

## **B.S./M.S. Program in Applied and Engineering Physics**

**Statement of Purpose:** The proposed B.S./M.S. program in Applied and Engineering Physics aims to provide new opportunities for undergraduate Engineering Physics majors. The program is specifically addressed to the students in Plan 4 Engineering Physics Major Program of the Department of Physics. The Plan 4 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 combined B.S./M.S. program in Applied and Engineering Physics allows an early start on graduate course work and on research in a broad range of areas (see below). This early exposure should allow students to save one or two semesters in the time needed to begin Ph.D. work. For students interested in immediate professional employment, the B.S./M.S. program would serve as a terminal degree program that qualifies students for a higher level of employment.

1. **Admission to the program:** Students are eligible to apply for the program at the end of the first semester of their junior year (or upon completion of the typical first semester Junior physics courses as described in the Plan 1 curriculum) and may apply at any time thereafter prior to completion of their undergraduate studies. Applications are available in the main office of the Department of Physics. The applicant should normally have a minimum GPA of 3.0 at the time of application (petitions for admission from students with a lower GPA will be considered). The application should be accompanied by recommendation letters from two professors with whom the applicant took/are taking upper division physics courses. The applicant should also produce a letter of acceptance from a faculty sponsor/advisor to do research towards their Master's thesis. Upon acceptance of the applicant into the program at the departmental level, the application will be forwarded to the Deans of the College of Engineering and Applied Sciences and the Graduate School for endorsement.
2. **Continuation in the program:** In order to continue in the program after admission, the minimum cumulative GPA required at the end of the senior year, with 128 hours completed, is normally 3.0. After the senior year, the student should maintain a cumulative GPA of 3.0 (B) in graduate physics courses.

3. **Curriculum:** The following charts show a typical curriculum for years 1 through 4 and the first year of graduate studies.

<b>Fall</b>	<b>Spring</b>
<u>Freshman Year</u> PHYS 1110-4, General Physics 1	<u>Freshman Year</u> PHYS 1120-4, General Physics 2 PHYS 1140-1, Exper. Physics 1
<u>Sophomore Year</u> PHYS 2140-3, Methods of Theoretical Physics	<u>Sophomore Year</u> PHYS 2170-3 Foundations of Modern Physics PHYS 2150-1, Exper. Physics 2
<u>Junior Year</u> PHYS 3210-3, Analytical Mechanics PHYS 3310-3, Principles of Electricity and Magnetism 1 PHYS 3330-2, Electronics for the Physical Sciences	<u>Junior Year</u> PHYS 3220-3 Quantum Mechanics and Atomic Physics 1 PHYS 3320-3, Principles of Electricity and Magnetism 2
<u>Senior Year</u> PHYS 4230-3, Thermodynamics and Statistical Mechanics PHYS 4410-3, Quantum Mechanics and Atomic Physics 2 3 credits of Physics elective.	<u>Senior Year</u> 3 credits of Physics laboratory elective. 3 credits of Physics elective

The charts emphasize the required physics courses. In addition, students are expected to take courses to satisfy the College of Engineering and Applied Science undergraduate requirements, and additional applied mathematics and chemistry courses that are part of the Plan 4 engineering physics major. At the end of the 4<sup>th</sup> year, students will have completed 45 credit hours of physics courses, consistent with the present Plan 4 major requirements of 45 credits. Out to the end of the 4<sup>th</sup> year, the primary difference between the proposed curriculum and Plan 4 is the likely choice of graduate courses for senior physics electives. We also note that students in the B.S./M.S. program may still participate in the physics honors sequence and qualify for honors designation on their B.S. degree.

The fifth year typical curriculum includes 9 credit hours of required physics classes, 9 credit hours of physics electives, and 6 credit hours of thesis research, for a total of 24 credit hours at the graduate level:

Fifth Year standard required graduate courses (9 credit hours)

PHYS 5260-3, Introduction to Quantum Mechanics 2

PHYS 7230-3, Statistical Physics

PHYS 7310-3, Electromagnetic Theory 1

Other graduate courses may be taken in place of these required courses by petition to the Graduate Associate Chair of the Department of Physics.

Fifth Year typical graduate electives (9 credit hours by selecting several courses)

PHYS 5030-3, Intermediate Mathematical Physics 1

PHYS 5430-3, Modern Physics Laboratory

PHYS 5770-3, Gravitational Theory

PHYS 7160-3, Introduction to Plasma Physics

PHYS 7240-3, Advanced Statistical Physics

PHYS 7320-3, Electromagnetic Theory 2

PHYS 7440-3, Introduction to Solid State Theory

PHYS 7720-3, Introduction to Particle Physics

PHYS 6610-3, Earth and Planetary Physics 1

PHYS 7810-3, Lasers

PHYS 7810 , Special Topics

Graduate electives other than those listed above, including those from other disciplines may also be taken. Examples of electives for biotechnology, nanotechnology, materials physics, optics, geophysics, and several other fields may also qualify the student for a Certificate in Applied Physics. A full description of the CU Applied Physics Certificate Program can be found on the web at:

<http://www.colorado.edu/physics/Web/AppliedPhysics/apcp.html>

See the attached example curricula for Certificates in Applied Physics.

Fifth Year Master's research experience (6 credits graduate research hours)

4. **Escape plan:** Participating students can drop out of the B.S./M.S. program at the end of the 4<sup>th</sup> year and graduate with the B.S. in Engineering Physics. The curriculum chart shows that at this point the student will have completed 45 credit hours in required physics courses. This number of hours is equal to the number presently required of Plan 4 majors earning the B.S. degree