

PROGRAM REVIEW – CURRICULUM PACKET

2018-2019

PHYSICS

This report includes course student learning outcome (cSLO) assessment summaries from 2015-16 to 2017-18.

Table 1. Course offerings per academic year from 2015-16 to 2018-19

Table 2. Course assessment status between 2015-16 and 2017-18

Table 3. cSLOs that were not assessed between 2015-16 and 2017-18

Table 4. cSLOs assessed and corresponding Data Evaluation

Table 5. cSLOs assessed and corresponding Data Planning

COURSE OFFERINGS

Table 1. Course offerings per academic year from 2015-16 to 2018-19

Course Name	2015-2016	2016-2017	2017-2018	2018-2019
PHYS G110	x	x	x	x
PHYS G111	x	x	x	x
PHYS G120	x	x	x	x
PHYS G120L	x	x	x	x
PHYS G125	x	x	x	x
PHYS G125L	x	x	x	x
PHYS G185	x	x	x	x
PHYS G185L	x	x	x	x
PHYS G280	x	x	x	x
PHYS G280L	x	x	x	x
PHYS G285	x	x	x	x
PHYS G285L	x	x	x	x

COURSE ASSESSMENT STATUS

Fully Assessed



Partially Assessed



No Assessment



Table 2. Course Assessment Status between 2015-16 and 2017-18

*No enrollment data between 2013-14 and 2018-19

Course Name	Total cSLOs	No. cSLOs Assessed	Assessment Status	Last Term Offered
PHYS G110	4	2 out of 4	Partially Assessed ↔	Spring 2019
PHYS G111	3	2 out of 3	Partially Assessed ↔	Spring 2019
PHYS G120	3	1 out of 3	Partially Assessed ↔	Fall 2018
PHYS G120L	3	1 out of 3	Partially Assessed ↔	Fall 2018
PHYS G125	4	4 out of 4	Fully Assessed ↑	Spring 2019
PHYS G185	5	3 out of 5	Partially Assessed ↔	Spring 2019
PHYS G185L	5	2 out of 5	Partially Assessed ↔	Spring 2019
PHYS G280	5	3 out of 5	Partially Assessed ↔	Spring 2019
PHYS G280L	4	4 out of 4	Fully Assessed ↑	Spring 2019
PHYS G285	9	2 out of 9	Partially Assessed ↔	Fall 2018
PHYS G285L	4	2 out of 4	Partially Assessed ↔	Fall 2018

Table 3. cSLOs that were not assessed between 2015-16 and 2017-18

Course Name	cSLO Name	cSLO to Assessed
PHYS G110	cSLO 2	Demonstrate knowledge of Newton's 3 Laws of Motion, electrical generation regarding Faraday's Law, the role of fission in a nuclear bomb and a nuclear reactor, and the role of fusion in a nuclear bomb.
PHYS G110	cSLO 3	Apply the following: momentum laws to answer conceptual questions and Coulomb's Law to answer conceptual questions about electrical force.
PHYS G111	cSLO 3	Explain observations based upon current physics theory.
PHYS G120	cSLO 2	Solve problems involving energy and energy transfer and momentum.
PHYS G120	cSLO 3	Apply algebra to solve problems involving fluid dynamics and thermodynamics.
PHYS G120L	cSLO 2	Solve problems involving energy and energy transfer and momentum.
PHYS G120L	cSLO 3	Apply algebra to solve problems involving fluid dynamics and thermodynamics.
PHYS G185	cSLO 1	Solve problems involving constant acceleration equations using calculus.
PHYS G185	cSLO 3	Solve problems involving energy and energy transfer using calculus.
PHYS G185L	cSLO 3	Solve problems involving energy and energy transfer using calculus.
PHYS G185L	cSLO 4	Solve problems involving momentum using calculus.
PHYS G185L	cSLO 5	Solve problems involving waves using calculus.
PHYS G280	cSLO 1	Solve problems involving electromagnetic theory using calculus.
PHYS G280	cSLO 4	Solve problems involving electromagnetic induction and Faraday's Law using calculus.
PHYS G285	cSLO 1	Solve problems involving thermodynamics using calculus.
PHYS G285	cSLO 2	Solve problems involving optics using calculus.
PHYS G285	cSLO 5	Solve problems involving fluid mechanics using calculus.
PHYS G285	cSLO 6	Demonstrate understanding of the basic concepts involved in estimating experimental uncertainties and performing an error analysis, including propagation of error for actual experimental data collected in lab.
PHYS G285	cSLO 7	Use various types of equipment for the purpose of making measurements related to temperature and thermodynamics.
PHYS G285	cSLO 8	Employ various types of equipment for the purpose of making measurements related to light and optics, including lasers.
PHYS G285	cSLO 9	Construct an accurate record of laboratory work in a notebook and extract information from that record that can be used to write a lab report, just as experimental scientists do when reporting results to a journal for publication.
PHYS G285L	cSLO 1	Demonstrate understanding of the basic concepts involved in estimating experimental uncertainties and performing an error analysis, including propagation of errors for actual experimental data collected in the lab.
PHYS G285L	cSLO 4	Construct an accurate record of laboratory work in a notebook and extract information from that record that can be used to write a lab report, just as experimental scientists do when reporting results to a journal for publication.

