

Department of Physics and Astronomy, CSULB

Goals and Program-Level Student-Learning Objectives For Degree Programs

1. A “successful learning outcome” in most physics lecture and seminar courses in our degree programs is defined by an ability to solve problems given on examinations in the course, usually within some limited time frame. In doing so, students must recognize how the physical system operates or evolves as time passes, in ways consistent with physics principles. The students need to create symbols for various entities of interest in the problem, describe the system with a mathematical model, and be able to manipulate that mathematical model to produce quantities or entities of interest. It often requires active engagement and creative thinking. Some problems in advanced courses require an attack using computational codes, since “hand-wrought” solutions would take extraordinary amounts of time, if they can ever be satisfactorily approached.

2. A “successful learning outcome” in advanced physics laboratory classes, while sharing the physical insight, visualization and mathematical skills just described, has a focus on the design, execution, and reporting of an experiment. The student must extract meaningful data from a physical system, using appropriate instruments. In some classes, these reports are public posters. In particular, the uncertainties of the measurements need to be determined, so that some measure of the experimenter’s confidence in the results is stated. Undergraduate laboratories are much more structured than research laboratories, with projects and goals set by the instructors.

PROGRAM	GOALS & LEARNING OUTCOMES
BS or general MS Physics programs	Graduates in these degree programs should have mastered the formal theoretical techniques and advanced experimental techniques that are commonly expected for students entering or in graduate studies in physics or related fields. Graduates in these degree programs should be able to apply their knowledge to solve state of the art problems at the appropriate level of their preparation, either acting individually, or, when appropriate, as part of a team.
Applied Physics MS and the proposed MS Option in Computational Physics	These outcomes share much with outcomes described above for the BS and general MS programs. Graduates of the Applied Physics MS program should have a broad physics education that will allow them to succeed in areas where uses of experimental equipment, the acquisition/analysis of data, and the uses of computational physics are important. These degree programs emphasize special skills in various areas of physics that some graduates may need to be successful.
BA Physics program	Graduates of the BA program should have a broad education that will allow them to succeed in diverse fields such as elementary and secondary school teaching, business, law, medicine, science writing, and many other careers for which a quantitative scientific education has a positive value.

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Learning outcomes for all physics majors

All physics majors should

- have a firm grasp of the theories that form the basis of mechanics, electricity and magnetism, thermodynamics, quantum mechanics, and special relativity, and some knowledge of optics and/or nuclear and particle physics and/or condensed matter physics and/or astrophysics
- be able to apply the principles of physics and appropriate mathematical methods to usefully approach and solve some appropriate real world problems.
- be familiar with experiments upon which a basic understanding of physics rests, and have a familiarity with the uses of computational physics.
- be familiar with basic laboratory equipment and basic symbolic software computational techniques.
- be able to discuss, design, and carry out some simple experiments to answer basic questions or to demonstrate basic principles.
- be able to keep comprehensive laboratory notebooks when appropriate.
- be able to communicate results through written reports and oral presentations,
- be able to speak to the role of science in our society, which requires a basic broader understanding of societal institutions, cultures, literacy, and the arts
- **For graduate students, in addition:** be familiar with laboratory equipment appropriate to their area of research, computational codes, data collection with computers, and experimental and theoretical techniques necessary and appropriate to their interests and specialization. With a faculty member, they should be able to formulate and carry out a thesis project, and write it up and defend it successfully. In special cases approved by the department's Graduate Committee, be able to pass a comprehensive examination that can replace the thesis requirement.