Undergraduate Advising Guide

Academic Year 2016-2017

Duane Physics, E1B32
390 UCB
Boulder, CO 80309-0390
phys.colorado.edu
# Table of Contents

Introduction .................................................................................................................... 1

Engineering Physics Mission Statement ......................................................................... 1

Engineering Physics Overview ........................................................................................ 1

Employment Opportunities for Engineering Physics Graduates .................................... 2

Engineering Physics Curriculum ..................................................................................... 2

Academic Advising Policy ............................................................................................... 3

  Advising Required Every Semester .............................................................................. 3

  Student E-mail Policy .................................................................................................. 3

  Questions ..................................................................................................................... 3

Additional Advising Resources ........................................................................................ 4

  Petitions ....................................................................................................................... 4

  Transfer Credit Procedures ......................................................................................... 4

  Career Services .......................................................................................................... 5

Grading Policies .............................................................................................................. 5

  Prerequisites and Passing Grades ............................................................................... 5

  Pass/Fail (P/F) ........................................................................................................... 5

  No Credit (NC) ........................................................................................................... 6

College of Engineering Graduation Requirements .......................................................... 6

Honors Designations ....................................................................................................... 7

  Physics Department Honors Program ........................................................................ 7

  College of Engineering Honors .................................................................................. 8

Additional Educational Opportunities ............................................................................. 8

  Independent Study and Undergraduate Research ....................................................... 8

  Minors ......................................................................................................................... 8

  Double Majors/Double Degrees ............................................................................... 9

  Study Abroad ............................................................................................................. 9

  Student Societies ....................................................................................................... 9

Degree Requirements for BS in Engineering Physics ...................................................... 10
Introduction

The purpose of this guide is to assist undergraduate students majoring in Engineering Physics (EPEN) to fulfill the curriculum requirements for the Bachelor of Science (BS) degree. In order to earn a Bachelor’s degree in Engineering Physics, students must complete the curriculum described later in this document. (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. Specifically included in the general requirements is the achievement of a GPA of at least 2.25 in the student’s physics courses.

The EPEN Bachelor of Science degree program rules and requirements are subject to annual revision and changes. These program rules apply to all undergraduates enrolled in the program, regardless of the date when they first enrolled in the program. However, no student can be denied credit for any courses that were previously required or allowed in the program, provided that those courses were taken after the student had been admitted to the EPEN program and the student has been continuously enrolled.

The student is responsible for adherence to the EPEN curriculum rules and requirements and should be aware that deviation from the planned sequence of courses may result in delayed graduation.

Engineering Physics Mission Statement

Our mission is to prepare students for exciting research, development, and entrepreneurial careers in many frontier areas of engineering including quantum devices, ultra-fast lasers, adaptive optics, cryogenic electronics, computer simulation of physical systems, solar cells, magnetic storage technology, micro-mechanical systems, and molecular electronics. We achieve this through a high quality undergraduate education in the core theoretical subjects of mechanics, electricity and magnetism, thermal physics, and quantum mechanics that are supplemented by courses in mathematics, computation, and laboratory technique. The program can be tailored to a student’s interests through electives in engineering, physics, or other sciences.

Engineering Physics Overview

The College of Engineering and Applied Science, in cooperation with the College of Arts & Sciences, offers two different Engineering Physics degree plans.

1) The Department of Physics Plan 4 leads to a Bachelor of Science degree in four years. The purpose of this plan is to give the engineering student thorough and fundamental training in physics and its applications. With this preparation, a student can proceed to graduate work or to professional employment.
2) A five-year concurrent Bachelor’s/Master’s program with a BS in Engineering Physics and an MS in Physics. Students with strong academic records who plan to continue in the Graduate School for a Master’s in the same discipline may find it advantageous to apply for admission to the concurrent BS/MS degree program. For more information, please see the Director of the Engineering Physics program or visit: [http://phys.colorado.edu/undergraduate-students/concurrent-bachelors-masters-degree-program](http://phys.colorado.edu/undergraduate-students/concurrent-bachelors-masters-degree-program)

The BS in Engineering Physics is not accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Students who plan to become registered professional engineers should check the requirements for registration in their state before choosing their major. Students may take the Fundamentals of Engineering Exam after graduation and should check the current requirements and application on the Department of Regulatory Agencies website.

