SAINT LOUIS UNIVERSITY

Program Assessment Plan

Program: Engineering Physics BS

Department: Physics

College/School: Parks

Date: December 22, 2017

Primary Assessment Contact: William D. Thacker

Note: Each cell in the table below will expand as needed to accommodate your responses.

#	Program Learning Outcomes	Assessment Mapping	Assessment Methods	Use of Assessment Data
#	**Program Learning Outcomes** What do the program faculty expect all students to know, or be able to do, as a result of completing this program? ▪ *Note: These should be measurable, and manageable in number (typically 4-6 are sufficient).*	**Assessment Mapping** From what specific courses (or other educational/professional experiences) will artifacts of student learning be analyzed to demonstrate achievement of the outcome? Include courses taught at the Madrid campus and/or online as applicable.	**Assessment Methods** What specific artifacts of student learning will be analyzed? How, and by whom, will they be analyzed? ▪ *Note: the majority should provide direct, rather than indirect, evidence of achievement.* Please note if a rubric is used and, if so, include it as an appendix to this plan.	**Use of Assessment Data** How and when will analyzed data be used by faculty to make changes in pedagogy, curriculum design, and/or assessment work? How and when will the program evaluate the impact of assessment-informed changes *made in previous years*?
a	An ability to apply knowledge of mathematics, science, and engineering.	Classical Mechanics I & II, Quantum Mechanics I&II, Electricity and Magnetism I&II, Optics, Thermodynamics and Statistical Mechanics ; research	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
b	An ability to design and conduct experiments and analyze and interpret data.	Modern Physics Lab, Optics Lab, Analog and Digital Electronics, Nanoscience Frontiers, Experimental Physics	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
c	An ability to design a system, component, or process to meet desired needs within realistic constraints such	Modern Physics Lab, Analog and Digital Electronics, Optics Lab, Nanoscience Frontiers, Experimental Physics, and	Student performance on specific assignments in listed courses assessed by course instructor according outcome-	In annual department meetings assessment results at individual level and in aggregate, corrective action for

	as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Senior Design	specific rubric listed below.	weaknesses in student attainment, and impact of previous corrective actions are discussed.
d	An ability to function on multi-disciplinary teams.	Group projects in Modern Physics Lab, Analog and Digital Electronics, Optics Lab, Nanoscience Frontiers, Experimental Physics	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
e	An ability to identify, formulate, and solve engineering problems.	Final papers in Optics Lab, Nanoscience Frontiers, and Senior Design	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
f	An understanding of professional and ethical responsibility.	Final papers in Optics Lab and Nanoscience Frontiers Students learned about professional and ethical considerations such as proper citations and acknowledgement Analog and Digital Electronics Students viewed a video about government surveillance, had a discussion about the social implications of their future careers as engineers and scientists, and wrote a paper on this subject	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
g	An ability to communicate effectively.	Paper and oral presentation with questions and answers, Optics Lab, Modern Physics, and Nanoscience Frontiers Write a two page executive summary of selected course material not covered in lecture, Optics, Optics Lab, Modern Physics, and Nanoscience Frontiers	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.

h	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.	Final Papers and Oral Presentation guidelines ask students to include technological, economic and societal aspects of their study and give examples of how the technology can benefit society, oral presentation Nanoscience Frontiers and Optics Lab.	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
i	A recognition of the need for, and an ability to engage in life-long learning.	Paper and oral presentation, Modern Physics, Optics Lab, Nanoscience Frontiers	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
j	A knowledge of contemporary issues.	Paper and oral presentation, Modern Physics, Optics Lab, Nanoscience Frontiers	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.
k	An ability to use techniques, skills, and modern engineering tools necessary for engineering practice.	Modern Physics Lab, Optics Lab, Analog and Digital Electronics, Nanoscience Frontiers, and Experimental Physics	Student performance on specific assignments in listed courses assessed by course instructor according to outcome-specific rubric listed below.	In annual department meetings assessment results at individual level and in aggregate, corrective action for weaknesses in student attainment, and impact of previous corrective actions are discussed.

