Undergraduate Academic Assessment Plan Physics 2012 2013

Physics BA and BS
(CIP 40.0801)

College of Liberal Arts and Sciences

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Physics, Liberal Arts and Sciences
Undergraduate Academic Assessment Plan

Introduction

The Department of Physics at the University of Florida is one of the premier physics departments in the United States in its undergraduate and graduate education as well as in leading-edge research. From a small department with 22 faculty members in 1979, it has grown to more than 40 faculty members and consistently produces around 30 bachelors a year. The undergraduate program provides a rigorous curriculum to meet the educational goals of the program. The physics faculty members, who are internationally renowned researchers in their areas of expertise, are fully in charge of all classroom courses and provide invaluable guidance in laboratory courses and undergraduate research.

The Department of Physics offers two Bachelor's degrees: BS and BA. The BS degree is appropriate for students interested in pursuing advanced degrees in physics and other physical sciences. The BA degree is for students who aim to be teachers in science or to pursue advanced or professional degrees in other related areas.

Mission Statement

The laws of physics are the starting point for most scientific research and engineering applications. The undergraduate physics program at the University of Florida provides a comprehensive curriculum which prepares students to serve and to play leading roles as researchers and educators in a broad spectrum of academic and industrial fields as well as informed citizens in our society. Students majoring in physics obtain broad-based knowledge of physics, the ability to apply physics laws to the real-world problems, and hands-on experiences in building equipment, and designing and performing experiments. Through this program students build intellectual foundation, sharpen their critical and analytical thinking, and refine skills in problem solving not only the fundamental problems of Nature but also diverse practical issues.

The mission of the undergraduate physics program is coherent with the mission of the College of Liberal Arts, in that "Students acquire an intellectual foundation based on a well-rounded and comprehensive education designed for an increasingly technological and rapidly changing society (http://www.clas.ufl.edu/about/index.html)." The program mission is also directly aligned with the mission of the University of Florida to provide an educational process that "… explores physical and biological universes and nurtures generations of young people from diverse backgrounds to address the needs of the world's societies (https://catalog.ufl.edu/ugrad/current/uf-mission/Pages/home.aspx)."

Student Learning Outcomes (SLOs)

Existing SLOs in the 2012-13 undergraduate catalog:

1. Competence in mechanics, electromagnetism, thermal physics and quantum mechanics.
2. Knowledge of and competence in experimental physics and data analysis.
3. The ability to formulate and solve problems in physics in the above areas, and draw conclusions from experimental data.
4. The ability to effectively and clearly communicate ideas in speech and in writing in an accepted style and presentation.

Revised SLOs for the 2013-14 undergraduate catalog:

Content Knowledge:

SLO 1: Students identify, define, and describe the core fields of physics: Classical Mechanics, Electricity and Magnetism, Thermal Physics, and Quantum Mechanics.

SLO 2: Students identify, define, and explain Experimental Physics and Data Analysis.

Critical Thinking:

SLO 3: Students formulate, solve problems and draw conclusions from data.

Communication:

SLO 4: Students effectively and clearly communicate ideas in speech and in writing in an accepted style.

New/Revised SLOs, 2013-14*	Link to 2012-13* SLOs
Content	
Students demonstrate knowledge and competence in the core fields of physics: Classical Mechanics, Electricity and Magnetism, Thermal Physics, and Quantum Mechanics.	Competence in mechanics, electromagnetism, thermal physics and quantum mechanics.
Students demonstrate knowledge and competence in Experimental Physics and Data Analysis.	Knowledge of and competence in experimental physics and data analysis.
Critical Thinking	
Students formulate, solve problems and draw conclusions from data.	The ability to formulate and solve problems in physics in the above areas, and draw conclusions from experimental data.
Communication	
Students effectively and clearly communicate ideas in speech and in writing in an accepted style.	The ability to effectively and clearly communicate ideas in speech and in writing in an accepted style and presentation.