**Employment Opportunities for Engineering Physics Graduates**

Engineering Physics provides students with a broad exposure to the basic physical theories and mathematical techniques underlying engineering. The program may be specialized to meet the student’s interests through engineering electives. Most students become involved in laboratory research, and graduates find opportunities in optics, electronics, magnetics, and other hardware-based job markets. The program also provides excellent preparation for graduate study in physics, applied physics, and other areas of the natural sciences and engineering.

**Engineering Physics Curriculum**

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, and 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 where students use the knowledge acquired to build apparatus of their own choosing. The capstone lab course, Advanced Laboratory (PHYS 3340) 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.
Academic Advising Policy

The faculty advisors and staff are here to help you with whatever questions and problems you may have along the way to obtaining your Engineering Physics degree, but ultimately you have the responsibility to ensure you are satisfying all graduation requirements. If you have questions about career direction, curriculum requirements, department policies and requirements, or course sequences, contact your faculty advisor.

Advising Required Every Semester
Advising is an ongoing activity and it is mandatory that you consult your Engineering Physics faculty advisor each semester as you make decisions on which courses to take the next semester. You will not be allowed to register until your advising flag is lifted. A specific faculty advisor will be assigned to you but you may meet with any faculty advisor. Contact information and advising office hours for faculty advisors and staff are located on the physics website: http://phys.colorado.edu/undergraduate-students/advisors-mentors.

Student E-mail Policy
All CU students receive an e-mail account from the university, which is an official means of sending information to students. The official e-mail address can be used by professors to contact students and provide course-related information. Students are responsible for frequently checking and maintaining this CU e-mail address.

Engineering Physics utilizes an advising e-mail list that includes all current undergraduates in the Engineering Physics program. It is in the student’s best interest to be included on this list for important information relating to the College, events, and potential employment opportunities. Engineering Physics students are automatically subscribed to the list within the first two weeks of classes or within two weeks of declaring the major, and will remain on the list until they graduate or are no longer enrolled in Engineering Physics.

Questions
In most cases, students can find answers for questions concerning the Engineering Physics curriculum and other situations that might arise by reviewing this advising guide or by contacting a faculty advisor. If you have difficulty finding the answer to any question regarding the program, contact the Director of the Engineering Physics Program. For questions concerning College or University rules and policies, contact the Dean’s Office in the College of Engineering.
Additional Advising Resources

There are many advising resources available at CU-Boulder, but students frequently do not know they exist or hesitate to take advantage of them:

*University of Colorado Catalog* is an important publication, which includes degree requirements for all academic departments on campus, academic standards, administrative regulations, University and College policies and procedures. For additional information visit: colorado.edu/catalog

Selected academic policies can also be found on the College of Engineering and Applied Science website at http://www.colorado.edu/engineering/academics/policies, including:

- Academic Honesty
- Academic Policies
- Academic Probation & Suspension
- Confirming your Major
- Four-Year Graduation Guarantee
- Grading Policies / Grade Appeal Policy
- Graduation Requirements
- Humanities, Social Sciences, and Writing
- Classroom and Course-Related Behavior
- Student Conduct Code Policy
- Student Honor Code Policy

**Petitions**

A student desiring a waiver of college policies must secure approval for this waiver through a petition procedure. Petition forms and information on the petition procedure are available in the Office of the Dean or in the Department of Physics office. This petition must be completed and submitted to the Director of the Engineering Physics Program for approval and then forwarded to the College of Engineering and Applied Science Dean’s Office for approval. It is the student’s responsibility to follow up on the petition’s progress and be aware of the final decision. The College Petition Advising Guide can be obtained in the Engineering Office of the Dean. You can also refer to the College of Engineering and Applied Science’s Petition form for more information on examples of situations that must be petitioned. Go to the “forms” sections at: engineering.colorado.edu/students/advising