DATA EVALUATION

Table 4. cSLOs assessed and corresponding Data Evaluation.

*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
PHYS G110	cSLO 1	Spring 2016	Results showed: 76% of the students correctly answered the assessment question at the end of the semester (students included who did not answer at all). 84% of the students correctly answered the assessment question at the end of the semester (students excluded who did not answer at all). I conclude that a 76-87% correct response level demonstrates that students did achieve the skill of the SLO listed in Step #1.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
PHYS G110	cSLO 1	Spring 2018	<ul style="list-style-type: none"> • Students demonstrated an understanding of the SLO above an acceptable level.
PHYS G110	cSLO 4	Spring 2017	<p>-Students demonstrated an understanding of the SLO above an acceptable level. -The percentage of 90% correct exceeded my expectation of 70+% which is a typical SLO response level for this subject. A potential contributing factor to this level of achievement is my inclusion of several targeted videos that reinforced the lecture on wave interference.</p>
PHYS G110	cSLO 4	Fall 2017	<ul style="list-style-type: none"> • Students demonstrated an understanding of the SLO above an acceptable level. • The percentage of 81% correct exceeded my expectation of 70+% which has been a typical SLO response level for this subject. However, the Spring 2017 results was a 90% satisfactory completion of the same assessment. I believe that the current results, down 8%, is an acceptable class variation.
PHYS G111	cSLO 1	Fall 2016	77% of the Physics students assessed performed satisfactorily on this lab SLO
PHYS G111	cSLO 1	Fall 2017	<p>Physics 110 lab "Force, Mass, and Acceleration". In this lab the students investigated Newton's 2nd law $F=ma$ for a mass being accelerated by another mass connected to it hanging over a pulley. When one end of the track is elevated, the glider moves under the influence of a component of g. When the track is elevated students had to determine the value of the component of g that is causing the acceleration. With some help, the students recognized and were able to solve for the component. They also were able to identify possible errors in the experiment. The objectives of the lab: 1. To be able to distinguish between average and instantaneous velocity 2. To be able to express how the velocity of a uniformly accelerated object changes with time. 3. To be able to determine the acceleration of an object from distance and time measurements. 4. To be able to understand that the position of an object varies with the square of the time. Overall: 1) After a short lecture and explanation of the Physics involved, all students completed the lab successfully 2) About 90% of students needed more help after the lecture to complete the lab. 3) Students did not know/understand the basic kinematic equations. 4) Students understood the concept of velocity better than acceleration. 5) Students found it difficult to understand the concept of objects moving under the influence of gravity. 6) It was noted that the students had problems with the mathematics and practical applications. 7) Student's reports showed a general understanding of the concepts.</p>
PHYS G111	cSLO 2	Spring 2017	There were 16 students who completed a lab assignment. All students earned 80% on their lab and passed.
PHYS G120	cSLO 1	Fall 2016	4 student earned 5/5 or 100% 14 Students earned 4/5 or 80% 9 Students earned 3.5/5 or 70% This Data shows students are learning sufficiently to carry-out Newtonian Physics both in college and upon graduation.
PHYS G120	cSLO 1	Fall 2017	<p>Out of the 24 students whose work was assessed on test 1, it was determined that the students had the most problem with the following: Approximately 40% of students had problems resolving the forces into components. This was evident when dealing with multiple forces. A group of students would attempt the problem without drawing out a corresponding free body diagram. Therefore, they would incorrectly identify the forces acting upon the particle in question. There would also be additional forces acting on the body that was incorrect. This would result in exaggerated accelerations and forces, even when objects/particles are supposed to be in equilibrium. On test 2 of the semester, it was seen that the number of students that had problems with resolving forces into components had been</p>