Additional Questions

1. On what schedule/cycle will faculty assess each of the above-noted program learning outcomes? *(It is <u>not recommended</u> to try to assess every outcome every year.)*

Each year learning outcomes are assessed for every student in the program at the level of sophomore and above. Due to the limited number of students in the program, not every outcome is assessed every year.

2. Describe how, and the extent to which, program faculty contributed to the development of this plan.

The program faculty collectively developed the outcome-specific rubrics.

3. On what schedule/cycle will faculty review and, if needed, modify this assessment plan?

Faculty will review annually and, if needed, modify the assessment plan.

IMPORTANT: Please remember to submit any assessment rubrics (as noted above) along with this report.

Engineering Physics Assessment 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	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	Able to design innovative solutions within constraints to meet a variety

constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.			needs.	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	Not able to	Able to	Able to grasp	Has a broad

education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.	understand contemporary, engineering, scientific, and technological issues in a global context.	understand such issues at a basic level.	such issues with some sophistication.	knowledge of current issues and synthesizes diverse ideas persuasively.
i) a recognition of the need for, and an ability to engage in life-long learning.	Shows no interest in continued learning	Shows minimal interest in continued education	Very interested in continuing to learn	Has an insatiable thirst 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

Example Assignments for Outcomes Assessment

Outcome (a): Design and build a digital counter with digital display, this assignment uses digital logic (mathematics), integrated circuits (science) and their connection to device function (engineering), PHYS 351 Analog and Digital Electronics.
Derive standing wave modes with a variety of boundary conditions; derive population inversion ratio of a multistate laser, PHYS 331 Optics.
Calculate the voltage output of a fuel cell or battery, PHYS 341 Thermodynamics and Statistical Mechanics.

Outcome (b): Design and conduct an experiment to calibrate an optical microscope. Design and test a nanoprobe for patterning of nanomaterials.

Design a circuit that can drive a stepper meter using transistors. Design a low voltage probe and demonstrate magnetic memory read and write.

Outcome (c): Design a system to measure the heat capacity of various gasses, discuss the connection of this experiment with the greenhouse effect and climate change PHYS 351 Analog and Digital Electronics
Design and build a solar powered water purification system that uses materials that could be found in the trash (plastic bottles, aluminum foil, and aluminum cans, PHYS 332 Optics Lab

Outcome (d): Instructor observation of teams that may include students from more than one discipline. Students work in teams of two or more, often paired by different disciplines. Optics Lab , Analog and Digital Electronics. Students work in class editing each other's Draft 1 of the course paper. Students provide comments on each other's draft papers, PHYS 493 Nanoscience Frontiers.

Outcome (e): Design an optical system from a set of technical requirements with regard to performance and limits. Calibrate an optical microscope and verify the accuracy of measurements Optics Lab.

Outcome (f): Students viewed a video about government surveillance, had a discussion about the social implications of their future careers as engineers and scientists, and wrote a paper on this subject. Final papers in Optics Lab and Nanoscience Frontiers: students learned about professional and ethical considerations such as proper citations and acknowledgement.

Outcome (g): Paper and oral presentation with questions and answers, Optics Lab and Nanoscience Frontiers
Write a two page executive summary of selected course material not covered in lecture, Optics.

Outcome (h): Final Papers and Oral Presentation guidelines ask students to include technological, economic and societal aspects of their study and give examples of how the technology can benefit society, oral presentation Nanoscience Frontiers and Optics Lab.

Outcome (i): Paper and oral presentation Analog and Digital Electronics, Optics Lab, Modern Physics, and Nanoscience Frontiers.

Outcome (j): Paper and oral presentation Analog and Digital Electronics, Optics Lab, Modern Physics, and Nanoscience Frontiers.

Outcome (k): Programming modern electronics embedded systems, Modern Physics Lab. Programming modern electronics embedded systems and LabView, Experimental Physics. Using Matlab and Maple to numerically solve problems that arise during reverse engineering Optics Lab. Utilizing a programming language or environment to numerically solve for the energy levels and plot the wave functions of a particle in a finite square potential well, Quantum Mechanics.