*undergraduate catalog dates

Curriculum Map

Program: Physics **College: Liberal Arts and Sciences**

KEY: **I**ntroduced **R**einforced **A**ssessed

SLOs	PHY2048/PHY2060	PHY2049/PHY2061	PHY2048L	PHY2049L	PHY3101/PHY3063	PHY3221/PHZ3113	PHY3323	PHY3513	PHY4604	PHY4802L
Content Knowledge										
SLO 1	I	I	I	I	I, R	R, A Field Test	R, A Field Test	R, A Field Test	R, A Field Test	R, A Field Test
SLO 2			I	I						R, A Report
Critical Thinking										
SLO 3	I	I	I	I	I, R	R, A Field Test	R, A Field Test	R, A Field Test	R, A Field Test	R, A Report
Communication										
SLO 4			I	I	R	R	R	R	R	R, A Presenta-tion

Assessment Cycle

Program: Physics **College: Liberal Arts and Sciences**

Analysis and Interpretation: by the end of Summer A

Improvement Action: by September 15

Dissemination: by October 7

SLOs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Content Knowledge						
SLO 1	X	X	X	X	X	X
SLO 2	X	X	X	X	X	X
Critical Thinking						
SLO 3	X	X	X	X	X	X
Communication						
SLO 4	X	X	X	X	X	X

Methods and Procedures

SLO Assessment Matrix

The SLO Assessment Matrix is new for the 2012-13 Academic Assessment Plans. We have populated the matrix to the extent possible with the information we have available. Please complete the matrix.

Assessment Method - For each SLO, please enter the assessment method you are using – exam (course, internal, or external), project, paper, presentation, performance, etc.

Measurement – list the measurement procedure you use for this outcome. It can be a faculty-developed rubric with the minimum acceptable level identified, an exam score and the minimum passing score, or other measurement. **Required for 2012-13: Include at least one example of a rubric used to assess an SLO.**

SLO Assessment Matrix for 2012-13

2012-13 Student Learning Outcome	Assessment Method	Measurement Procedure
Students identify, define, and describe the core fields of physics: Classical Mechanics, Electricity and Magnetism, Thermal Physics, and Quantum Mechanics.	Field test; Report	Multiple-choice field test problems selected by the Undergraduate Coordinator
Students identify, define, and explain Experimental Physics and Data Analysis.	Report	Faculty assesses
Students formulate, solve problems and draw conclusions from data.	Field test; Report	Multiple-choice field test problems selected by the Undergraduate Coordinator
Students effectively and clearly communicate ideas in speech and in writing in an accepted style.	Presentation	Faculty assesses

I. Direct Methods

In recent years, the four SLOs have been directly assessed in both Fall and Spring semesters in five core courses (PHY3221, 3323, 3513, 4604, and 4802L) that are required for both BA and BS degrees. Multiple-choice field test problems selected by the Undergraduate Coordinator (UC) are provided to the instructor of each course by mid-semester (see Appendix for sample test problems). The test problems are administered to students during the last three weeks of each semester. Since 2011 Fall, the instructors of PHY2402L provide assessment of SLO 4 based on oral presentations of students' final "skunk works" projects. The results are collected and analyzed by the Undergraduate Coordinator. A revised assessment scheme will be implemented in Fall 2012. There are no differences in assessment between the BS and the BA track.

Revised Plan

The revised plan assesses the four SLOs in the same five core courses as are currently used. However, the nature of the assessment has been adjusted to provide more in-depth measures of students' attainment of the SLOs. At the same time, it has been decided to assess four of the courses only in one semester per year: the "on-track" semester for students following the standard physics major track. The table below shows the measurement cycle and the measured SLOs for each course.

Assessed Course	Measurement Time	Measurement Frequency	Measured SLOs

PHY3221	**Fall**	**Every Year**	**1 & 3**
PHY3323	**Spring**	**Every Year**	**1 & 3**
PHY3513	**Spring**	**Every Year**	**1 & 3**
PHY4604	**Fall**	**Every Year**	**1 & 3**
PHY4802L	**Fall & Spring**	**Every Year**	**1, 2, 3, & 4**

The format and management of the field tests differ significantly from the current scheme. The test problems are made and selected by the Undergraduate Curriculum Committee (UCC) chaired by Undergraduate Coordinator. The problems, similar in style to those in the Physics GRE Subject Test, are presented in multiple-choice format. For consistency and quantitative comparison, the UCC will establish test banks for each subject by the end of 2014-2015. In the revised plan, the number of the field test problems will increase to cover a broader base of physics knowledge and reduce statistical fluctuations. The assessment is incorporated into each course's grade only in participation but not in actual score of the test. SLO 4 is measured exclusively via an oral presentation and lab reports in PHY4802L. The results of analysis are presented to the UCC, and the UCC makes recommendations for plans and changes to improve student learning.