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			reduced to about 20%. Part 2) Constant acceleration equations. About 30% of students had difficulty recognizing that the acceleration in the x-direction is zero, especially if there is no wind resistance mentioned in the problem. This caused exaggerated ranges. On one of the problems from the "show your work" section on test 2, there was a problem that called for the student to find the velocity of the target ball using conservation of momentum problem solving methods. After finding the velocity of the target ball, it was projected horizontally off the table. Using the velocity information, students had to solve the problem as if it was a traditional horizontal projectile problem. It was estimated, that about 33% of the students still had difficulty in solving these type of problems. The most common mistake was not setting the acceleration in the x-direction to 0, followed by no attempt at solving the problem at all. Note: On test 2, 33% of the students still didn't realize that at the apex of projectile motion, the magnitude of the acceleration is g. The students replied that it was 0.
PHYS G120L	cSLO 1	Fall 2016	10 student earned 5/5 or 100% 13 Students earned 4/5 or 80% 3 Students earned 3.5/5or 70% All students were able to carry out successfully quiz and experiment demonstrating they knowledge and experimental skill.
PHYS G120L	cSLO 1	Fall 2017	Physics 120 lab "Force, Mass, and Acceleration". In this lab the students investigated Newton's 2nd law $F=ma$ for a mass being accelerated by another mass connected to it hanging over a pulley. When one end of the track is elevated, the glider moves under the influence of a component of g. The objectives of the lab: 1. To be able to distinguish between average and instantaneous velocity 2. To be able to express how the velocity of a uniformly accelerated object changes with time. 3. To be able to determine the acceleration of an object from distance and time measurements. 4. To be able to understand that the position of an object varies with the square of the time. Overall: 1) All students completed the lab successfully. 2) 50% of the students needed help with determining the acceleration of the object (glider) along the elevated air track. 3) 30% of the students needed extra help when trying to determine the magnitude of the instantaneous velocity.
PHYS G125	cSLO 1	Spring 2017	Of the four questions, 5 students passed with 90% range; 6 students in the 80% range and 7 students in the 70% range
PHYS G125	cSLO 2	Spring 2018	27 students took exam #1 on electricity and magnetism. Of those, only 13 passed with a score of 70% or above.
PHYS G125	cSLO 3	Spring 2018	16 students passed the exam on optics.
PHYS G125	cSLO 4	Spring 2018	Students were given a take home exam to complete.
PHYS G185	cSLO 2	Spring 2018	# OF STUDENTS ACCESSED: 42 # OF STUDENTS WHO SATISFACTORILY COMPLETED THE ASSESSMENT: 10 This result is not satisfactory. The students need to improve their critical skills along with their level of mathematics. The problem was difficult in that the student needed to demonstrate a reasonable level of algebraic manipulation. Overall, the students have demonstrated a successful completion of the SLO skill. The ability to apply physical concepts, critical thinking along with demonstrating a mathematical maturity is expected in the course.
PHYS G185	cSLO 4	Fall 2016	Common mistakes included: (1) failure to use vector components of linear momentum. (2) failure to use energy conservation. (3) failure to setup and solve the resulting equations. (4) algebraic mistakes. Apart from the above-mentioned mistakes, the instructor notes that students are often unable to connect concepts and use critical thinking to solve problems such as this one. I believe that the SLO was assessed in a very straightforward problem. The results might have been much higher. However, it is the opinion of the