**Transfer Credit Procedures**

The University and College of Engineering have established procedures for admission of transfer students and evaluation of transfer credits. These policies are described on the undergraduate admissions website: http://www.colorado.edu/admissions/undergraduate/transfer.
Once a student is admitted, the Office of Admissions will perform an initial evaluation of transfer credit. The final determination of how transfer credits are applied toward degree requirements is made by the Physics Department. Only courses taken at a college or university of recognized standing with grades of C- (1.7) or better are acceptable for transfer. Credit hours should have been earned no more than 10 years prior to transferring into an undergraduate degree program at CU-Boulder.

**Career Services**

*Career Services* can help students clarify career interests, values and work-related skills, explore potential careers and employers and refine job seeking, interviewing, and resume preparation skills. They host Career Fairs and Internship Fairs, sponsor resume writing workshops, and hold mock interview sessions. For additional information visit: careerservices.colorado.edu

**Grading Policies**

**Prerequisites and Passing Grades**

The minimum passing grade for a course that is a prerequisite for another required course is C-. If a grade of D+ or lower is received in a course that is a prerequisite to another, the student may not register for the subsequent course until the first grade has been raised to a C- or higher. The minimum passing grade for a course that is not specifically a prerequisite for another required course is D-. The Department of Physics reserves the right to drop students enrolled in physics courses who have not met the minimum prerequisite requirements. It is the student’s responsibility to communicate with the department if summer coursework and/or transfer credit will be used to meet the prerequisite requirement.

**Pass/Fail (P/F)**

The primary purpose for offering the opportunity for a student to enroll in a course for a grade of P or F rather than the standard letter grade is to encourage students to broaden their educational experience by electing challenging courses without serious risk to the cumulative grade point average. *P/F* credit will be permitted only for courses used as electives or for courses above and beyond degree requirements. **Students on academic probation may not elect the P/F grade option.** The college allows a maximum of six pass/fail credit hours per semester. Pass/fail hours counting toward graduation shall not exceed a cumulative total of 11 in the Engineering Physics major.

Engineering Physics permits the *P/F* grade option for free electives only. Students must obtain written approval in advance from an Engineering Physics faculty advisor to register for a course with the *P/F* grade option.
No Credit (NC)
A course taken for no credit cannot be used for fulfilling graduation requirements. Once a course has been taken for no credit it cannot be repeated for a grade. Consequently, a student must petition the college before enrolling for any course no credit. A student is still subject to course tuition and fee expenses when registering for a course with the no credit option.

College of Engineering Graduation Requirements

Failure to complete the course requirements listed below will postpone your graduation. Any exceptions or substitutions must be approved in writing by your advisor and a copy of the approval must be placed in your file in the Physics Office. Students should meet with their advisor no later than the first two weeks of the semester prior to their planned graduation to review their records. It is the student’s responsibility to be certain that all degree requirements have been met, to fill out the online application for graduation, and to keep their advisor informed of any change in graduation plans.

To be eligible for the baccalaureate degree from the College of Engineering and Applied Science on the Boulder campus, a student must meet all of the following minimum requirements:

1. The satisfactory completion of the prescribed and elective work in any curriculum as determined by the appropriate academic department. A student must complete a minimum number of semester hours, not less than 128, of which the last 45 must be Boulder coursework earned after admission to the university and this college.

2. A University of Colorado cumulative grade point average of 2.250 (2.000 for new students pre-Fall 2011) for all courses attempted.

3. A cumulative grade point average, separately computed, of 2.250 (2.000 for new students pre-Fall 2011) in courses taken from the student’s major department is also required. For students in the engineering physics program, the major department shall be the Physics Department.

4. The recommendation of the faculty of the academic department (or program) offering the degree. The campus designation on the diploma and transcript shall correspond to the campus designation of the academic department initiating the degree recommendation.

