

# PORTLAND STATE UNIVERSITY

## DEPARTMENT OF PHYSICS

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### Undergraduate Programs

Physics is the branch of knowledge that attempts to explain all of the phenomena we observe or infer on earth and in the universe. Its study has made possible a modern understanding of the origin of the universe as well as the behavior of biological materials and chemical processes. Scientists trained in this field can engage in such diverse areas as solid state devices, particle physics, energy and the environment, and space travel.

As an undergraduate, you will take a group of core courses that will give you a general background in the subject. You will study force and motion, heat, optics, electricity, magnetism, atomic and nuclear physics, quantum mechanics, and the physical properties of materials, learning both the theoretical and the experimental aspects.

Physicists are employed by almost all industries, particularly by the technical industries and by government laboratories. Although you can work in the field with a bachelor's degree, graduate work will give you a strengthened background that will increase your opportunities.

**Requirements for the B.A. or B.S. Degree in Physics.** It is important that students planning to major in physics contact the Department of Physics prior to the start of their work in order that a coherent program can be planned with their assigned adviser. Students planning to transfer to PSU from community colleges or other universities are strongly advised to contact the Department of Physics well ahead of their proposed date of transfer so that a smooth transition, which avoids course duplication and untimely delays, can be accomplished. There are two options available: standard option and environmental physics option. In addition to meeting the general University degree requirements, the student must meet the following minimal departmental course requirements:

	Credits
Ph 201, 202, 203 General Physics <i>or</i> Ph 211, 212, 213 <i>or</i> Ph 221, 222, 223, General Physics (with Calculus)	9-12
Ph 204, 205, 206 Lab for Ph 201, 202, 203, <i>or</i> Ph 214, 215, 216 Lab for Ph 211, 212, 213 ( <i>or</i> Ph 221, 222, 223)	3
Ph 311, 312 Introduction to Modern Physics	8
Ph 314, 315 Experimental Physics I	8
Ph 321 Current Electricity	4
Ph 322 Computational Physics	4
Ph 424 Classical Mechanics I	3
Upper division electives	8
Total in physics (minimum)	47-50
Mth 251, 252, 253, 254 Calculus	16
Mth 256 Applied Differential Equations	4
Mth 343 Linear Algebra	4
One year of general chemistry: Ch 221, 222, 223, 227, 228, 229	15
Total	39

Select one of the two options (standard or environmental option):

#### Standard option:

Ph 316 Methods of Experimental Physics I	4
Ph 425 Classical Mechanics II <i>or</i> Ph 432 Electricity and Magnetism II	3-4
Total in physics (minimum)	7-8
Two courses in a related area of science or technology (biology, geology, additional chemistry, computer science, electrical circuitry)	6-8
Total	13-16

#### Environmental physics option:

Choose 30 credits from the following list: Ph 451, 471, 490, 492; Bi 251, 252, 253, 357, 475, 476; G 443, 444, 484, Ch 426, 427; CE 371.

Courses taken under the undifferentiated grading option (pass/no pass) are not acceptable toward fulfilling department major requirements except for those major courses offered on a pass/no pass basis only.

# Electrical Engineering/Physics Dual Majors

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## How EE majors can look at the physics program:

### Common to both options:

#### Physics requirements:

Ph 211, 212, 213 General Physics (with Calculus)  
Ph 214, 215, 216 Lab for Ph 211, 212, 213  
Ph 311, 312 Introduction to Modern Physics  
Ph 314, 315 Methods of Experimental Physics  
Ph 321 Current Electricity  
Ph 322 Computational Physics  
Ph 424 Classical Mechanics I  
Physics elective  
Ph 431 Electricity and Magnetism (elective)  
Mth 251, 252, 253, 254 Calculus  
Mth 256 Applied Differential Equations  
Mth 343 Linear Algebra  
One year of general chemistry: Ch 221, 222, 223, 227, 228, 229

#### EE requirements

Ph211, 212, 213 or 221, 222, 223 General Physics  
Ph 214, 215, 216 Lab  
EE: Ph317, 318  
EE: ECE201, 202, 203, 301, 302  
EE: EE321  
EE: EAS101, 102, ECE311, STATS 460  
EE: Ph411 (?)  
ECE Elective: ECE491 (or any other physics course)  
EE: ECE331  
EE: Mth251, 252, 253, 254  
EE: Mth256  
EE: Mth343  
*Substitute another year of science or technology (EE electives)*

### Standard option:

#### Physics requirements:

Ph 316 Methods of Experimental Physics I  
Ph 425 Classical Mechanics II or  
Ph 432 Electricity and Magnetism  
One year of approved courses in a related area of science or technology (biology, geology, additional chemistry, computer science, electrical engineering)

#### EE requirements

EE: Ph464 (?)  
EE: ECE332  
*Substitute another year of science or technology (EE electives)*

The question marks in the above list indicate a less than ideal fit between the physics and EE programs, but in some approximation these courses are acceptable. In fact, these courses are highly desirable for both the EE and the Physics major. From this analysis, the following can be deduced. Besides completing the BS in EE, EE majors need to take two additional courses in physics and one specific ECE elective to qualify for a BS degree in physics (based on the Portland State University Bulletin '02/'03).

These include:

Ph 464: Applied Optics  
Ph 411: Quantum Mechanics  
ECE 491: Laser Systems Design I (or any other physics course)

**Administrative detail:** You can simply add physics as your second major in the online registration procedures. The additional work is minimal, if done over two years. This should increase your potential.

**These courses are of great importance in high technology and will add considerable value to your electrical engineering degree. The minimum acceptable grade, in both Applied Optics and Quantum Mechanics (Ph 464 and 411), is C. If one or more grades of C- are obtained, you will need to take one more course, one or more credits, 300-level or above, with grade C- or better.**

**If for some reason (class time conflicts and/or other reasons) you cannot take one of these courses (Applied Optics and Quantum Mechanics or Ph 464 and 411), you can substitute any two courses in physics for the course that you missed. Thus, in this case, you will have to take three additional courses. Any course of two or more credits will do (300-level and above).**

### Undergraduate advisor:

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