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			instructor that a simpler problem would not really assess the students' ability to apply concepts of physics. Any student continuing on to higher level of mathematics and/or physics will need to be able to use critical thinking in their solutions to problems involving calculus based physics.
PHYS G185	cSLO 5	Fall 2015	87% of the Physics G185 students assessed performed satisfactorily on this SLO. Students who did not satisfactorily complete the SLO questions had problems with: • Correctly setting up the differential equation • Identifying the appropriate parameters (mass, force constant, rotational inertia) • Forgetting to convert units • Didn't attempt the question
PHYS G185	cSLO 5	Fall 2017	50% for the correct setup of the equation 30% for the correct steps to solve the equation 20% for getting the correct answer
PHYS G185L	cSLO 1	Fall 2016	81% of the Physics G185 students assessed performed satisfactorily on this lab SLO
PHYS G185L	cSLO 2	Fall 2017	All students who remained in the class successfully completed the lab.
PHYS G185L	cSLO 2	Spring 2018	The results was satisfactory. To make sure that students are performing at a acceptable mathematical level, it has been noted that it may be a benefit to have a review the first day or two of class.
PHYS G280	cSLO 2	Spring 2018	27 students took the second exam on DC electric circuits and 22 successfully completed to SLO.
PHYS G280	cSLO 3	Spring 2018	21 students took the exam and 16 successfully completed the assessment.
PHYS G280	cSLO 5	Spring 2018	Most students had difficulty with this SLO assessment due to the fact that it involves more advanced mathematics (calculus 3) and many students are not at the necessary math level for this type of problem.
PHYS G280L	cSLO 1	Spring 2018	34 students who originally signed up for the class were given the assessment as their first laboratory assignment for the semester, and all 34 successfully completed the assessment.
PHYS G280L	cSLO 1	Spring 2018	Students performed a laboratory experiment in which they measured the voltage, current, and resistance for several resistors connected in series and parallel, and verified some basic electric circuit theory.
PHYS G280L	cSLO 2	Spring 2018	Students performed electrical measurements using various meters and an oscilloscope.
PHYS G280L	cSLO 3	Spring 2018	Students were given various circuit elements and were required to wire up a specified electrical circuit.
PHYS G280L	cSLO 4	Spring 2018	All students were required to turn in a laboratory notebook with a record of their work in the lab throughout the semester and were give a grade which counted 20% of their final grade in the class.
PHYS G285	cSLO 3	Fall 2017	12 out of the 17 students were able to successfully solve the problem of an inelastic relativistic collision.
PHYS G285	cSLO 4	Fall 2016	After assessing the SLO, the instructor notes the following results. Common mistakes included: (1) failure to use Newton's Law of Gravitation. (2) failure to use the spherical symmetry. (3) failure to evaluate the resulting integral. (4) incorrect limits of integration. Apart from the above-mentioned mistakes, the instructor notes that students are often unable to connect concepts and use critical thinking to solve problems such as this one. I believe that the SLO could have been assessed in a very straightforward surface integral with the correct limits of integrated given for the spherical shell. The results might have been much higher. However, it is the opinion of the instructor that such a problem would not really assess the students' ability to apply concepts of physics. Any student continuing on to higher level of mathematics and/or physics will need to be able to use critical thinking in their solutions to problems involving multivariable calculus.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
PHYS G285L	cSLO 2	Fall 2016	76% of the Physics G285 students assessed performed satisfactorily on this lab SLO
PHYS G285L	cSLO 2	Fall 2017	100% of students setup the experimental apparatus correctly and 80% got an acceptable result to within 10% of the actual value.
PHYS G285L	cSLO 3	Fall 2017	All 17 students successfully completed the lab portion of the course.

DATA PLANNING

Table 5. cSLOs assessed and corresponding Data Planning.

