SAINT LOUIS UNIVERSITY.

Program Assessment: *Annual Report*

Program(s): Engineering Physics

Department: Physics

College/School: Parks College of Engineering, Aviation, and Technology

Date: July 5, 2018

Primary Assessment Contact: William D. Thacker

1. Which program student learning outcomes were assessed in this annual assessment cycle?

a)an ability to apply knowledge of mathematics, science, and engineering.

b)an ability to design and conduct experiments, as well as to analyze and interpret data.

c)an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d)an ability to function on multi-disciplinary teams.

e)an ability to identify, formulate, and solve engineering problems.

f)an understanding of professional and ethical responsibility.

g)an ability to communicate effectively.

i)a recognition of the need for, and an ability to engage in life-long learning.

j)a knowledge of contemporary issues.

k)an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

2. What data/artifacts of student learning were collected for each assessed outcome? Were Madrid student artifacts included?

Student Outcome	Assignment(s) and Course for Assessment

(a) an ability to apply knowledge of mathematics, science, and engineering	Apply knowledge of mathematics, science, and engineering to solution of quantum mechanics problems and electricity and magnetism, final exams PHYS 4610 Quantum Mechanics homework problems PHYS 4210 Electricity and Magnetism. Use diffraction experiment data to calculate difference between crystal planes; Compute the coefficient of gamma ray attenuation for various materials; Find the charge to mass ratio of an electron PHYS 2620 Modern Physics Lab. Solve engineering problems with micro-controller driven circuits and analog amplifiers PHYS 3510 Analog and Digital Electronics.	
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	Conduct diffraction experiment, analyze and interpret data to find distance between crystal planes PHYS 2620 Modern physics Lab. Design and build components of sputter deposition system Laboratory Research. (I) Build, measure, and analyze data: (1) to investigate diode characteristics, (2) to build, investigate, and optimize a high-gain amplifier circuit; (II) design and build a prototype device for the project PHYS 3510 Analog and Digital Electronics.	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	Design and build a magnetic shield from given available resources from given available resources Laboratory Research. Design and build a prototype of a useful device for the project, subject to very constraint budget and time PHYS 3510 Analog and Digital Electronics.	
(d) an ability to function on multi-disciplinary teams	Some labs and the final project were performed in groups involving physics and engineering physics majors PHYS 3510 Analog and Digital Electronics. Research Project.	
(e) an ability to identify, formulate, and solve engineering problems	Laboratory research. Design and build a prototype of a useful device for the final project: engineering problems on design and implementation stage PHYS 3510 Analog and Digital Electronics.	
(f) an understanding of professional and ethical responsibility	Lab reports are original, not plagiarized, and demonstrate character and integrity PHYS 2620 Modern Physics Lab. Choose and build functioning prototype with safety and ethics in mind PHYS 3510 Analog and Digital Electronics.	
(g) an ability to communicate effectively	Research project. Oral presentation with questions and answers PHYS 2610 Modern Physics. Oral final project presentation, and written lab reports PHYS 3510 Analog and Digital Electronics	

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context	Not assessed this year.
(i) a recognition of the need for, and an ability to engage in life-long learning	Research project. Extensive discussions on what is being discussed in class PHYS 4210 Electricity and Magnetism. Final project PHYS 3510 Analog and Digital Electronics.
(j) a knowledge of contemporary issues	Classroom discussion PHYS 4210 Electricity and Magnetism. Oral Presentation of contemporary issue of science or technology PHYS 2610 Modern Physics.
(k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice	Utilize a programming language or environment to numerically solve for the energy levels and wave functions of a particle in a finite square potential well PHYS 4610; Use coding for operation of Atmel micro-controllers PHYS 2620 Modern Physics Lab. Use engineering tools for labs and final project PHYS 3510 Analog and Digital Electronics.

3. How did you analyze the assessment data? What was the process? Who was involved?
NOTE: If you used rubrics as part of your analysis, please include them in an appendix.

The department held its annual assessment meeting May 22, 2018 to discuss assessment data collected by each course instructor, suggest corrective action, and report on examples of continuous improvement. Levels of attainment of student outcomes are scored according to the following rubrics:

Outcome\Level of Attainment	**1.Below Expectations**	**2. Progressing to Expectations**	**3. Meets Expectations**	**4. Exceeds Expectations**
a) an ability to apply knowledge of mathematics, science, and engineering.	Not able to apply knowledge of mathematics, science, and engineering.	Can apply this knowledge to simple problems with guidance.	Can apply this knowledge to problems of increasing complexity	Can apply this knowledge to problems beyond the classroom
b) an ability to design and conduct experiments, as well as to 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.
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Not able to place engineering problems in broader societal contexts.	Able to design engineering solutions but not always within realistic constraints.	Able to design engineering solutions within realistic constraints to meet desired needs.	Able to design innovative solutions within constraints to meet a variety of needs.
d) an ability to function on multi-disciplinary 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.
e) an ability to identify, formulate, and solve engineering problems.	Not able to identify, formulate, or solve engineering problems.	Able to perform these tasks with guidance.	Able to identify, formulate, and solve a variety engineering problems with minimal guidance.	Able to identify, formulate, and solve complex engineering problems and demonstrate originality.
f) an understanding of professional and ethical responsibility.	Unable to relate ethical concepts to professional responsibility.	Rudimentary understanding of basic ethical concepts.	Incorporates ethical concepts into various aspects of her/his work.	Demonstrates an exceptional grasp of ethical aspects of the profession.
g) an ability to communicate effectively.	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.
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.	Not able to understand contemporary, engineering, scientific, and technological issues in a global context.	Able to understand such issues at a basic level.	Able to grasp such issues with some sophistication.	Has a broad knowledge of current issues and synthesizes diverse ideas persuasively.
i) a recognition of the need for, and an	Shows no interest in continued	Shows minimal interest in	Very interested in continuing to	Has an insatiable thirst

ability to engage in life-long learning.	learning.	continued education.	learn.	for new knowledge.
j) a knowledge of contemporary issues.	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.
k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.	Not able to use techniques, skills, and tools of modern engineering.	Can apply these capabilities to simple problems with guidance.	Can apply these capabilities to problems of increasing complexity.	Can apply these capabilities to complex problems and real-world situations.

This rubric provides a set of guidelines for evaluating student work and assessing levels of attainment of student outcomes. Level of attainment is given by a score:

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

4. What did you learn from the data? Summarize the major findings of your analysis for each assessed outcome.
NOTE: If necessary, include any tables, charts, or graphs in an appendix.

Five EPHYS majors were in the assessment this year. Four students meet or exceed expectations in all outcomes. One student did not meet expectations in several outcomes (the same student).

5. How did your analysis inform meaningful change? How did you *use the analyzed data to make or implement recommendations for change* in pedagogy, curriculum design, or your assessment plan?

If any student does not meet or exceed expectations for any outcome corrective action is necessary for that outcome. Corrective actions are discussed at the assessment meeting.

6. Did you follow up ("close the loop") on past assessment work? If so, what did you learn? *(For example, has that curriculum change you made two years ago manifested in improved student learning today, as evidenced in your recent assessment data and analysis?)*

Continuous Improvement: In response to earlier weakness in outcome (g), an ability to communicate effectively, instructors of courses that require written and oral presentations shall give more guidance on technical writing and speaking. Examples of continuous improvement:
An instructor developed a document (Guidance for writing technical paper or report) and shared it with the students. This document was discussed in class as well. Examples were provided how to write introduction to a report, how to prepare high quality graphical images, and how to write a concise caption for each figure. Instructor observed that after multiple discussions and additional feedback on the drafts, students were able to produce, a

quality written technical documents. Executive Summaries in Optics PHYS 3310 involve each student giving an oral presentation summarizing one textbook chapter not covered in lecture. In 2018, in response to an observed weakness in past assignments, the instructor provided comments post-presentation, which each student had to implement in a revised version to be turned in for final grading. As a result the final presentations were much improved thereby closing the loop.

IMPORTANT: Please submit any revised/updated assessment plans to the University Assessment Coordinator along with this report.

Appendix: Data and Corrective Actions

Student Outcome	Level of Achievement of each student	Average	Comments & corrective actions
(a) an ability to apply knowledge of mathematics, science, and engineering	3.5, 2.3, 3.5, 3.5	3.2	1 student not meeting expectations; apply additional support and guidance on applying knowledge in mathematics, science, and engineering.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	3.5, 3, 2, 4, 3	3.1	1 student not meeting expectations; apply broad guidance without telling students exactly what to do in designing and conducting experiments and analyzing and interpreting data.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and	4, 3, 4, 3	3.5	Students meet expectations

safety, manufacturability, and sustainability			
(d) an ability to function on multi-disciplinary teams	4, 4, 2, 4, 3	3.4	1 student does not meet expectations; observed to passively follow others. Instructor should find ways to actively engage passive students.
(e) an ability to identify, formulate, and solve engineering problems	4, 2, 4, 4	3.5	1 student not meeting expectations; apply additional support and guidance.
(f) an understanding of professional and ethical responsibility	4, 4, 2, 4, 4	3.6	1 student does not meet expectations. Instructor should engage students in discussions about ethical issues related to engineering physics.
(g) an ability to communicate effectively	4, 4, 4, 3, 4, 3	3.7	Students meet expectations.
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context	Not assessed this year.		
(i) a recognition of the need for, and an ability to engage in life-long learning	4, 4, 4, 3, 4, 3	3.7	Students meet expectations.
(j) a knowledge of contemporary issues	4, 3.5, 4	3.8	Students meet expectations
(k) an ability to use techniques, skills, and modern engineering tools necessary for	3, 4, 2, 4	3.25	1 student does not meet expectations. Apply additional instruction concerning modern

engineering practice			engineering tools.