UNIT REPORT Physics BS - Assessment Plan Summary

# **Physics BS**

## **Competence For Bachelor Of Science**

## **Goal Description:**

Seniors studying Physics will demonstrate competence to graduate with a Bachelor of Science in Physics

RELATED ITEMS/ELEMENTS ------

#### **RELATED ITEM LEVEL 1**

## **Mastery Of Fundamental Principles In Physics**

## Learning Objective Description:

Students preparing to graduate with a BS in Physics will demonstrate comprehension of fundamental principles and the ability to apply these principles in solving problems.

#### **RELATED ITEM LEVEL 2**

## **Previous GRE Subject Test In Physics**

## **Indicator Description:**

Students will complete a common earlier version of the Graduate Record Subject Exam in Physics related to PHY 4370 (Classical Mechanics ) under GRE standardized conditions. Faculty will have classified the questions into domains specific to the major principles in this area.

## **Criterion Description:**

Students will score above the 50th percentile determined as a result of the graduating seniors' scores from the common exam. A raw score of 50% is in the 74th percentile for the Physics GRE with a <sup>1</sup>/<sub>4</sub> penalty for wrong answers.

## **Findings Description:**

Quantum mechanics is a subject area in which very few entering physics majors have experience. The questions selected for these subject exams were not generally computationally difficult, although they tend to be completely inaccessible to a person with no experience in the subject. Pretest scores were statistically consistent with zero, after adjusting for the expected random rate of correct responses. Once the basic analysis techniques and intuition of the subject had been taught, students performed significantly better on the post-test, answering a majority of questions correctly, on average. The mean scaled score improved by more than two in units of the standard deviation.

## Attached Files

## Copy of Quantum

**RELATED ITEM LEVEL 3** 

## Previous GRE Subject Tests in Physics

## **Action Description:**

GRE Physics tests will provide a standardized assessment, which is normalized to national expectations for graduating seniors with the physics degree.

Provide The Necessary Basic Skills For Beginning Students In Physics, The Physics/engineering Dual Degree And Pre

## Engineering Programs

## **Goal Description:**

The Department of Physics provides discipline-specific offerings for beginning students in physics, the dual degree in physics/engineering and pre engineering

#### RELATED ITEMS/ELEMENTS -----

#### **RELATED ITEM LEVEL 1**

## **Apply Foundational Concepts**

## Learning Objective Description:

Students who complete the second course in calculus based Physics will be able to apply foundational concepts, particularly in the areas of (1) proofs and derivations, and (2) translation of written problems into mathematical equations.

**RELATED ITEM LEVEL 2** 

## **Comprehensive Exam**

## **Indicator Description:**

Students will complete a faculty-developed comprehensive exam in Physics 1411 assessing the common foundational concepts in Physics. **Criterion Description:** 

Eighty percent of students completing the exam will score 70% or higher on the comprehensive exam.

## **Findings Description:**

Due to a mistake made by Dr. Friedman the wrong course was assessed - we used the GRE to assess the junior senior

mechanics course. In the next assessment cycle we will assess the correct course. The assessment for the junior senior course is below:

After adjusting for the expected random rate of correct responses, the average pre- and post-test scores in Classical Mechanics were both statistically consistent with zero.

We conclude that a rethinking of the assessment tool is in order. The selected exam questions were both sophisticated and subtle, and the allowed time was rather short for the number of questions asked.

We believe that this combination has prevented the exam from effectively revealing the progress made by the students.

## Attached Files

## Copy of Mechanics

## **RELATED ITEM LEVEL 3**

## Comprehensive Exam

## Action Description:

Examinations at end of term of essential materials for each upper division required course.

## Update to Previous Cycle's Plan for Continuous Improvement

## Previous Cycle's Plan For Continuous Improvement (Do Not Modify):

The department will use nationally standardized assessment tools for quantification of mastery and retention of essential skills.

## Update of Progress to the Previous Cycle's PCI:

Standardized examination questions from GRE subject tests in quantum mechanics and classical mechanics were administered. Scores in quantum mechanics improved by more than two standard deviations. Scores in classical mechanics were consistent with the pretest at a level of less than one deviation. We attribute the larger improvement in quantum mechanics to the fact that students are starting from zero information in this case. The classical mechanics exam may not be optimally aligned with course coverage, and improvement could be sought here. Results require additional statistics for interpretation.

## **Plan for Continuous Improvement**

## **Closing Summary:**

We will continue to align standardized assessment instruments with course curriculum, and to extend the courses participating in this trial.

We will partner with marketing and the visitor center to expand our contact with surrounding high-school physics and astronomy programs, seeking to increase enrollment.

We will improve our presence on the web, and emphasize success stories of prior graduates.

We will partner with Brian Loft and the new STEM grant on improving first year experience, possibly in connection to our established Physics Boot Camp.