5. The recommendation of the faculty of the college.

6. The satisfactory completion of all Minimum Academic Preparation Standards (MAPS) deficiencies.

Note: Double degree students must obtain approval of both designated departments and colleges.
Honors Designations

Students in the Engineering Physics program can earn honors designations through either the Physics Department Honors Program and/or through one of two ways in the College of Engineering.

Physics Department Honors Program

Physics and Engineering Physics majors may graduate with an honors designation on their diploma. Three levels of honors are achievable:

- Summa Cum Laude – highest honors
- Magna Cum Laude – high honors
- Cum Laude – honors

An honors designation is only achievable by the completion of an original piece of work. A senior thesis must be submitted, with the typical lengths anywhere from 20 to 100 pages. An oral defense of the thesis also must be given to a committee of 3 faculty members. Typically the presentations last for 40 minutes.

The thesis will be directed by a faculty member from physics or any of the associated departments, including APS, CASA, JILA, or possibly a research lab such as NIST of NREL. The physics department honors chair can play a helpful role in directing students toward potential advisors.

The first order determination for graduation with honors is based upon the GPA:

- GPA > 3.8 Summa Cum Laude
- GPA > 3.5 Magna Cum Laude
- GPA > 3.3 Cum Laude

However, a GPA of 4.0 with no honors thesis will not earn honors designation, nor will a 4.0 GPA with a very poor quality thesis earn a designation. An especially high quality thesis will often bump a student up from one designation to another; for instance, a student with a 3.4 and a very strong thesis may earn a Magna or possibly even a Summa designation. It is for this reason that we open enrollment in PHYS 4610/4620/4630 to students with a GPA > 3.0.

There will be weekly one hour honors meetings that all enrolled students are required to attend. The students will rotate through giving 20 minute oral presentations of their research to their peers. To be eligible for Departmental Honors in Physics, a student must complete an original piece of research and write and defend an honors thesis. Information on how to obtain a research opportunity can be found on our Research Opportunity page [http://phys.colorado.edu/undergraduate-students/undergraduate-research-opportunities](http://phys.colorado.edu/undergraduate-students/undergraduate-research-opportunities).

PHYS 4610/4620/4630 are the Physics Honors Seminars for students pursuing Departmental Honors in Physics. To graduate with an honors designation, students should enroll in at least one semester of honors, although two or three are more usual. Registration for Physics Honors is by special arrangement through the Department of Physics.

March 2016
College of Engineering Honors
Undergraduate students in the college are eligible for two honors designations at graduation:

Latin Honors
If a student's cumulative CU GPA (all coursework in the undergraduate career GPA on the CU transcript) is at least 3.700, and he/she meets all graduation requirements described above, the student will automatically receive a Latinate honor. A GPA of 3.700-3.799 earns the "cum laude" designation, 3.800-3.899 earns "magna cum laude," and 3.900-4.000 earns "summa cum laude."

Engineering Honors Program
Students in the Engineering Honors Program who complete a set of requirements may be eligible to earn "with Honors" at graduation. For more information, see the Engineering Honors Program website at www.cuhonorsengineering.com.

Additional Educational Opportunities

Independent Study and Undergraduate Research
These opportunities allow for individual contact with faculty and graduate students, and they provide an educational experience that cannot be obtained in the traditional classroom setting. If you wish to use Independent Study to fulfill any Engineering Physics requirement, it must be approved ahead of time by an Engineering Physics faculty advisor.

An Independent Study Agreement form must be completed and signed by both the student and the sponsor of the Independent Study or Undergraduate Research. These forms are available in the Physics Department Office (DUAN E1B32). In most cases, students will contact faculty in an area the student is interested in pursuing.

Paid research (no course credit) may be available at the discretion of sponsoring faculty, either part-time during the academic year or full-time during the summer. It is also available from the Undergraduate Research Opportunities Program (UROP) in the form of an expense allowance or stipend. If interested in UROP, please visit enrichment.colorado.edu/urop. The policy of the College of Engineering and Applied Science is that no academic credit for a particular activity is allowed if a student is being paid for that activity.

