Institutional Effectiveness Report
Academic Year 2013-2014
Physics and Engineering Technology

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Mission and Goals

Physics

The Department of Physics and Astronomy offers a baccalaureate degree in Physics with a concentration in Computational Physics or Health Physics. Students completing the majors offered by the department will be prepared for careers in industry and scientific research or for graduate school.

Engineering Technology

The Francis Marion University B.S. degree programs in Civil Engineering Technology (CET) and Electronics Engineering Technology (EET) allow students with an associate's degree in Engineering Technology or those in pursuit of such a degree to earn their bachelor's degree after approximately two years of additional coursework. FMU's Engineering Technology programs provide a unique cooperative educational opportunity to students and workers of the Pee Dee region and South Carolina by offering a liberal arts education to Engineering Technology students from the state's Technical Colleges in addition to their chosen technical and scientific training. The Engineering Technology degree programs enable graduates to compete more effectively for technical positions within local and regional industry.

Assessment Activities

Student learning and development	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**
All laboratory courses will require mandatory written lab reports. Benchmark: 70% of the physics and engineering technology majors who complete the 300 and 400 level physics laboratory courses will submit a complete set of laboratory reports for each course.	39/48 (81%)	22/28 (79%)	26/33 (78%)	29/39 (75%)	31/41 (76%)	29/41 (71%)
Physics majors will complete one or more senior projects in PHYS 419 and 420 and will submit a written report. Benchmark: The written reports will be graded by two physics faculty members, assessed for accurate and clear scientific information reporting, and 70% of the students will score 4 or more on a 1-7 point scale.	8/8 (100%)	7/7 (100%)	9/10 (90%)	8/8 (100%)	9/11 (82%)	7/9 (78%)
Physics majors will be required to make at least one oral scientific report. An oral presentation based on a student's senior projects will be required as part of PHYS 397* and 420. Benchmark: Students will make an oral presentation at a special Society of Physics Students meeting, which will be evaluated by the physics faculty and at least one faculty member from another discipline for oral presentation quality. The mean score for these presentations should be at least 70 on a 100-point scale. * Physics 397-Research in Physics- has been added to this criteria beginning 2013. This explains the large increase in number of students.	2/2 (100%)	0/0	3/3 (100%)	6/6 (100%)	15/16 (94%)	16/19 (84%)

Instructional Technology	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**
Students will be required to demonstrate the ability to use computers to solve physics problems Physics 301 or Physics 302 or Physics 401. Benchmark: one computer project will be completed in either physics 301, 302, or 401 and 70% of the students will score 4 or better on a 1-7 point scale of computer use, as assessed by two faculty members.	6/7 (86%)	7/8 (87)	13/18 (72%)	15/20 (75%)	9/13 (69%)	8/11 (72%)

Reviews Of Student Graduate School Admission And Fellowship Or Assistantship Acquisition	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**
Within any four-year period, 80% of FMU physics graduates who apply to graduate school in a related discipline will be accepted.	3/3 (100%)	3/3 (100%)	1/2 (50%)	2/2 (100%)	6/7 (86%)	2/2 (100%)
One in eight of FMU physics graduates who are accepted to graduate school in a related field will receive a fellowship or assistantship.	4/4 (100%)	3/3 (100%)	3/3 (100%)	1/1 (100%)	1/2 (50%)	2/2 (100%)
Faculty Service To The University And To The Community	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**
The level of involvement of the physics faculty in University committees will be evaluated through an examination of the faculty's annual reports. The benchmark for this activity is for the department's faculty, on average, to serve on at least two campus committees.	23/7 (3.3)	24/7 (3.4)	22/7 (3.1)	26/7 (3.7)	19/7 (2.7)	17/8 (2.1)
The extent of the physics faculty's participation in activities of the community at large is assessed through an examination of the faculty's annual reports. Value listed is the number of documented activities.	27	20	26	28	19	29

Issues and Actions

Issues of Concern	***Actions Taken***
Improvements to the Computational Physics major: Program requirements, course content, and facilities	• Dr. Engelhardt has been awarded a $100k grant to construct a high-performance computing cluster on campus, which is now up and running. Another grant will support two students' efforts to expand its capabilities. • Dr. Fulmer has revised the PHYS 310 Electronics course in anticipation of the course being converted to an engineering course in the Industrial Engineering major. • In at least three upper-division courses, students are now required to demonstrate proficiency in obtaining information from various scientific websites, manipulate data using standard software, and use it in various in-depth calculations.
Improvements to the Health Physics major: Program requirements, course content, and facilities	• Two upper-division Health Physics courses have been revised to better meet the needs of the students in terms of practical applications they are likely to encounter in workplaces ranging from medical to particle accelerator to nuclear power facilities. • A workshop was arranged for upper-division Health Physics majors at Oak Ridge, TN, which introduced the students to the practical side of Health Physics at one of the premier national labs.
General improvements	• An Industrial Engineering program is underway which will be administered within the department. One faculty member has been hired to date and the first group of students has begun classes in the new major. • New laboratory and demonstration equipment have been purchased via a $25k federal grant designed to attract minority students to careers in science. • Dr. Myers has obtained a grant from NASA to upgrade the University's planetarium to a fully digital system. This new system will enhance not only the department's offerings in astronomy, but also its public outreach efforts.

Recruiting of students	• The department's major recruiting effort, the South Carolina Physics Scholars Institute (SCPSI) has been modified to include experiments and presentations related to Industrial Engineering. The acronym has thus been changed to SCEPSI, the "E" standing for Engineering. • Several visits to local high schools by the department faculty took place to publicize the new Industrial Engineering program. • A renewed/greater emphasis is being placed of student research projects. Studies indicate that a vibrant research program is key to recruiting and retaining students in the successful Physics program.

