

Program Assessment Plan for Physics & Astronomy – Undergraduate Programs - DRAFT

I. Document Control Plan

This document, the “Program Assessment Plan for Physics & Astronomy – Undergraduate Programs,” will be housed in the Department of Physics and Astronomy and will be controlled by the Undergraduate Programs Assessment Coordinator as assigned by the Department Chair. The document will be updated every five (5) years and approved by the Department Faculty by Reading Day in the Fall Semester based on input from Department Faculty and guided by similar entities (NC Department of Public Instruction [DPI], Appalachian’s Strategic Plan, Southern Association of Colleges & Schools [SACS], etc.). The document will be made available on the department website no later than the first day of classes in the Spring semester of each five-year cycle. The document will be tracked by academic year of applicability, as specified in the footer below. The annual progress report is a separate document available from the Undergraduate Programs Assessment Coordinator or from those with access to TracDat.

2009-10 Undergraduate Programs Assessment Coordinator:

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II. Mission and Vision Statements

Mission Statement

The Department of Physics and Astronomy is responsible for the preparation of students for numerous careers requiring a technical background and for offering service courses at appropriate levels for students in many disciplines. In addition, the Department is active in research and in service to the region and to other departments of the University. (1995 edition)

Vision Statement

In concert with the ASU strategic plan, UNC-tomorrow, and our program assessment plans, the Department of Physics and Astronomy's vision is to further the legacy of excellence in undergraduate teaching, continue the development of graduate programs, and grow scholarship that will position our department faculty and graduates as leaders in their respective fields.

III. Learning Goals & Outcomes - Summary

This section contains the learning Goals and Outcomes for undergraduate programs in Physics & Astronomy. The Goals for Undergraduate Physics are the same for all three programs (266A – Teaching; 269A – BA; 270B – BS, Applied Physics). The Outcomes for all three programs are the same for Goals 1 through 4, with some minor differences in the Outcomes for Goal 5. These differences are indicated below. (**Note:** Separate documents for each program area are required for various agencies, NCDPI, SACS, etc.)

Learning Goals

1. Students should demonstrate a fundamental understanding of classical and modern physics

Learning Outcomes

Student will:

- a. Demonstrate an understanding of Newton's laws, Maxwell's equations, and Schrodinger's equation
- b. Demonstrate the mathematical concepts and methods appropriate for classical and modern physics.
- c. Answer conceptual questions in classical mechanics, electricity & magnetism, and modern physics.
- d. Answer quantitative problems in classical mechanics, electricity & magnetism, and modern physics.

2. Students should demonstrate advanced analytical, critical thinking and problem-solving skills

Learning Outcomes

Student will:

- a. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
- b. Apply appropriate mathematical concepts and models for solving problems in classical and modern physics.
- c. Estimate and check answers to problems in order to determine reasonableness, identify alternatives, and select optimal results.

3. *Students should demonstrate experimental skills in basic and applied research*

Learning Outcomes

Student will:

- a. Construct and assemble experimental apparatuses to conduct experiments that decisively test a hypothesis.
- b. Analyze experimental results and draw reasonable conclusions from them.
- c. Interpret experimental data to make meaningful comparisons between experiment and theory.
- d. Identify and assess sources of experimental uncertainty and error.

4. *Students should demonstrate communication skills, especially in scientific/technical settings*

Learning Outcomes

Student will:

- a. Locate research results by searching electronic and traditional databases.
- b. Effectively select and use hardware, software applications, and other technologies for communication.
- c. Convey physics concepts to a general audience.
- d. Present research in a form consistent with the AIP style manual.

5. *Students should contribute to the field of science and/or engineering at the entry level in industry, government, or academia*

Learning Outcomes

Student will:

- a. Demonstrate proficiency in standard software tools (Excel, Word, Graphical Analysis, etc.) for modeling, data analysis, and report writing.
- b. Apply their physics experience and knowledge to analyze new situations.
- c. Identify and use standard laboratory equipment and instrumentation.
 - i. *Teachers (266A)*: Teachers will also be able to set up and use standard laboratory equipment and instrumentation in a high-school setting.
- d. *Teachers (266A)*: Develop a variety of teaching strategies to accommodate multiple learning styles of students.
Or BA (269A): Demonstrate understanding of upper-level physics content.

Or *BS (270B)*: Demonstrate proficiency in an area of applied physics.

IV. Assessment Plan for Learning Outcomes

A. Evaluation Protocols

Learning Outcomes for the program will be evaluated according to the protocols listed in Table 1. Column headings refer to the following categories:

Where measured – when is outcome/goal assessed: which course(s), at beginning and or end of time in department, etc.

