Program-Level Assessment: Annual Report

Program: PHYSICS BS/ BA	Department: Physics
Degree or Certificate Level: PHYS BS & BA	College/School: College of Arts and Sciences.
Date (Month/Year): June 11, 2020	Primary Assessment Contact:
In what year was the data upon which this report is based collected? 2019/2020	
In what year was the program's assessment plan most recently reviewed/updated? December 2017	

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle?

In accordance with the schedule set by the assessment plan the following two outcomes were assessed:
In 2019/2020 items ***1*** and ***4*** were assessed (see Appendix 2 for detailed description of Outcomes 1-6).

1. *Students will apply the principles of physics to problems of fundamental and practical interest.*
4. *Students will communicate effectively and professionally in oral and written formats.*

2. Assessment Methods: Student Artifacts

Which student artifacts were used to determine if students achieved this outcome? Please identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

Student assignments, laboratory reports, written term paper, and students' oral presentation were used to determine if students achieved these specific outcomes. The following courses were used to collect data for the assessment process:
Modern Physics I & II, Optics, Optics Lab, Nanoscience Frontiers, Applications of Quantum Mechanics Classical Mechanics I & II, Quantum Mechanics I&II, Electricity and Magnetism I & II, and Research 1, Research 2, & Research 3. (three semester sequence of undergraduate research course)

All Courses were offered face-to-face until the onset of COVID-19. Starting on March 15, 2020, courses were moved online. Class that were moved online in the Spring 2020 semester included the following: Optics Lab & Optics Lecture, Modern Physics, Classical Mechanics, Applications of Quantum Mechanics, Thermal Physics, Senior Capstone Experience: Students complete a research project encompassing at least three semesters at the conclusion of which they give an oral presentation in a department seminar. At the end of the seminar the physics faculty meets to discuss and assess students' oral presentations.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the student artifacts, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and include them in/with this report.

Faculty evaluated artifacts collected in courses they taught using the rubrics in Appendix 1 Physics Faculty met on May 22, 2020 for Annual Assessment meeting. Each Faculty provided feedback based on each Faculty observations and their evaluations of students artifacts such as tests, term papers, oral presentations. Evaluations were ranked per specific Learning Outcome and approved rubric.

Rubric is provided in Appendix 1.

Summary of the data is provided in Appendix 2.

4. Data/Results

What were the results of the assessment of the learning outcomes? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

Results in general indicate that individually students in the program/s meet expectation. We had one student selecting incomplete.

Prior to March 16 2020, all classes took place on SLU campus in face-to-face modality. In this year's assessment report the achieved results were not significantly different, (averaged scores were very comparable) from previous year 2018/2019.
Additionally, in spite of mid-semester modality changes due to CIOVID-19, assessments results were steady and positive. This is, in part, due to the specific outcomes that were assessed in 2019/2020. Outcome 1 *(Students will apply the principles of physics to problems of fundamental and practical interest)* and Outcome 4 *(Students will communicate effectively and professionally in oral and written formats)*

For example, all final presentations took place via Zoom that also included Research 3, Senior Capstone Experience presentations and presentations by students in Zoon Class meeting. Specifically in Oral presentations students did as well as it would be expected in face- to- face class presentation. In assessment of communications in writing, the same was noted. There was no statistically viable difference noted in written test and assignments.

(See Appendix 2: *outcome 1*, average = 3.29; *outcome 4*, average =3.23). Moreover, no individual scores fall below 3 "Meets Expectations".

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

The physics program provides outlets for students to flourish. More mathematical background in general, for some students will be beneficial. Research projects and written papers and oral presentations related to Senior Capstone research courses have greatly benefited from close Instructor-Student interaction. Students demonstrated resilience and adapted easily to remote learning. During the recent difficult times, students demonstrated remarkable patience and motivation.

Faculty demonstrated dedication to students' learning in difficult situation, dictated by COVID-19, while discovering new ways to implement the use of online recourses (library/e-journals, e-books and webinars) as pedagogical tool.
Several faculty members experienced a high learning curve due to new technology such as Zoom and insufficient technological infrastructure at home. Certain faculty had outdated and obsolete computers which hindered their ability to communicate synchronously (for example via Zoom). This required some faculty to resort to other forms of communications such as e-mail, Blackboard discussions, and other messaging applications.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

This report will be sent to the Associate Dean and will eventually be posted on the website http://www.slu.edu/the-office-of-the-provost/assessment-of-student-learning/program-level-assessment/college-of-arts-and-sciences

where it can be viewed by faculty, staff, students, and alumni.

