Degree/Certificate: BS in Physics

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Date: February 9, 2017

Part I – Program SLO Assessment Report for 2015-16

Student Learning Outcome: Students will demonstrate knowledge of the basic concepts of physics, such as mechanics, thermodynamics, and electricity and magnetism. This assessment covers the first two quarters of electromagnetism: Physics 401 and 402.

Overall evaluation of progress on outcome: *SLO is met, but with changes forthcoming*

Strategies and methods:
This assessment was applied to those nine students who formed the BS in Physics cohort in the 2015-2016 academic year. In assigning a standard, consideration must be made for two conflicting imperatives – that the course material is presented and assignments completed at a level of sophistication which meets a professional standard common in such courses nationwide, and that the presentation and subsequent assignments be accessible to students at EWU, who are on average less academically prepared than the national average. Also, the fact that these courses are offered every other year means a few students enter while concurrently enrolled in calculus IV, a prerequisite. Accordingly, the assessment standard used for Physics 401 and 402 is for 70% or better on homework grades, and 60% or better on exams. Given the mathematical sophistication of the test questions, and the fact that the exams are closed book, a lower standard for exam success is warranted, and in fact consistent with the undergraduate experience at the University of Michigan for the assessing professor.

Physics 401

Specific Content Assessments (70% of total points meets standard)		Met Standard
HW1:	General Review of Vector Calculus.	6 of 9 students
HW2+3:	Calculating Electric Forces and Electric Fields	6 of 9 students
HW4:	Applying Gauss' Law	3 of 9 students
HW5:	Calculating the Scalar Potential	3 of 9 students
HW6:	Conductors in Electrostatics	5 of 9 students
HW7:	Electrostatic Energy	6 of 9 students
HW8:	Electric Multipoles	7 of 9 students
HW9:	Boundary Conditions	5 of 9 students
HW10:	Electrostatics and Matter	6 of 9 students
Exam 1	5 of 9 students scored 60% or better (High score 84%)	
Exam 2	3 of 9 students scored 60% or better (High Score 91%)	
Final Exam	5 of 9 students scored 60% or better (High score 87%)	

Physics 402		Met Standard
HW1 – HW4:	Special Methods + Orthogonal Functions	6 of 9 students
HW5:	Steady Currents and Magnetic Forces	5 of 9 students
HW6:	Calculating Magnetic Fields + Ampere's Law	3 of 9 students
HW7:	Vector Potential + Faraday's Law	5 of 9 students
HW8:	Magnetic Energy + Magnetic Multipoles	5 of 9 students
HW9:	Magnetism and Matter	5 of 9 students

Exam 1	5 of 9 students scored 60% or better (High Score 77%)
Exam 2	2 of 9 students scored 60% or better (High Score 88%)
Final Exam	5 of 9 students scored 60% or better (High Score 80%)

Observations gathered from data:

1) There exists a wide variety of academic preparation of students within the BS program in physics. All find it challenging, and a few students find it overwhelming.
2) The success rate is higher on homework, in which student cooperation is encouraged, than on exams, where it is prohibited.
3) The overall success rate on the final exams should be higher, at least to a level of 2/3 of students completing the courses.

What program changes will be made based on the assessment results?

1) Failure in exam settings is often traced to a lack of mathematical foundations. This can be addressed by i) more class exercises describing vectors in mixed systems (ie, Cartesian unit vectors within spherical coordinates), ii) class exercises in building integrals over linear systems as well as cylindrical or spherical volumes.
2) Additional class time can be used for visualizing fields and source charge distributions for obvious symmetries. Students do not reliably recognize functions as even or odd, particularly as functions of the spherical polar angles.
3) A discussion with the math department is warranted so as to underline the skills needed in this course from day 1

Action on items 1, 2, and 3 in this section will be addressed in the next offering of these classes, in the 2017-2018 academic year. The assessment method will be the same, as this is the first time it is applied and establishes a baseline for comparison. It may change in subsequent program assessments.