Department of Physics and Astronomy

Assessment Plan

Draft March 26, 2011

The department offers courses of study leading to a B.S. or B.A. in physics, physics courses aimed at majors in other natural sciences or mathematics, and physics, astronomy, and geology courses aimed at a general education audience.

I. Educational Goals

Physics majors

1) Students completing the major in physics will know and understand in detail many of the concepts that are used to describe the physical world, including:

a) the relationship between force and motion
b) work and mechanical energy
c) thermal energy and statistical mechanics
d) electric and magnetic fields
e) electric circuits
f) electromagnetic radiation
g) special relativity
h) quantum phenomena
i) elementary quantum mechanics
j) the structure of matter
k) the fundamental interactions of matter
l) collection, analysis and presentation of experimental data

2) Students completing the major in physics will be able to apply fundamental physical principles to the solution of complex problems.

3) Students completing the major in physics will be able to communicate results of their calculations and experimental work clearly,

a) orally
b) in written form

Students majoring in other natural sciences or mathematics

4) Students completing physics courses as cognate requirements will know and understand physics concepts that will help them to better understand concepts in their own major areas of study.

5) Students completing physics courses as cognate requirements will understand the relevance of their studies in physics to their own major areas of study.

Students studying physics, astronomy, or geology for general education purposes

6) Students completing courses in these areas as part of their general education curriculum will know and understand a limited set of concepts that illustrate a scientific approach to explaining the physical world.

7) Students completing courses in these areas as part of their general education curriculum will have gained an appreciation of the scientific approach to understanding the physical world.

II. Methodology for Measuring Attainment of Educational Goals

Classroom assessment: For all three groups of students, knowledge and understanding of course-specific content is assessed primarily through exams, quizzes and homework. (Goals 1, 2, 4, 6)

Oral and written reports: Written communication of observations and conclusions is a central emphasis of the laboratory component of courses. Lab reports provide an opportunity for students to build written communication skills, as well as an opportunity for the instructor to evaluate students' understanding of the concepts involved and their success at communicating that understanding. In some courses, students are required to make oral presentations on topics they have selected for individual study. Again, these oral presentations serve both instructional and evaluative purposes. (Goals 1, 3, 4, 6)

Research experience: Physics majors are required to complete a meaningful research experience, either under the direct supervision of a member of the department's faculty or as part of a structured summer research experience elsewhere (e.g., as a participant in the NSF-funded Research Experiences for Undergraduates [REU] program). They are also required to make public presentations of the results of their research. This serves as an integrative experience for our majors, in that they are called upon to apply knowledge and skills they have acquired through their earlier coursework to a real research task. Each member of the department's faculty evaluates the extent to which the student's presentation indicates success in the department's educational goals for majors. (Goals 1, 2, 3)

Pre-/post-testing: In courses that include a thorough introduction to the relationship between force and motion, specifically the courses PHYS P201 (General Physics 1) and PHYS P221 (Physics 1), we have performed pre- and post-testing using the Force Concept Inventory (FCI), an instrument in wide use for this purpose. (Goals 1, 4)

Success in graduate school admission and completion: For those students who aspire to graduate study in physics or a related field, we track their success in being admitted and in completing their intended course of study. (Goals 1, 3)

Items on student course evaluations: Our student course evaluations include items related to the fairness and effectiveness of exams and other classroom assessment techniques, items concerning the quality and effectiveness of our laboratory exercises, and items that measure students' perceptions of the relevance of our courses. (Goals 5, 7)

Faculty inventory: The department's faculty members are often in a position to identify program strengths and weakness that are not addressed by the other methodologies listed here. Comments from the teaching sections of faculty members' annual reports provide an opportunity for the department chair to bring these observations to the attention of the rest of the department's faculty. (Goals 1, 2, 3, 4, 5, 6, 7)

Alumni survey: The department will survey physics major graduates approximately two years after their graduation, in order to solicit their current perceptions of the strengths and weaknesses of their undergraduate education. These surveys will also present an opportunity to collect direct measures of graduates' success in graduate study or employment. Surveys of all the department's alumni will be carried out periodically – perhaps every five years – for the same purposes. (Goals 1, 2 3)

III. Process for Using Assessment Information to Improve Programs

Internal assessment report: Each February the department's assessment coordinator will prepare a report of the assessment measures collected during the previous year and distribute it to the department's faculty. The report will include:

-- relevant comments from the teaching section of faculty annual reports from the past year
-- results of pre-/post-testing using the FCI, as reported by the instructors administering these instruments
-- summary results of relevant items on student course evaluations
-- summary results of faculty evaluations of students' research presentations during the past year
-- any available information concerning the success of recent graduates in securing suitable employment, admission to graduate study, or completion of graduate degrees
-- results of alumni surveys completed during the past year

Department assessment meeting: The faculty will devote time at a department meeting in March to discussion of the department's internal assessment report. If the discussion identifies either shortcomings in the department's programs or strengths that could be capitalized on through programmatic changes, the faculty will attempt to identify measures that could be taken to accomplish this.

Departmental assessment report: The department's assessment coordinator will prepare the appropriate annual report for the campus Assessment Committee.

IV. Participation of All Constituencies

Faculty involvement will include participation in the department assessment meeting, as well as collection of direct assessment data via classroom assessment, pre- and post-testing and student course evaluations.

Course evaluation responses provide opportunities for student participation in the assessment process.

Alumni will be invited to participate in the department's assessment activities through alumni surveys.

V. Record Keeping

Department records of assessment activities will include these items:

-- relevant comments from teaching section of faculty annual reports
-- detailed results of pre-/post-testing using FCI or other instruments
-- results from relevant items on student course evaluations
-- faculty evaluations of students' research presentations
-- results of alumni surveys

-- internal assessment reports
-- minutes of departmental assessment meetings
-- assessment reports submitted to the campus Assessment Committee
-- departmental assessment plans