UNIVERSITY OF SAN FRANCISCO | College of Arts and Sciences

ASSESSMENT REPORT
FOR ACADEMIC YEAR 2023-2024

ENGINEERING PHYSICS MINOR

Department of Physics & Astronomy

University of San Francisco

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Submitted by Prof. Horacio E. Camblong

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1 LOGISTICS, MISSION STATEMENT & PROGRAM LEARNING OUTCOMES

1.1 PHYSICS & ASTRONOMY CONTACT PERSON (FACULTY ASSESSMENT COORDINATOR).

Name: Professor Horacio E. Camblong, Email: camblongh@usfca.edu

1.2 PHYSICS & ASTRONOMY DEPARTMENT MISSION STATEMENT

No changes were made to the program mission statement since the last assessment cycle in November 2023.

> The mission of the Physics & Astronomy Department is to provide our students with the fundamental knowledge and the practical tools of a rigorous physics education that will help them be players and leaders in shaping a more humane world. The Physics program is implemented via a comprehensive coverage of experimental, theoretical, and computational physics, and by combining coursework together with on- and off-campus research and exposure to cutting-edge equipment and laboratory techniques. This rigorous training prepares students for careers and/or graduate studies in any discipline within fundamental or applied science (physics, astronomy, mathematics, chemistry, biology, etc); in any of the standard engineering fields; in education; in medicine and related disciplines; and many other fields, such as law, financial analysis, or positions in the high-technology sector of the global economy.

1.3 ENGINEERING PHYSICS MINOR LEARNING OUTCOMES (PLOs)

No changes were made to the program learning outcomes (PLOs) since the last assessment cycle in November 2023.

1. - **PLO 1 (a).**
   Demonstrate competent knowledge of the core concepts, principles, and applications of *electronics*.
   - **PLO 1 (b).**
   Demonstrate competent knowledge of the core concepts, principles, and applications of *computational physics*.

2. • **PLO 2.**

   Conduct experiments for a comparison with physical models and theories, and *examine* the results with the statistical methods of error analysis.

1.4 CURRICULAR MAP LINKING THE ENGINEERING PHYSICS MINOR LEARNING OUTCOMES AND THE RELEVANT PHYSICS COURSES

In the curricular map below, the check-mark symbol ✓ indicates the applicable PLOs for each course.

PLOs ⟹ **PHYS courses** ⇓	**PLO 1 (a)** **Demonstrate** knowledge/applications electronics	**PLO 1 (b)** **Demonstrate** knowledge computational physics	**PLO 2** **Conduct and examine** experiments + error analysis
PHYS 110 (General Physics I)			✓
PHYS 210 (General Physics II)			✓
ENGR 264 (Electronics)	✓		✓
ENGR 262 (Intro Digital Electronics)	✓		✓
PHYS 301 (Intro Scientific Computation)		✓	
PHYS 302 (Sci. Comp/Machine Learning)		✓	
PHYS 303 (Bayesian/Deep Learning in Sci.)		✓	

1.5 PROGRAM LEARNING OUTCOME(S) ASSESSED FOR THE ACADEMIC YEAR 2023-2024

The Engineering Physics Minor Program Learning Outcome assessed for this one-year period involves one of three major learning goals relevant to physics and astronomy: proficiency in the basic subfields of physics and astronomy, as well as areas of application.

- **PLO 1 (b).**
  Demonstrate competent knowledge of the core concepts, principles, algorithmic methods, and applications of *computational physics*.

1.6 ASSESSMENT SCHEDULE

For the Engineering Physics Minor discussed in this report, the following timetable of Program Learning Outcomes has been followed thorough last academic year:

- AY 2020-21: PLO 1 (b)
- AY 2021-22: PLO 2
- AY 2023-24: PLO 1 (b)

We anticipate reassessment of these PLOs and any additional adjustments according to a flexible timetable that will depend on internal factors involving course offerings (as some courses are not offered every year) and ongoing departmental discussions on the assessment procedures. For this academic year, we are already collecting data for next year's report as follows:

- AY 2024-25: PLO 2

2 METHODOLOGY

2.1 Methodology.

Assessment activities in the Engineering Physics Minor program were undertaken as planned during the AY 2023-2024, following multiyear departmental guidelines.