B. How specifically have you decided to use findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Student artifacts collected • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of the findings.

Changed will be discussed and introduced in the updated Assessment Plan in Fall 2020
Changes to the curriculum;
Courses such as Thermal Physics, were not included in the latest version of the assessment plan in 2017. The Physics Department will discuss its inclusion in the updated Assessment Plan in a future department meeting starting in December 2020.
Several upper division elective courses will be offered every other year. For example, course offering will rotate in odd/even years; such as Applications of Quantum Mechanics, Advanced Classical Mechanics, Electricity & Magnetism II. These courses generally had lower enrolment in the past 3-5 years, and offering those courses every other year will be beneficial.
This will allow additional upper division elective courses to be introduced, for example Solid State Physics, Introduction to Quantum Computing. Students will have more diverse menu for the selection of elective courses.
Changes to the Assessment Plan;
We will consider decreasing the frequency of data collection. According to a current plan we collect and assess only 2 out of 6 total outcomes, annually. We will consider assessing every other year 3 outcomes out of 6 total outcomes. This will allow for a completion of full cycle within in 3 years, same as before, and additionally eliminating spikes and fluctuations.

If no changes are being made, please explain why.

No identifiable issues were discovered.
Individual student scores were 3 or above on the scale (see below) which constitutes "Meets Exception". Average scores were above 3.

1.Below Expectations
2.Progressing to Expectations
3.Meets Expectations
4.Exceeds Expectations

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

No changes were made in recent years.

B. How has this change/have these changes been assessed?

N/A

C. What were the findings of the assessment?

N/A

D. How do you plan to (continue to) use this information moving forward?

N/A

IMPORTANT: Please submit any assessment tools and/or revised/updated assessment plans along with this report.

Appendix 1

Physics Assessment Rubrics

Outcome\Level of Attainment	1.Below Expectations	2. Progressing to Expectations	3. Meets Expectations	4. Exceeds Expectations
1. Students will apply the principles of physics to problems of fundamental and practical interest.	Not able to apply physics principles.	Can apply physics principles to simple problems with guidance.	Can apply physics principles to problems of increasing complexity	Can apply physics principles to problems beyond the classroom
2. Students will design and conduct experiments and analyze and interpret data.	Not able to conduct experiments or analyze data	Can conduct experiments and analyze data with direction	Can design and conduct experiments and analyze data with minimal direction	Can design and conduct experiments and analyze data independently. Demonstrates innovative thinking.
3. Students will collaborate effectively on teams.	Does not work well in groups	Contributes minimally to the efforts of a group	Participates actively in various aspects of group work	Works productively in groups, and inspires others
4. Students will communicate effectively and professionally in oral and written formats	Unable cogently to express ideas orally and in writing	Able to express simple ideas with some clarity	Able to express complex ideas with clarity	Able to express complex ideas with clarity and make connections among related ideas
5.Students will be able to discuss contemporary issues in science and technology	Not able to discuss contemporary scientific and technological issues in context.	Able to discuss such issues with guidance.	Able to discuss such issues on his/ her own clearly and concisely	Has a broad knowledge of current issues and conveys ideas clearly and concisely.
6.Students will be able to formulate numerically and solve scientific problems utilizing at least one programing language or environment	Not able to formulate a scientific problem as a set of numerical steps; and not able to produce code to solve it	Able to convert a scientific problem into numerically accessible steps with some assistance, code it and obtain results	Able to convert a scientific problem into numerically accessible steps, code it and obtain results. Investigate results and analyze errors.	Able to convert a scientific problem into numerically accessible steps, providing multiple alternative routes, code them and obtain results. Investigate results and analyze errors and optimize approaches.

