ENGINEERING PHYSICS - BACHELOR OF SCIENCE (BS)

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. The capstone lab course, 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 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.

For more information about the bachelor’s degree in engineering physics, contact the Department of Physics (http://www.colorado.edu/physics), Duane Physics E1B32; 303-492-6953.

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.

Note: Some variations may be possible; see an engineering physics faculty advisor.

In addition, students must meet the general undergraduate degree requirements of the College of Engineering and Applied Science.

Required Courses and Credits

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 1110</td>
<td>General Physics 1</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 1115</td>
<td>General Physics 1 for Majors</td>
<td></td>
</tr>
<tr>
<td>PHYS 1120</td>
<td>General Physics 2</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 1125</td>
<td>General Physics 2 for Majors</td>
<td></td>
</tr>
<tr>
<td>PHYS 1140</td>
<td>Experimental Physics 1</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 2150</td>
<td>Experimental Physics 2</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 2170</td>
<td>Foundations of Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2210</td>
<td>Classical Mechanics and Mathematical Methods 1</td>
<td>3</td>
</tr>
</tbody>
</table>

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
CHEM 1114  Laboratory in General Chemistry 1  1
CHEM 1133  General Chemistry 2  4
CHEM 1134  Laboratory in General Chemistry 2  1

Required Mathematics Courses

APPM 2360  Calculus 1 for Engineers  4
APPM 2350  Calculus 2 for Engineers  4
APPM 2340  Calculus 3 for Engineers  4
APPM 2360  Introduction to Differential Equations with Linear Algebra  4

Upper-division mathematics or applied mathematics course. 3

Required Engineering Courses

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

Choose one of the following writing courses. 3

HUEN 1010  Humanities for Engineers
HUEN 3100  Advanced Humanities for Engineers
WRTG 3030  Writing on Science and Society
WRTG 3035  Technical Communication and Design
PHYS 3050  Writing in Physics: Problem-Solving and Rhetoric

Choose 15 credits of electives in Humanities and Social Sciences. Of those, 6 credits must be at the upper-division level (3000 level or higher). 15

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
Choose from the following subject codes: APPM, AREN, ASEN, BMEN, CHEN, COEN, CSCI, CVEN, ECEN, EMEN, EVEN, GEEN, MCEN or STAT. Excluded: ASEN 3036, ASEN 3046, CHEN 1211 and any other courses otherwise approved for Humanities and Social Sciences credit.

Upper-Division Physics Electives
The selection of course offerings changes each semester. See the Engineering Advising Guide (https://www.colorado.edu/physics/node/336/attachment) for an up-to-date selection.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 4430</td>
<td>Advanced Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>or PHYS 543 Advanced Laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 4610</td>
<td>Physics Honors 1</td>
<td>1</td>
</tr>
<tr>
<td>or PHYS 462 Physics Honors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or PHYS 463 Physics Honors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 4840</td>
<td>Independent Study 1</td>
<td>1</td>
</tr>
</tbody>
</table>

Other Upper-Division Physics Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 3070</td>
<td>Energy and the Environment</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4150</td>
<td>Plasma Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4340</td>
<td>Introduction to Solid State Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4420</td>
<td>Nuclear and Particle Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4450</td>
<td>History and Philosophy of Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4460</td>
<td>Teaching and Learning Physics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4510</td>
<td>Optics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4550</td>
<td>Cells, Molecules and Tissues: A Biophysical Approach</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4560</td>
<td>Introduction to Biophysics</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 4810</td>
<td>Special Topics in Physics</td>
<td>1</td>
</tr>
<tr>
<td>Any PHYS graduate-level courses (5000 level or above), with permission of instructor.</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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.

Course Title Credit Hours

Year One Fall Semester
APPM 1350 Calculus 1 for Engineers 4
CSCI 1300 Computer Science 1: Starting Computing 1 4

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

Spring Semester
APPM 2360 Introduction to Differential Equations with Linear Algebra 4
PHYS 2210 Classical Mechanics and Mathematical Methods 1 3
Engineering Electives 3 3
Free Electives 3
Humanities or Social Science Elective 2 3

Year Three Fall Semester
CHEM 1133 General Chemistry 2 4
CHEM 1134 Laboratory in General Chemistry 2 1
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
Free Electives 3

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>PHYS 4410</td>
<td>Quantum Mechanics 2</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Electives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Physics Electives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Free Electives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>College-Approved Writing Course</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td></td>
<td><strong>15</strong></td>
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Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Electives</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Physics Electives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Free Electives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Humanities or Social Science Elective</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>

1. Engineering physics computer science/drafting requirement (7–8 credit hours) is as follows: CSCI 1300, along with CSCI 2270 or AREN 1027 or MCEN 1025.
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).

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.

BSEP 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
- 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.¹

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

¹ Students who were admitted prior to July 2019 follow a concurrent Bachelor’s/Master’s structure, and the two degrees are awarded simultaneously when requirements for both degrees are met.