2.2 Generic Assessment Procedures.

The program learning outcome PLO 1 (b) above was assessed in the following course: PHYS 303 (Bayesian/Deep Learning in Science). The process was organized at the departmental level with cooperation of all the instructors involved and our Program Assistant, and according to our multiyear departmental guidelines. The data were stored electronically. The faculty member teaching the relevant course was responsible for the required data collection and grading of the students' work products: Xiaosheng Huang (PHYS 303). In addition, the overall logistics and final re-grading of the work products was conducted by Horacio Camblong, and the results were subsequently discussed at a Physics & Astronomy Department meeting.

2.3 Assessment Procedures and Data Analysis.

The relevant learning outcome was assessed through a final computational project that required extensive knowledge and skills in building algorithms with the background gained in PHYS 303.

The learning outcomes were gauged with the *4-level scale system* listed below. It should be noted that these 4 levels are meant to be categories defined by comparison with the minimum benchmark standard, defined as "average," regardless of the statistical course average for any given class section. This classification refers to the level of proficiency of the skill and knowledge set involved in the learning outcome.

- Outstanding = Full Mastery. This represents superior performance, with an almost complete command of the relevant skill and knowledge set.
- Proficient = Partial Mastery. This represents basic, solid performance that reflects a level of achievement where errors or omissions only affect the final results in a minimal way.
- Satisfactory = Meets Expectations. This represents performance that meets expectations as benchmark standard set up to correspond to an overall, satisfactory outcome (involving most parts of the assessed problem, question, or project), but allowing for errors or omissions whose correction would otherwise lead to considerable performance improvement (i.e., not reaching partial mastery, but showing a minimum acceptable level for most of the relevant skills).

- Inadequate = Unsatisfactory Level. This mark does not necessarily imply complete failure to perform on the given outcome, but involves serious gaps in understanding and/or problem-solving outcomes for the relevant skill and knowledge set.

3 RESULTS & MAJOR FINDINGS

The results for the course selected for assessment are summarized below:

- PHYS 303 (Bayesian/Deep Learning in Science), Spring 2024:

  This course introduces to the students a selected set of state-of-the-art scientific computing tools, centered on deep learning and Bayesian data analysis, with applications in the physical sciences.

  The chosen work product was a computational project titled "Face Detection and Recognition." The purpose of this project is to focus on a detailed analysis of one subtle aspect of pattern recognition, including a "proof of concept" exercise of face detection and recognition. This project involves an array of useful computational techniques and programming with Python, whose successful completion provides an excellent test of this learning outcome PLO 1 (b).

  All the students participated in the final project, and the results were graded and compiled as follows.

  Number of Students: 9;
  Outstanding: 9 students (100.0%);
  Proficient: 0 students (0%);
  Satisfactory: 0 students (0%);
  Inadequate: 0 students (0%).

4 CLOSING THE LOOP

4.1 Follow-Up Discussion and Decision-Making.

Two Physics & Astronomy faculty meetings addressed various aspects of assessment. The discussions included a review of our assessment plan, the learning outcomes, and the results of this assessment cycle, as well as the feedback from our last assessment cycle. In addition, follow-up discussions are planned for the ongoing 2023-24 Physics Department meetings.

The following conclusions were drawn:

- We are using a well established model of assessment that has been successful in our Physics & Astronomy programs for several years, and received an excellent positive review during our last Academic Program Review (conducted in Spring 2018).
- All in all, the results of the assessment activities show a very high level of performance by all students, with an excellent command of the computational-physics skills relevant for the engineering-physics-minor PLO 1 (b).
- The assessment outcomes of this cycle are also consistent (qualitatively and quantitatively) with the assessment outcomes of earlier academic years.
- In our departmental discussions of assessment activities and plans, we have often addressed "targeted curricular questions" that we consider central to the goals of our major and minor programs. One question relevant to this specific report has been:
  - Are physics majors proficient in problem-solving techniques for "complex problems" (involving multi-step tasks)?

  This is equally relevant for the engineering physics minor, and the types of projects it involves. From the assessment of this learning outcome, we found that students are learning the basic tools to solve a variety of problems over a broad range of physics fields, and with all degrees of complexity. In this instance, the emphasis was on computational techniques relevant for complex problems.
- No significant curricular changes are planned/required for AY 2024-25.