Appendix 2

Physics Assessment Data

Outcome\Level of Attainment	Results
1.Students will apply the principles of physics to problems of fundamental and practical interest.	*Analog & Digital Electronics* In A&D Electronics students do final projects of designing and building a functioning electronic device of their choice. The device must be functioning and of practical utility. To that end they apply knowledge of physics principles to design their device. NT 3 KMe 3 RS 3 *Optics* Based on homework and written solutions of test problems KMc 3 RS 3 *Modern Physics II* Students gave presentations, and wrote essays on topics of their interests, related to Modern Physics. TM 4 DM 3.5 KMc 3 KMe 3 FS 3.5 RS 3.5 NT 3 PV 4 *Quantum Mechanics II* Because of the fundamental, introductory nature of the course material, the students' ability to express quantum mechanics ideas was assessed based on their responses in the classroom during the semester, and in the "explain" components of the written exam questions. MB 3 PK 3 TM 4 DM 3.5 KMe 3 KM 3 FS 3.5 RS 3 PV 4 *Classical Mechanics 1* Evaluation based on written solutions of test problems JL 3 NG 3 SK 3 KL 3 *Classical Mech II* Evaluation based on written solutions of test problems KM 3 RS 3 PV 3 *E&M I* Evaluation based on written solutions of homework and test problems MB 3 JL 3 TM 3 DM 4 KM 3 FS 4 PV 4, and AI* (incomplete) *E&M II* Evaluation based on written solutions of homework and test problems KM 3 GN 4 NT 4 *Modern Physics I* Scores based on written solutions of homework and test problems. Additionally, students had an essay on an exam. MC 3 MH 3 SK 4 JL 3 ML 4 YM 3 CL 3 GM 4 AR 4 *Thermal Physics* Students do "research" homework assignments, where they are asked to investigate some fundamental problem in all possible aspects instead of answering specific questions.

	TM 3 DM 3 KMc 3 FS 3 PV 3 **Average = 3.29 (**Average does not include (*) student who submitted Incomplete)
2. Students will design and conduct experiments and analyze and interpret data.	
3. Students will collaborate effectively on teams.	
4. Students will communicate effectively and professionally in oral and written formats	*Analog & Digital Electronics* In A&D Electronics students have lab reports and go through final oral presentation of their final projects. NT particularly, gave an excellent detailed presentation and had well-written reports. NT 4 KM 3 RS 3 *Senior Research Projects* This was based of students' oral presentations and written reports summarizing students' research. NT 3 KMer 3 *Optics Lecture* Based on 20-minute presentation on a textbook chapter KM 3, RS 3, and AI* (incomplete) *Optics Lab* Students write lab reports and technical description of study re-producing results of computational experiments from published scientific articles KM 3 RS 3 *Classical Mechanics 1* Based on written solutions of test problems JL 3 NG 3 SK 3 KL 3 *Classical Mechanics II* Based on written solutions of test problems KM 3 RS 3 PV 3 *E&M I* Based on written solutions of homework and test problems. MB 3 JL 3 TM 3 DM 4 KMc 3 FS 4 PV 4 and AI* *E&M II* Based on written solutions of homework and test problems KMc 3 GN 4 NT 4

	Modern Physics I Based on written solutions of homework and test problems. Additionally, students had an essay on an exam. MC 3 MH 3 SK 4 JL 3 ML 4 YM 3 CL 3 GM 4 AR 4 *Nanoscience Frontiers* Based on project and a technical paper that describes experiment, analysis, and results of experimental project KMc 4 *Thermal Physics* Based on the overall performance in the class. In Thermal Physics, each student presents a single chapter. Students did well in summarizing fundamental ideas within the scope of the textbook. TM 3 DM 3 KMc 3 FS 3 PS 3 *Quantum Mechanics I* Because of the fundamental, introductory nature of the course material, the students' ability to express quantum mechanics ideas was assessed based on their responses in the classroom during the semester, and in the "explain" components of the written exam questions. MB 3 PK 3 TM 4 DM 3.5 KM 3 KMe 3 FS 3.5 RS 3 PV 4 *Modern Physics II* TM 4 DM 3 KMc 3 KMe 3 FS 3 RS 3 NT 3 PV 4 **Average 3.27** (Average does not include $^{(*)}$ student who submitted Incomplete)
5. Students will be able to discuss contemporary issues in science and technology	
6.Students will be able to formulate numerically and solve scientific problems utilizing at least one programing language or environment	