*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
PHYS G110	cSLO 1	Spring 2016	No changes are planned to increase student retention of this SLO.
PHYS G110	cSLO 1	Spring 2018	The curriculum will not change.
PHYS G110	cSLO 4	Spring 2017	I will use this same SLO for Fall 2017. The curriculum will not change because I want to compare the next class results to these in order to validate this approach.
PHYS G110	cSLO 4	Fall 2017	The curriculum will not change. I will continue to include videos that reinforced the lecture on wave interference.
PHYS G111	cSLO 1	Fall 2016	Instructor Comments include the following: • Overall, I was very satisfied with the success rate of this SLO assessment. I was pleased with the students' abilities to correctly set up the equipment and follow lab instructions • Stress that this lab exercise is crucial for them to understand the concept of projectiles that satisfy the given SLO of the lab course and show them the common mistakes that may be made. • The SLO was well written and due to the importance of the topic, this SLO should be assessed again in the future. • I am happy with the number of students who completed the assessment.
PHYS G111	cSLO 1	Fall 2017	More discussion and demonstrations before the actual lab. Overall, the outcome of the lab was satisfactory.
PHYS G111	cSLO 2	Spring 2017	Give more demonstrations on projectile motion
PHYS G120	cSLO 1	Fall 2016	I am developing the ABC's to classical physics that will provide a founding substrate to build the students ability to understand the more difficult ideas taught in Newtonian physics.
PHYS G120	cSLO 1	Fall 2017	A free body diagram worksheet of different scenarios for students to work out during class or possibly as a homework assignment. This will be followed up by a quiz, to check for understanding. In regards to the use of constant acceleration problems, a demo and more emphasis during lecture and lab, followed by a possible check for understanding in the form of a quiz or other assessment. Also, as with every test, students are given a chance to do test corrections. Test questions from the previous tests will appear on future tests, especially if a majority of the class seemed to have difficulty with a certain topic.
PHYS G120L	cSLO 1	Fall 2016	Purchase of additional lab equipment so students will have more personal time when doing experiments.
PHYS G120L	cSLO 1	Fall 2017	More emphasis on objects moving under the influence of gravity. Making sure that students understand that Forces are vectors. More in class activities or group work on resolving vectors into their components.
PHYS G125	cSLO 1	Spring 2017	Next SLO will ask other types of questions to see how well students are doing in other categories like circuits. This will help to build an over all approach to teaching to help students learn comprehensively
PHYS G125	cSLO 2	Spring 2018	Since the original assessment, 11 students have dropped the course. Of those remaining, all will pass the course.
PHYS G125	cSLO 3	Spring 2018	Of the remaining 16 students who will take the final exam, it is expected that all will pass the class.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
PHYS G125	cSLO 4	Spring 2018	All remaining students who completed the take home exam have enough points to pass the course.
PHYS G185	cSLO 2	Spring 2018	The instructor seen the need for the students to have more challenging problems inside and outside the classroom. During lab, a certain amount of time is dedicated so that the students can work on given problems that are more challenging than the given assigned text homework. This is time dedicated for the students to work in groups to challenge their selves and others. The instructor is present to guide, and at times, correct the thought process.
PHYS G185	cSLO 4	Fall 2016	The instructor feels that critical thinking needs to be emphasized in all levels of mathematics, and physics. Problems involving critical thinking, and where students need to apply concepts of physics and construct the solution from the given information all the way to the end, need to be a normal part of the course. This SLO as well as the others should be continued to be assessed using critical thinking situations. In addition, the instructor will explore assessing the SLO again on the final exam with a straightforward problem where critical thinking is not a major part of the solution.
PHYS G185	cSLO 5	Fall 2015	Instructor Comments include the following: <ul style="list-style-type: none"> • Overall, I was very surprised with the success rate of this SLO assessment. I was pleased with the students' abilities to correctly set up the equations. I put these in a separate portion of the exam, so based on the fact that they had no "indicators" that they should use a particular method, this assessment shows that students have the ability to select the appropriate method. • Stress that these problems are typical problems that satisfy the given SLO of the course and show them the common mistakes that may be made. • Discussions with the department faculty from other campuses will continue to determine best practices and assessment of more challenging SLO problems. • The SLO was well written and due to the importance of the topic, this SLO should be tested on in the future. • I am happy with the number of students who completed the assessment. To help the students who did NOT complete the assessment, I will emphasize the importance of the basics. I will also dedicate one full lecture to this section of the textbook, rather than devoting half a lecture.
PHYS G185	cSLO 5	Fall 2017	<ul style="list-style-type: none"> • Overall, I was not really okay with the success rate of this SLO assessment. I was disappointed with the students' abilities to correctly set up the equations. I put these in a separate portions of the exam, so based on the fact that they had no "indicators" that they should use a particular method, this assessment shows that students have limited ability to select the appropriate method. • Stress that these problems are typical problems that satisfy the given SLO of the course and show them the common mistakes that may be made. • Discussions with the department faculty from other campuses will continue to determine best practices and assessment of more challenging SLO problems. • The SLO was well written and due to the importance of the topic, this SLO should be tested on in the future. • I was not happy with the number of students who completed the assessment. To help the students who did NOT complete the assessment, I will emphasize the importance of the basics. I will also dedicate one full lecture to this section of the textbook, rather than devoting half a lecture.
PHYS G185L	cSLO 1	Fall 2016	Instructor Comments include the following: <ul style="list-style-type: none"> • Overall, I was very satisfied with the success rate of this SLO assessment. I was pleased with the students' abilities to correctly set up the equipment and follow lab instructions • Stress that this lab exercise is crucial for them to understand the concept of projectiles that satisfy the given SLO of the lab course and show them the common mistakes that may be made. • The SLO was well written and due to the

