| **Student Learning Outcome**  **(Stated in Measurable Terms)** | **Assessment Method** | **Results**  **(Data Summary and Analysis)** |
| --- | --- | --- |
| Graduates will demonstrate competency in the subject knowledge of Physics in the areas of mechanics, electricity and magnetism, thermodynamics, and quantum/wave mechanics. | All students will take the Education Testing Service (ETS) Field Exam in Physics during their senior year.  The average student score on both the basic and advanced level of the ETS exam will be at or above the national average. | Six students took the ETS exam. At the basic level, 37.5% of students scored at or above the 50th percentile. At the advanced level, 37.5% of students scored at or above the 50th percentile.   |  |  |  | | --- | --- | --- | | Student | Basic | Advanced | | 1 | 38 | 15 | | 2 | 38 | 15 | | 3 | 69 | 69 | | 4 | 77 | 69 | | 5 | 15 | 38 | | 6 | 38 | 15 | | 7 | 85 | 90 | | 8 | 45 | 45 | | Average | 50.6 | 44.5 | |
| **Use of Results for Improving Student Learning** | | |
| Results will only become meaningful when more statistics have been accumulated. We will work to improve course experiences, for example by trying to reduce the number of adjunct teachers of such classes or through other programmatic changes. For example, we will steer prospective majors into studio-based physics classes, as these have proven to be effective means of developing students' conceptual understanding of physics (see the article entitled “Modeling instruction: Positive attitudinal shifts in introductory physics measured with CLASS”, Kramer, Brewe, O’Brien (2009) Physical Review Special Topics – Physics Education Research 5, 013102.) | | |

| **Student Learning Outcome**  **(Stated in Measurable Terms)** | **Assessment Method** | **Results**  **(Data Summary and Analysis)** |
| --- | --- | --- |
| B. S. graduates will demonstrate their ability to think critically in terms of identifying and summarizing a problem or question, analyzing and examining ideas and research findings, assessing the influence of context, and constructing and interpreting information within Physics. | A three member faculty panel will use a rubric describing 4 indicators of critical thinking (5 point rating scale; 20 point maximum) to assess the laboratory reports required in the Modern Physics Laboratory I and II, or Senior Laboratory courses. All students will be evaluated.  A mean score for each student will be obtained from the faculty ratings. Graduates will attain an average minimum score of 12 on critical thinking. | Seven out of eight students performed at, or above, the minimum score.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Student | I&S | A&E | A&I | C&I | Total | | 1 | 3 | 3 | 3 | 3 | 12 | | 2 | 3 | 3 | 3 | 3 | 12 | | 3 | 5 | 4 | 5 | 3 | 17 | | 4 | 3 | 3 | 4 | 3 | 13 | | 5 | 4 | 3 | 4 | 4 | 15 | | 6 | 2 | 3 | 3 | 3 | 11 | | 7 | 3 | 4 | 3 | 4 | 14 | | 8 | 4 | 3 | 5 | 4 | 16 | | aver | 3.4 | 3.3 | 3.8 | 3.4 | 13.8 | |
| **Use of Results for Improving Student Learning** | | |
| Results will only become meaningful when more statistics have been accumulated. However, we were encouraged that most of our students performed at, or above, the minimum score. We will seek to integrate physics education research-based techniques (for example studio-based instruction; see the article entitled “Modeling instruction: Positive attitudinal shifts in introductory physics measured with CLASS”, Kramer, Brewe, O’Brien (2009) Physical Review Special Topics – Physics Education Research 5, 013102) into upper division courses (Quantum Mechanics, Intermediate Electromagnetism, Intermediate Classical Mechanics), inspired by success of similar techniques adopted in lower division courses. | | |

| **Student Learning Outcome**  **(Stated in Measurable Terms)** | **Assessment Method** | **Results**  **(Data Summary and Analysis)** |
| --- | --- | --- |
| B.S. graduates will demonstrate effective written communication skills in Physics by explaining content and developing ideas, effectively organizing information, demonstrating a command of the written language, and using the conventions of language and documentation appropriately. | A three member faculty panel will use a rubric describing 4 indicators of written communication skills (5 point rating scale; 20 point maximum) to assess the laboratory reports required in Modern Physics Laboratory I and II, or Senior Laboratory courses. All students will be evaluated.    A mean score for each student will be obtained from the faculty ratings. Graduates will attain an average minimum score of 12 points on the written communication rubric.  . | Four out of eight of our students performed at, or above, the minimum level.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Student | C&D | Org | Lang | Conven | Total | | 1 | 2 | 3 | 3 | 3 | 11 | | 2 | 2 | 2 | 3 | 3 | 10 | | 3 | 5 | 5 | 5 | 4 | 19 | | 4 | 4 | 4 | 3 | 4 | 15 | | 5 | 4 | 5 | 4 | 4 | 17 | | 6 | 2 | 3 | 2 | 3 | 10 | | 7 | 3 | 3 | 3 | 2 | 11 | | 8 | 4 | 5 | 4 | 4 | 17 | | Average | 3.3 | 3.8 | 3.4 | 3.4 | 13.8 | |
| **Use of Results for Improving Student Learning** | | |
| Results will only become meaningful when more statistics have been accumulated. Faculty will provide students with critical feedback on how to write professional style reports. Formal report-writing tutorials will be added to the Modern I, II and Senior Lab courses. | | |
| B.S. graduates will demonstrate effective oral communication skills through their subject knowledge of Physics, organization of ideas, adequate connection to an audience, efficient delivery, and appropriate use of technology. | A three member faculty panel will use a rubric describing 4 indicators of oral communication skills (5 point rating scale; 20 point maximum) to assess the oral presentation required in Modern Physics Laboratory I and II, or Senior Laboratory courses. All students will be evaluated.  A mean score for each student will be obtained from the faculty ratings. Graduates will attain an average minimum of 12 points on the oral communication rubric.  . | Six out of eight of our students performed at, or above, the minimum level.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Student | SK | Org | Conn | Del | Total | | 1 | 4 | 3 | 5 | 5 | 17 | | 2 | 2 | 1 | 3 | 4 | 10 | | 3 | 5 | 4 | 3 | 4 | 16 | | 4 | 3 | 3 | 3 | 3 | 12 | | 5 | 5 | 4 | 3 | 4 | 16 | | 6 | 2 | 3 | 3 | 4 | 12 | | 7 | 3 | 3 | 2 | 3 | 11 | | 8 | 3 | 4 | 4 | 4 | 15 | | Average | 3.4 | 3.1 | 3.3 | 3.9 | 13.6 | |
| **Use of Results for Improving Student Learning** | | |
| Results will only become meaningful when more statistics have been accumulated. Faculty who teach Modern Physics I and II Laboratory and Senior Laboratory will be required to include speaking tutorials and student oral presentations as part of their course curriculum. | | |

**Summarize use of results for continuous improvement of the educational program:**

Results of the ETS exam will be analyzed per sub-area, allowing us to identify courses which would benefit from improvements in instructional methods. Courses such as Modern Physics I and II Laboratory, and Senior Laboratory, provide the ideal platform for students to develop oral and written communication skills. In these courses, emphasis on these aspects will continue to build.