Method	Format/ Scoring	Passing Score	Target Outcome	Use of Results for Improvements
Field Test	Problems in multiple-choice format. 100 full score	Higher than 50	100% passing	Review of curriculum and also test problems. Provide feedback to instructors.
Lab Report	Instructor grades Lab reports. Follow UF Letter Grading scale.	C and higher	100% passing	Analysis used to guide to improve data analysis skills and technical writing skills
Presentation	Oral presentation. Follow UF Letter Grading scale.	C and higher	100% passing	Analysis used to guide to improve communication in presentation.

II. Indirect Methods

Most of the indirect assessments are not quantifiable and are only used to provide qualitative evaluation of the program.

Enrollment Statistics: Enrollment data for the four core courses are collected each semester by the Undergraduate Coordinator.

Exit Survey: The Undergraduate Coordinator emails exit survey to graduating seniors each Spring (see Appendix). Student feedback is an important source of input for changes in course offerings and structure.

Placement of Graduating Seniors: Through exit surveys and personal contacts, information on placement of graduating seniors is collected: graduate schools attended, employment accepted, and immediate plans after graduation.

Awards: Recipients of the following scholarships or fellowships are traced as an indicator of excellence of physics program:

- Barry M. Goldwater Scholarship
- NSF Graduate Research Fellowship
- National Defense Science and Engineering Graduate (NDSEG) Fellowship
- Fulbright Scholarship/ Hertz Foundation Scholarship
- University Scholar (UF internal award)

Assessment Oversight

Associate Chair of Physics: Oversee overall assessment procedures and activities.

Kevin Ingersent	Professor of Physics	kevin@phys.ufl.edu

Undergraduate Coordinator/Chair of Undergraduate Curriculum Committee (UCC): Plan, execute, and analyze assessment and lead UCC action.

Yoonseok Lee	Associate Professor of Physics	yoonslee@phys.ufl.edu

Undergraduate Curriculum Committee Members: Make and select field test problems for all courses assessed. Make recommendations for changes and improvements based on the assessment.

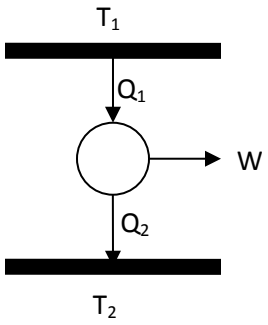
Robert DeSerio	Sr. Associate In Physics	deserio@phys.ufl.edu
Selman Hershfield	Professor of Physics	Selman@phys.ufl.edu
Katia Matcheva	Assistant Professor of Physics	katia@phys.ufl.edu
Khandker Muttalib	Professor of Physics	muttalib@phys.ufl.edu
Heather Ray	Assistant Professor of Physics	hray@phys.ufl.edu

Appendix

I. Examples of Test Problems

From Spring 2011 PHY3513

1. Choose a wrong statement on a Carnot engine shown in the figure.



A. The efficiency of this engine is $1 - Q_2/Q_1$

B. The high temperature reservoir loses entropy in one cycle.

C. The low temperature reservoir gains entropy.

D. Because of the work produced in this process, the entropy of the total system has increased.

E. The internal energy of the whole system remains the same.

Answer: D

2. Which of the following process(es) will result in cooling of an ideal gas? The internal energy of an ideal gas has to decrease in the process in order to have cooling.

I. Isothermal reversible decompression

II. Adiabatic reversible expansion.

III. Adiabatic free expansion.

A. I, II, and III

B. II and III

C. II only

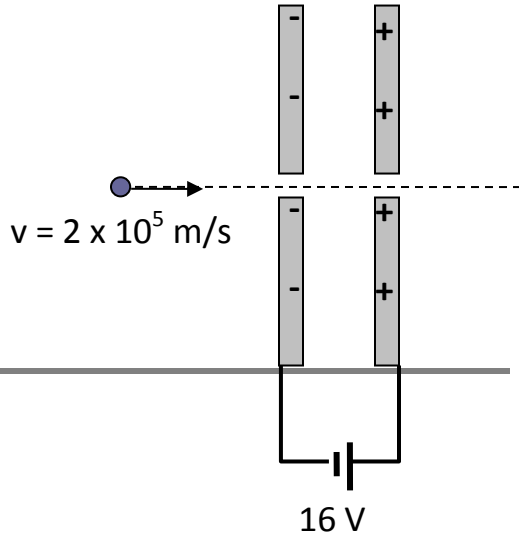
D. III only

E. I and II

Answer: C

From Fall 2010 PHY3323

1. A proton (+e) originally has a speed of 2.0×10^5 m/s as it goes through a plate as shown in the figure. It shoots through the tiny holes in the two plates across which 16 V



of electric potential is applied. Find the speed as it leaves the second plate in m/s.