Minors
A number of departments in the University offer minor programs. Participation in a minor program is optional for students pursuing a bachelor's degree. Course work applied to a minor may also be applied toward general education (core curriculum or college list) and major requirements. Students may not earn a major and a minor in the same program of study. See your advisor for information on declaring a
minor. A minor completion form must be on record to verify minor requirements have been completed. For a minor in the College of Engineering and Applied Science, the minor completion form can be found here: http://www.colorado.edu/engineering/sites/default/files/Minor_Completion_Form.pdf

**Double Majors/Double Degrees**

It is possible for an undergraduate student to complete degree requirements for two or more majors within the College of Engineering and Applied Science, with the approval of the relevant major departments. The decision to earn more than one major in the college should be carefully weighed, since qualified students may rather consider obtaining a master's degree.

It is also possible to obtain the BS degree in engineering and a second degree from a department in another college or school of the university. Students must satisfy curricula for both programs and may need to complete additional semester credit hours above and beyond the largest minimum credit hour requirement.

**Study Abroad**

The Office of International Education at CU-Boulder offers a variety of study abroad programs. The Study Abroad program allows students to earn course credit while exploring an interest in another culture and seeing the world. For more information about this program, visit: studyabroad.colorado.edu

**Student Societies**

**CU Prime** is a student-driven effort led by grad students in the Physics Department, aimed at building an inclusive and diverse community of scientists at all levels. They run biweekly talks on cutting-edge research that are understandable to intro physics students, a one-credit course on model building and what it is to be a physicist, and a mentorship program. For more information on CU Prime, please visit their website: http://www.colorado.edu/studentgroups/cuprime/

The **Society of Physics Students** is a student organization open to all Physics, Engineering Physics, and Astronomy majors and minors. Society of Physics Students meets once per week to discuss physics and life, relax, and enjoy some pizza. For more information, please visit: http://phys.colorado.edu/undergraduate-students/society-physics-students

**Sigma Pi Sigma** is the only nationally recognized Physics Honor Society. Students who enter junior or senior year with a satisfactory cumulative grade point average may be invited to join the University of Colorado at Boulder Chapter of Sigma Pi Sigma.

**Beyond Boulder** is a resource for undergrads in fields related to physics and astronomy at CU-Boulder. It is a program designed to help guide you through the process of thinking about and planning for your future career. During the academic year, Beyond Boulder meets once per week for useful workshops, seminars, questions and frank answers. For more information on Beyond Boulder, please visit: http://beyondboulder.pbworks.com
Degree Requirements for BS in Engineering Physics

The purpose of the engineering physics major is to give the engineering student a thorough, fundamental training in physics and in its applications. With this preparation a student can proceed to graduate work or to professional employment. Students intending to graduate under this program must complete 128 credit hours, including courses as detailed below.

Engineering Physics 8-semester Overview (suggested schedule only)