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			importance of the topic, this SLO should be assessed again in the future. • I am happy with the number of students who completed the assessment.
PHYS G185L	cSLO 2	Fall 2017	Continue to run the labs in a similar manner.
PHYS G185L	cSLO 2	Spring 2018	A review of mathematical methods.
PHYS G280	cSLO 2	Spring 2018	Most of the students were able to complete the SLO correctly. Of those that missed the problem, most were not able to recognize when resistors were in series and when they were in parallel.
PHYS G280	cSLO 3	Spring 2018	Most students were able to correctly demonstrate proficiency in this SLO. In the future, more complicated examples will be given by the instructor to help students achieve better results on this SLO.
PHYS G280	cSLO 5	Spring 2018	Sine only about half the students were able to successfully complete this assessment, in the future we will try and devote more lecture time to the concept.
PHYS G280L	cSLO 1	Spring 2018	This assignment will continue to be given each semester since it is necessary for the students to be able to perform these types of calculations and analysis in order to complete the lab portion of the course.
PHYS G280L	cSLO 1	Spring 2018	The experiment worked out well with all of the students getting acceptable results.
PHYS G280L	cSLO 2	Spring 2018	All students who participated in the lab activity successfully completed the SLO assessment.
PHYS G280L	cSLO 3	Spring 2018	Of the students who participated in the lab experiment, all were eventually able to successfully complete the assignment.
PHYS G280L	cSLO 4	Spring 2018	All students who remained in the class and took the final exam successfully completed this SLO assessment.
PHYS G285	cSLO 3	Fall 2017	Continue to try and demonstrate to students how to solve complicated problems in this very important area of physics.
PHYS G285	cSLO 4	Fall 2016	The instructor feels that critical thinking needs to be emphasized in all levels of mathematics, and physics. Problems involving critical thinking, and where students need to apply concepts of calculus and construct the solution from the given information all the way to the end, need to be a normal part of the course. This SLO as well as the others should be continued to be assessed using critical thinking situations. In addition, the instructor will explore assessing the SLO again on the final exam with a straightforward problem where critical thinking is not a major part of the solution.
PHYS G285L	cSLO 2	Fall 2016	Instructor Comments include the following: • Overall, I was very satisfied with the success rate of this SLO assessment. I was pleased with the students' abilities to correctly set up the equipment and follow lab instructions • Stress that this lab exercise is crucial for them to understand the thermodynamics that satisfy the given SLO of the lab course and show them the common mistakes that may be made. • The SLO was well written and due to the importance of the topic, this SLO should be assessed again in the future. • I am happy with the number of students who completed the assessment.
PHYS G285L	cSLO 2	Fall 2017	The lab experiment worked well. No changes are planned in the future.
PHYS G285L	cSLO 3	Fall 2017	No changes are needed for the lab.