A. 1.92×10^5

B. 5.0×10^7

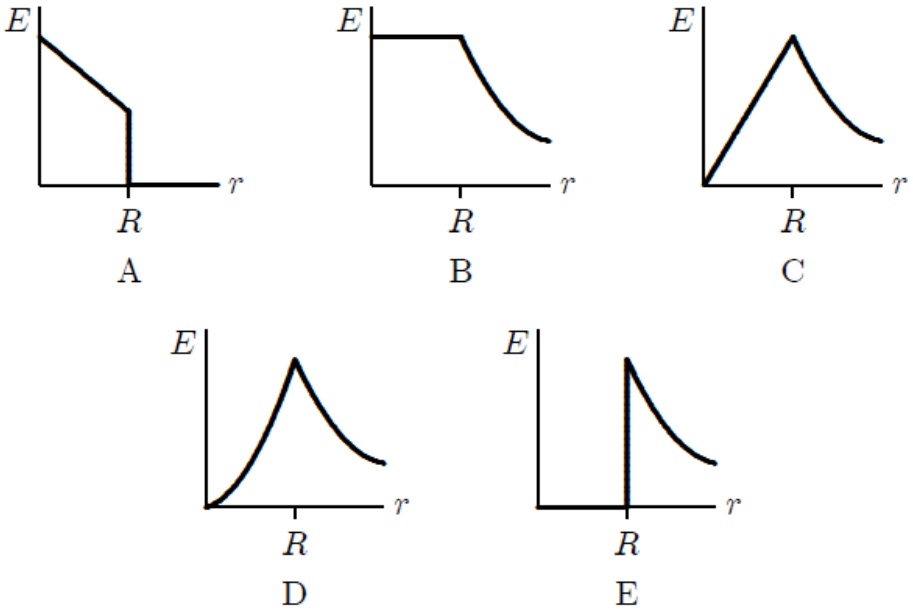
C. 505.3

D. 7.8×10^4

E. 1.1×10^5

Answer: A

2. A solid insulating sphere of radius R contains positive charge that is distributed with a volume charge density that does not depend on angle but does increase with distance from the sphere center. Which of the graphs below might give the magnitude E of the electric field as a function of the distance r from the center of the sphere?



Answer: D

II. Exit Survey Questionnaire

1. Your Name

2. Please list all the degrees you are graduating with. (*e.g. Physics BA – Math BS or Physics BS – Math minor*)

3. If you switched your major to Physics at some point at UF, from which major did you switch and why? Please indicate if you came to UF with an AA degree.

4. Did you receive any recognizable awards (scholarships, fellowships, grants...) during your time at UF or for your future career? Please list all.

5. What is your immediate plan (within a year) after graduation?

6. If you are planning to attend a graduate program, please specify the name of the school and the field of study.

7. If you have applied for graduate programs, please list the names of the schools, field of study, and whether you were accepted.

8. If you are planning to work in industry, please specify the name of the company and the field of industry.

9. If you are planning to teach, did you go through any teacher training program at UF such as UFTeach?

10. If you have participated in research on UF campus, please list the group and the period of time.

11. If you have participated in summer research, please list the year, program name (*e.g., REU*), and the host institute.

12. Did your research result in any types of presentations or publications? Please list all.

13. How would you describe your overall experience as a Physics major at UF?

14. What do you think are the strengths and weaknesses of our Physics curriculum?

15. Did you feel that the Department responded fairly and properly to the students' concerns and/or requests

16. Did you feel that the academic advising in Physics helped your academic progress? What could have done to make academic advising more effective and efficient?

17. What was the most memorable thing (*moment, course, event...)* that you experienced as a Physics major at UF?

18. How much did you know about the UF Physics Program in high school?

19. Thank you for completing this survey. Please state anything else you want to address but has not been addressed in this survey.