The New Industrial Engineering Major

The Department of Physics and Astronomy now offers a new major in Industrial Engineering along with its pre-Engineering and Engineering Technology programs. The first group of freshmen entered the program in the spring semester of 2014. From the FMU catalog:

> *Industrial engineers analyze and evaluate methods of production and help organizations improve systems and processes that improve quality and productivity. They work to eliminate any waste of time, money, materials, energy, and other commodities. An industrial engineering graduate will be prepared for a career in business, health care, consulting, government, or manufacturing. The industrial engineering program provides students with a rigorous study of the theory of the Industrial Engineering discipline, including areas of physics, mathematics, and business.*

In addition to the normal course work, IE students will be encouraged to pursue a summer of supervised training (internship) at a professionally related site off campus.

Assessment criteria will need to be developed for this new program in coordination with the department's consultant, Dr. Pat Koelling, from Virginia Tech University, with an eye toward eventually achieving accreditation by ABET (Accreditation Board for Engineering and Technology).

In February 2014 six students and two faculty chaperones were invited to attend the Annual Institute of Industrial Engineering student conference at Virginia Tech in Blacksburg VA. For three days the students attended presentations about careers in Industrial Engineering, engaged in meet and greet icebreakers with students from the twenty other attending universities, (including Clemson, Penn State, N.C. State, and the University of Tennessee). The event was sponsored by industries including UPS, Deloitte Consulting, PepsiCo and others. The students also participated in interview experiences, visits to the Va. Tech. National Highway testing track and other local industries. Students competed in a student research paper presentation competition, and we're exposed to the types of activities they will encounter in their professional engineering careers.

Assessment of General Education Courses

The Department of Physics and Astronomy has chosen to assess its General Education offerings by having students complete a survey concerning the results of an experiment they have just designed and completed. The techniques of data acquisition, experiment design, and analysis required in this experiment are considered representative of the students' mastery of the laboratory course material.

The experimental problem given to the students concerns a simple pendulum. The students must identify variables that may effect the time period of a pendulum (length, mass, amplitude) and investigate to see which one(s) actually have an influence. By analyzing the results, the students attempt to develop an empirical equation that correctly predicts the time period for any simple pendulum.

A copy of the survey questions and a reporting of the results follow.

SURVEY FOR PSCI 101 FINAL EXAM
SIMPLE PENDULUM EXPERIMENT

Directions: In response to the following questions, circle the answers that best characterize your results from the Simple Pendulum Experiment.

1. Did variations in the amplitude of the oscillating pendulum affect its time period?
   a) The amplitude had no effect on the time period.
   b) The amplitude seemed to have a slight effect on the time period.
   c) The amplitude had a major effect on the time period.

2. Did variations in the length of the oscillating pendulum affect its time period?
   a) The length had no effect on the time period.
   b) The length seemed to have a slight effect on the time period.
   c) The length had a major effect on the time period.

3. Did variations in the mass of the oscillating pendulum affect its time period?
   a) The mass had no effect on the time period.
   b) The mass seemed to have a slight effect on the time period.
   c) The mass had a major effect on the time period.

4. Which of the following expressions best characterizes the relationship between the time period (T) of a simple pendulum and its length (l)?
   a) $T = kl^2$ b) $T = kl$
   c) $T = kl^2$ d) $T = \frac{k}{l}$
   e) none of the above

Survey Results
(Last four years)

Question #/Response characterizations	**2010-2011 (250 students)**	**2011-2012 (211 students)**	**2012-2013 (230 students)**	**2013-2014 (258 students)**
1.Correct	72 (29%)	76 (36%)	88 (38%)	109 (42%)
Incorrect/reasonable	133(53%)	119 (56%)	113 (49%)	131 (51%)
Incorrect	45 (18%)	16 (8%)	29 (13%)	18 (7%)
2.Correct	157(63%)	182 (86%)	168 (73%)	224 (87%)
Incorrect/reasonable	53 (21%)	17 (8%)	54 (23%)	24 (9%)
Incorrect	15 (6%)	12 (6%)	8 (3%)	10 (4%)
3.Correct	103(41%)	104 (49%)	109(47%)	141(55%)
Incorrect/reasonable	120(48%)	97 (46%)	104(45%)	99 (38%)
Incorrect	27 (11%)	10 (5%)	17 (7%)	18 (7%)
4.Correct	25 (10%)	66 (31%)	123 (53%)	108 (42%)
Incorrect/reasonable	120(48%)	93 (44%)	84 (37%)	108 (42%)
Incorrect	90 (36%)	54 (25%)	23 (10%)	42 (16%)

Commentary: This past academic year involved no new experiments in the Physical Science 101 Laboratory. A comparison with last year's results shows significant improvement in students' responses to Questions 1-3, which involve specific tests related to one variable each. Question 4 is more involved in that the students must infer the nature of the relationship between two variables and is considered to be the most difficult and important of the survey questions. The results indicate a decrease in the percentage of students arriving at the correct answer. This is a rather unexpected and disturbing outcome, given the improvements elsewhere. One possible explanation for this result involves the cancelled class meetings due to inclement weather that occurred during the spring semester. The students missed two experiments that normally would have been performed. Overall, however, the results from the last several years indicate a noticeable improvement in the students' performance in designing a simple experiment and the subsequent analysis of the results.