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credits</th>
<th>Spring Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>15</td>
<td>Spring Semester</td>
<td>15</td>
</tr>
<tr>
<td>APPM 1350 Calculus 1 for Engineers</td>
<td>4</td>
<td>APPM 1360 Calculus 2 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 1300 Computer Science 1</td>
<td>4</td>
<td>AREN 1027 or MCEN 1025</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 1110 General Physics 1</td>
<td>4</td>
<td>PHYS 1120 General Physics 2</td>
<td>4</td>
</tr>
<tr>
<td>HSS Elective</td>
<td>3</td>
<td>PHYS 1140 Experimental Physics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HSS Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
<th>Spring Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>17</td>
<td>Spring Semester</td>
<td>16</td>
</tr>
<tr>
<td>APPM 2350 Calculus 3 for Engineers</td>
<td>4</td>
<td>APPM 2360 Diff Eq with Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1113 General Chem 1</td>
<td>4</td>
<td>PHYS 2210 Classical Mech &amp; Math Methods 1</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1114 General Chem 1 Lab</td>
<td>1</td>
<td>Engineering Elective</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2170 Foundations of Modern Phys</td>
<td>3</td>
<td>General Elective</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2150 Experimental Physics</td>
<td>1</td>
<td>HSS Elective</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Elective</td>
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<td></td>
<td></td>
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<table>
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<th>Junior Year</th>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>16</td>
<td>Spring Semester</td>
<td>18</td>
</tr>
<tr>
<td>CHEM 1133 General Chem 2</td>
<td>4</td>
<td>PHYS 3220 Quantum Mechanics 1</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1134 General Chem 2 Lab</td>
<td>1</td>
<td>PHYS 3320 Principles of Elec &amp; Mag 2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 3210 Classical Mech &amp; Math Meth 2</td>
<td>3</td>
<td>PHYS 4230 Thermo/Stat Mech</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 3310 Principles of Elec &amp; Mag 1</td>
<td>3</td>
<td>Upper Division Math or Applied Math</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 3330 Junior Laboratory</td>
<td>2</td>
<td>Physics Elective</td>
<td>3</td>
</tr>
<tr>
<td>General Elective</td>
<td>3</td>
<td>HSS Elective</td>
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<table>
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<tr>
<th>Senior Year</th>
<th>Credits</th>
<th>Spring Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>15</td>
<td>Spring Semester</td>
<td>16</td>
</tr>
<tr>
<td>PHYS 4410 Quantum Mechanics 2</td>
<td>3</td>
<td>Engineering Electives</td>
<td>8</td>
</tr>
<tr>
<td>Engineering Elective</td>
<td>3</td>
<td>Physics Elective</td>
<td>3</td>
</tr>
<tr>
<td>Physics Elective</td>
<td>3</td>
<td>General Elective</td>
<td>3</td>
</tr>
<tr>
<td>General Elective</td>
<td>3</td>
<td>HSS Elective</td>
<td>2</td>
</tr>
<tr>
<td>College-approved Writing Course</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outline of Required Courses for BS in Engineering Physics

1. Required Physics Courses (36 credit hours)

All prerequisites require a minimum grade of C-

- PHYS 1110: General Physics 1 (4)
  Coreq., APPM 1350

- PHYS 1120: General Physics 2 (4)
  Prereq., PHYS 1110; Coreq., APPM 1360; normally taken concurrently with PHYS 1140

- PHYS 1140: Experimental Physics 1 (1)
  Prereq. or coreq., PHYS 1120

- PHYS 2150: Experimental Physics (1)
  Prereqs., PHYS 1120 and PHYS 1140; Coreq., PHYS 2170

- PHYS 2170: Foundations of Modern Physics (3)
  Prereqs., PHYS 1120 and PHYS 1140; Coreq., APPM 2350; normally taken concurrently with PHYS 2150

- PHYS 2210: Classical Mechanics and Mathematical Methods 1 (3)
  Prereqs., PHYS 2170 and APPM 2350; Coreq., APPM 2360

- PHYS 3210: Classical Mechanics and Mathematical Methods 2 (3)
  Prereqs., PHYS 2210 and APPM 2360

- PHYS 3220: Quantum Mechanics and Atomic Physics 1 (3)
  Prereq., PHYS 3210

- PHYS 3310: Electricity & Magnetism 1 (3)
  Prereq., PHYS 2210

- PHYS 3320: Electricity & Magnetism 2 (3)
  Prereq., PHYS 3310

- PHYS 3330: Electronics for the Physical Sciences (2)
  Prereqs., PHYS 2150 and PHYS 2170

- PHYS 4230: Thermodynamics and Statistical Mechanics (3)
  Prereqs., PHYS 2210 and APPM 2360; Coreq., PHYS 3220

- PHYS 4410: Quantum Mechanics and Atomic Physics 2 (3)
  Prereqs., PHYS 3220 and PHYS 3310
## 2. Upper-Division Physics Electives (9 credit hours)

With a combination of research activity and upper-division physics electives selected from the list below, you can satisfy this requirement by completing one of the following options:

