Spring 2016

Physics Discipline Assessment Report 2015/2016

Physics Discipline

Physics Student Learning Outcome 4. To develop students' ability to communicate, in form and content, both orally and in writing, the results of scientific work.

Senior Thesis I - fall 2015

The students reviewed the physics literature to find a recent article in a reputable journal in their individual area of physics interest. The students processed the contents of the article and prepared a 15 minute oral presentation and a five to seven page paper describing the content of the article. The oral presentations were evaluated based on the quality of the presentation, the organization and clarity, and the science and math content of the presentation. The papers were evaluated on the grammatical correctness, the clarity of the writing, and the accuracy of the description of the scientific content. The presentations and papers indicated the students' ability to process and present highly technical information. All of the students achieved the objective of PSLO 4 as demonstrated through the strength of their written and oral presentations.

Senior Thesis II – spring 2016

The students carried out an in-depth study of one area of physics through the investigation of one published paper. This study was carried out under the mentorship of one of the physics faculty. Extensive background beyond standard physics coursework had to be understood to master the topic. At the completion of the investigation, each student wrote a paper of 15 or more pages on the topic and a 45 minute oral presentation was made. As in Senior Thesis I the presentations and papers indicated the students' ability to process and present highly technical information and exhibited their mastery of communicating scientific work orally and in writing..

As a result of past assessment the physics discipline implemented the two credit Senior Thesis I and II program replacing the former one credit Senior Thesis. This change has produced the desired result of more opportunities for students to communicate scientific results orally and in writing and to receive more feedback on their presentations increasing their command of PSLO 4.

Physics Student Learning Outcome 3. To acquire the skills necessary to perform experimental work

Modern Physics – spring 2016

Three laboratory activities were assessed with respect to the students' acquisition of experimental skills. In the first lab the speed of light in air was measured. This experiment requires students to accurately position equipment and measure distances. All of the students were successful in the implementation of the experiment and

achieved results within 5% of the accepted value. Several lab groups achieved results within 2% of the accepted value. There were some incorrect approaches to the uncertainty analysis that will be proactively addressed in the future. The second experiment assessed used the X-ray diffractometer. This activity was preceded by a safety discussion concerning X-rays. All of the students got very good results in the measurement of the unit cell size for silicon and the wavelength of the Kα2 wavelength of copper. Various levels of sophistication can be used to determine the peak of the X-ray counts, i.e. the channel with the highest number of counts, a simple weighted fitting of the channels around the maximum, or a Poisson fit to a number of channels around the maximum. An introduction to more sophisticated fitting will be included next year. The third lab activity assessed consisted of measurements made during a high altitude balloon flight. Students worked as a group to carry out the preparation, launch, and recovery of the balloon payload. They worked individually to measure various aspects of cosmic ray flux, flight parameters, and atmospheric parameters. The results were then presented in PowerPoint presentations. This activity required the cooperation of the group and individual effort.

The group and all of the individuals exhibited an improved mastery of a variety of experimental skills. these skills included understanding apparatus design, developing the apparatus, data acquisition by hand and through computer interfaces, data analysis by hand and using computer programs, and presenting results in writing and orally.

Physics 1092 Assessment Report

May 23, 2016

The first two program student learning outcomes in the physics program are:

1. to help students understand the concepts of classical and modern physics and
2. to develop students' ability to solve quantitative problems in these areas.

Eight concepts in Phys 1092 Principles of Physics II were selected for assessment. These topics span the semester-long timeframe of the course. Students were given a quantitative problem to solve that requires an understanding of that concept as well as the ability to design and execute a solution.

Concept	Learning outcome substantially met	Learning outcome partially met	Learning outcome not met
Vectors: recognize that vector quantities have both magnitude and direction and be able to manipulate them correctly	54%	38%	8%
Series and parallel circuit components: be able to recognize relationships between circuit components and understand the net impact of those combined components.	31%	46%	23%
Kirchoff's Rules: be able to apply Kirchoff's Rules to a complex electronic circuit and generate the proper number of equations that can be solved for the currents.	54%	23%	23%
Magnetic field due to currents: understand how moving charges create magnetic field and be able to calculate the magnetic field that results from a current configuration.	15%	54%	31%
Electromagnetic induction: understand how changing magnetic flux creates electricity and be able to use Faraday's and Lenz's Laws to predict the outcome	15%	46%	38%

Electromagnetic Waves: understand the nature of electromagnetic waves and be able to connect that understanding to macroscopic properties of electromagnetic radiation	46%	15%	38%
Thin lens with ray diagram: understand how the refraction of light by a thin lens results in optical image formation and be able to calculate the characteristics of images produced by thin lenses using mathematics as well as ray diagrams	54%	46%	23%
Nuclear binding energy: understand the nature of nuclear energy and be able to calculate the energy with which a particular nucleus is held together.	31%	31%	38%

In order to improve student learning, feedback from the students was solicited after each exam, and changes were made in two areas in response to that feedback. These changes were in the areas of exam design and the collection and grading of homework. Both changes led to greater student engagement with the course, according the feedback from the students, but whether student learning improved as a result is unclear. Implementing such changes at the beginning of the course next year will provide a better indication of their

Physics 1102 Assessment Report

December 22, 2015

The first two program student learning outcomes in the physics program are:

1. to help students understand the concepts of classical and modern physics and
2. to develop students' ability to solve quantitative problems in these areas.

Seven concepts in Phys 1102 General Physics II were selected for assessment. These topics span the timeframe of the course. Students were given a quantitative problem to solve that requires an understanding of that concept as well as the ability to design and execute a solution.

Concept	Learning outcome substantially met	Learning outcome partially met	Learning outcome not met
Vectors: recognize that vector quantities have both magnitude and direction and be able to manipulate them correctly	22	7	4
Current, Voltage and Power in electric circuits: understand the relationships between current, voltage, and power and be able to predict their values	29	1	3
Motion of charged particle in magnetic field: understand the force that acts on a moving charged particle and be able to predict the trajectory of that particle	25	1	7
Electromagnetic induction: understand how changing magnetic flux creates electricity and be able to use Faraday's and Lenz's Laws to predict the outcome	21	1	11
Electromagnetic Waves: understand the nature of electromagnetic waves and be able to connect that understanding to macroscopic properties of electromagnetic radiation	27	2	4
Thin lens with ray diagram: understand how the refraction of light by a thin lens results in optical image formation and be able to calculate the characteristics of images	25	8	0

produced by thin lenses using mathematics as well as ray diagrams			
Interference by thin films: understand how the interference of reflected light suppresses or enhances light and be able to predict the relationship between wavelength and film thickness.	20	8	5