Outcome – how we know student has achieved Learning Outcome. Shortcut names for TracDat Learning Outcome entries are included in brackets [] at end of Outcome statement.

Data/Evidence – what data are collected & how information will be used to evaluate the program

How measured – in what manner will the student be assessed: rubric, standardized tests, etc.

Status – what needs to be done to implement the evaluation process/instrument

Reporting period – how often will assessment information be collected and who is responsible for collecting the information

Note: All Data/Evidence are to be in a format that can be electronically entered into TracDat.

Table 1: Protocols for assessing program outcomes.

Where measured	Outcome(s) [TracDat Outcome name]	Data/Evidence	How measured	Status	Reporting period
PHY4210	1.a. Demonstrate an understanding of Newton’s laws, Maxwell’s equations, and Schrodinger’s equation [Fundamental laws & equations] 1.b. Demonstrate the mathematical concepts and methods appropriate for classical and modern physics. [Math methods] 2.a. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them. [Math models] 2.c. Estimate and check answers to problems in order to determine reasonableness, identify alternatives, and select optimal results. [Check answers]	Student scores for talks/posters and reports. Goal: Minimum scores “Acceptable” for each class	4210 Talk, Poster, Report Rubrics	In use	Yearly by course instructor(s)

	4.c. Convey physics concepts to a general audience. [Communicate to audience] 4.d. Present research in a form consistent with the AIP style manual. [Present research]				
PHY2210 & PHY4210	3.a. Construct and assemble experimental apparatuses to conduct experiments that decisively test a hypothesis. [Construct approaches] 3.b. Analyze experimental results and draw reasonable conclusions from them. [Analyze data] 3.c. Interpret experimental data to make meaningful comparisons between experiment and theory. [Interpret data] 3.d. Identify and assess sources of experimental uncertainty and error. [Uncertainty] 4.b. Effectively select and use hardware, software applications, and other technologies for communication. [Use technology] 5.a. Demonstrate proficiency in standard software tools (Excel, Word, Graphical Analysis, etc.) for modeling, data analysis, and report writing. [Use software] 5.b. Apply their physics experience and knowledge to analyze new situations. [Apply physics] 5.c. Identify and use standard laboratory equipment and instrumentation. <i>Teachers (266A)</i> : [Use equipment]	Student scores for talks/posters and reports. Goal: Minimum scores “Acceptable” for each class	4210 Talk, Poster, Report Rubrics	In use in 4210. Needed in 2210.	Yearly by course instructor(s)
PHY 3400	5.c (cont'd) (for 266A only) Teachers will also be able to set up and use standard laboratory equipment and instrumentation in a high-school setting. [Use equipment]	Student scores for in-class presentations that use equipment	RCOE rubrics	In use	Every 1 to 2 years by Teacher Education Coordinator
Diagnostic Tool	1.c. Answer conceptual questions in classical mechanics, electricity & magnetism, and modern physics. [Conceptual understanding]	Pre-test scores from 1 st intro course and Post-test scores from end of 4210	Pre- and post-test comparisons	In use	Dept Assessment Committee
PHY3400: Physics Instruction Practicum and Student Teaching	5.d. <i>Teachers (266A)</i> : Develop a variety of teaching strategies to accommodate multiple learning styles of students. [Teaching strategies]	Student scores for in-class presentations and student teaching	RCOE Rubrics	In use	Every 1 to 2 years by Teacher Education Coordinator

PHY 4210	1.d. Answer quantitative problems in classical mechanics, electricity & magnetism, and modern physics. [Quantitative problems] 2.b. Apply appropriate mathematical concepts and models for solving problems in classical and modern physics. [Apply math] 5.d. <i>BA (269A)</i> : Demonstrate understanding of upper-level physics content. [Upper-level physics] OR 5.d. <i>BS (270B)</i> : Demonstrate proficiency in an area of applied physics. [Applied physics]	Student scores on Exit Exam at end of 4210	Exit Exam rubric	Both Exit Exam and rubric need to be developed	Yearly by course instructor(s)
PHY 2210	4.a. Locate research results by searching electronic and traditional databases. [Research databases]	Student scores on research assignment	Rubric	To be developed	Yearly by course instructor(s)

B. Program Annual Progress Report

Each year, a progress report summarizing the results from the Program Outcomes will be presented to the department. Data/Evidence from the Outcomes entered into TracDat will be collected by the Assessment Coordinator, or designated representative, and summarized for the progress report. Members of the Assessment and Curriculum committees will work in concert to generate the full report and to provide recommendations to the department for the program(s). The annual progress report will be housed in the Department of Physics & Astronomy in the office of the Department Chair. Copies of the report will be made available upon request.