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
</table>
| PHYS 4430: Advanced Laboratory (3) AND Physics Electives (6) *see below for selection of physics electives* | No credit research experience (0)  
- Documentation of your accomplishments as an intern with a research group in the Physics Department or a suitable cognate department. Approval by an Engineering Physics faculty advisor is required and should be obtained in advance. AND Physics Electives (9) *see below for selection of physics electives* | Research credit (3-6):  
- PHYS 4610/4620/4630: Physics Honors (2) (may be repeated up to three times)  
- PHYS 4840: Independent Study (1-3) AND Physics Electives (3-6) *see below for selection of physics electives* |

### Selection of Upper-Division Physics Electives

*Note: Choose from the following. Selection of course offerings changes each semester.*

- PHYS 3070: Energy and the Environment (3)
- PHYS 4150: Plasma Physics (3)
- PHYS 4340: Intro to Solid State Physics (3)
- PHYS 4420: Nuclear and Particle Physics (3)
- PHYS 4430: Advanced Laboratory (3)
- PHYS 4450: History and Philosophy of Physics (3)
- PHYS 4460: Teaching and Learning Physics (3)
- PHYS 4510: Optics (3)
- PHYS 4550: Cells, Molecules and Tissues: A Biophysical Approach (3)
- PHYS 4610/4620/4630: Physics Honors (2)*
- PHYS 4810: Special Topics in Physics (3)
- PHYS 4840: Independent Study (1-3)*
- Any PHYS 5000-level or above graduate level courses, with permission of instructor

*Maximum of 6 credit hours from a combination of PHYS 4610/4620/4630 and PHYS 4840 can be counted for Physics Electives.*
3. **Required Chemistry Courses (10 credit hours)**
   - CHEM 1113: General Chemistry 1 (4)
   - CHEM 1114: General Chemistry 1 Lab (1)
   - CHEM 1133: General Chemistry 2 (4)*
   - CHEM 1134: General Chemistry 2 Lab (1)*
   *Note: Alternate CHEM courses can be substituted with prior EPEN faculty advisor approval

4. **Required Mathematics Courses (19 credit hours)**
   - APPM 1350: Calculus 1 for Engineers (4)
     *Prereq., APPM 1235 or an ALEKS math score of 76% or greater*
   - APPM 1360: Calculus 2 for Engineers (4)
     *Prereq., APPM 1350 with a minimum grade of C-*
   - APPM 2350: Calculus 3 for Engineers (4)
     *Prereq., APPM 1360 with a minimum grade of C-*
   - APPM 2360: Introduction to Differential Equations with Linear Algebra (4)
     *Prereq., APPM 1360 with a minimum grade of C-*
   - Upper-division Mathematics or Applied Mathematics course (3)

5. **Required Engineering Courses (25 credit hours)**
   - Computer Science Requirement, choose one: (4)
     - CSCI 1300: Computer Science 1: Programming (4)
     - CSCI 1310: Computer Science 1: Starting Computing - Experienced (4)
   - Drafting Requirement (or second Computer Science course), choose one: (3-4)
     - AREN 1027: Engineering Drawing (3)
     - MCEN 1025: Computer Aided Drawing and Fabrication (4)
   - Second CSCI course at 2000-level or above (3)
   - Engineering Electives (17-18)
     - Any courses offered by departments in the College of Engineering and Applied Science, other than those listed above that are required. Choose from the following subject codes: APPM, AREN, ASEN, CHEN, COEN, CSCI, CVEN, ECEN, EMEN, EVEN, GEEN, or MCEN
     - Excluded courses: ASEN3036, ASEN3046, CHEN1211
6. Humanities, Social Sciences, and Writing (18 credit hours)
Visit the College of Engineering Humanities Requirements page for more information:
http://www.colorado.edu/engineering/academics/policies/hss

☐ Writing (3)
  ○ Choose one: HUEN 1010 (first-year freshmen only, Fall 2011 or later), HUEN 3100, WRTG 3030, WRTG 3035, or PHYS 3050

☐ Humanities and Social Sciences (15)
  ○ 6 credits must be at the upper-division level (3000-level or higher)

7. Free Electives (11 credit hours)
☐ In addition to completing the above requirements, students must take at least 11 credit hours of free electives to meet the minimum 128 credit hours required for the BS degree.