colorado.edu/physics/) website.

Year One		
Fall Semester		**Credit Hours**
APPM 1350	Calculus 1 for Engineers	4
CSCI 1300	Computer Science 1: Starting Computing [1]	4
PHYS 1115 or PHYS 1110	General Physics 1 for Majors or General Physics 1	4
COEN 1830	Special Topics (Engineering First-Year Seminar)	1
Humanities or Social Science Elective [2]		2
	Credit Hours	**15**
Spring Semester		
APPM 1360	Calculus 2 for Engineers	4
Select one of the following: [1]		3
AREN 1027	Engineering Drawing	
MCEN 1025	Computer-Aided Design and Fabrication	
CSCI 2270	Computer Science 2: Data Structures	
PHYS 1125 or PHYS 1120	General Physics 2 for Majors or General Physics 2	4
PHYS 1140	Experimental Physics 1	1
Humanities or Social Science Elective [2]		3
	Credit Hours	**15**
Year Two		
Fall Semester		
APPM 2350	Calculus 3 for Engineers	4
CHEM 1113	General Chemistry 1	4
CHEM 1114	Laboratory in General Chemistry 1	1
PHYS 2150	Experimental Physics 2	1
PHYS 2170	Foundations of Modern Physics	3
Engineering Electives [3]		4
	Credit Hours	**17**
Spring Semester		
APPM 2360	Introduction to Differential Equations with Linear Algebra	4

PHYS 2210	Classical Mechanics and Mathematical Methods 1	3
Engineering Electives [3]		4
CHEM 1133	General Chemistry 2 [6]	4
CHEM 1134	Laboratory in General Chemistry 2 [6]	1
	Credit Hours	**16**
Year Three		
Fall Semester		
PHYS 3210	Classical Mechanics and Mathematical Methods 2	3
PHYS 3310	Principles of Electricity and Magnetism 1	3
PHYS 3330	Electronics for the Physical Sciences	2
Engineering Elective [3]		3
Humanities or Social Science Elective [2]		3
Free Electives		2
	Credit Hours	**16**
Spring Semester		
PHYS 3220	Quantum Mechanics 1	3
PHYS 3320	Principles of Electricity and Magnetism 2	3
PHYS 4230	Thermodynamics and Statistical Mechanics	3
Upper Division Math or Applied Math elective		3
Physics Electives [4]		3
Humanities or Social Science Elective [2]		3
	Credit Hours	**18**
Year Four		
Fall Semester		
PHYS 4410	Quantum Mechanics 2	3
Engineering Electives [3]		3
Physics Electives [4]		3
College-Approved Writing Course [5]		3
Free Electives		3
	Credit Hours	**15**
Spring Semester		
Engineering Electives [3]		8
Physics Electives [4]		3
Humanities or Social Science Elective [2]		2
Free Electives		3
	Credit Hours	**16**
	Total Credit Hours	**128**

1. Engineering physics computer science/drafting requirement (7–8 credit hours) is as follows: CSCI 1300 or PHYS 2600, along with CSCI 2270 or AREN 1027 or MCEN 1025 or a 2000-level or above Computer Science course.
2. Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (http://www.colorado.edu/engineering/academics/policies/hss/).
3. Engineering electives: 17–18 engineering elective credit hours above and beyond the required courses for engineering physics. Total credit hours required in engineering electives plus the required computer science/drafting credit hours: 25.
4. Nine credit hours of physics electives are required. For details, visit the Department of Physics (http://www.colorado.edu/physics/) website.
5. Students may choose a course from the list of college-approved writing courses (http://www.colorado.edu/engineering/academics/policies/hss/).
6. CHEM 1133/1134 or advisor-approved natural science course

Learning Outcomes

Upon completing the program, students will acquire:

- Knowledge of the basic subfields of physics (classical mechanics, electricity and magnetism, quantum mechanics, statistical mechanics and thermodynamics), as well as at least one specialty area of application (e.g., condensed matter physics or optics).
- The ability to apply major principles of physics towards solving problems in various subfields of physics, including the use of mathematical and computational tools as appropriate.
- Skills in assembling and using experimental apparatus to conduct and analyze measurements of physical phenomena.
- Knowledge of the role of systematic and random experimental errors, along with methods used to analyze experimental uncertainty and compare experiment with theory.
- Skills in collaborating effectively, and communicating results of scientific inquiries verbally and in writing.

Bachelor's–Accelerated Master's Degree Program(s)

The bachelor's–accelerated master's (BAM) degree program options offer currently enrolled CU Boulder undergraduate students the opportunity to receive a bachelor's and master's degree in a shorter period of time. Students receive the bachelor's degree first but begin taking graduate coursework as undergraduates (typically in their senior year).

Because some courses are allowed to double count for both the bachelor's and the master's degrees, students receive a master's degree in less time and at a lower cost than if they were to enroll in a stand-alone master's degree program after completion of their baccalaureate degree. In addition, staying at CU Boulder to pursue a bachelor's–accelerated master's program enables students to continue working with their established faculty mentors.

BS in Engineering Physics, MS in Physics

The BAM program in engineering physics aims to provide new opportunities for undergraduate engineering physics majors. The program is specifically addressed to engineering physics majors in the Department of Physics. The engineering physics major gives students a thorough grounding in theoretical physics, applied mathematics and broad exposure to engineering topics, so that they are well prepared either to proceed with graduate work or with professional employment in either basic science or in applied fields.

For students interested in graduate studies, the BAM program in engineering physics allows for participation in graduate coursework and research in a broad range of areas. For students interested in immediate professional employment, this program would serve as a terminal degree program that qualifies students for a higher level of employment.

Admissions Requirements

In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a cumulative GPA of 3.30 or higher and a physics major GPA of 3.30 or higher.
- Have completed a minimum of 80 credit hours of coursework.
- Completion of all MAPS requirements and no deficiencies remaining (students admitted to CU Boulder prior to Summer 2023 only).
- Transfer students must have completed a minimum of 24 credit hours at CU Boulder.
- Have a letter of support from a faculty advisor to complete master's level research.

Program Requirements

Students may take up to and including 12 hours while in the undergraduate program which can later be used toward the master's degree. However, only six hours may be double counted toward the bachelor's degree and the master's degree. Students must apply to graduate with the bachelor's degree, and apply to continue with the master's degree, early in the semester in which the undergraduate requirements will be completed.

If you are interested in the BAM degree program, please contact the Engineering Physics Faculty Director for more information.