Year 4 Physics Department Assessment
Non-Accredited Program

Student Learning Outcomes

1. Demonstrate the ability to apply fundamental, overarching themes in physics, including conservation laws, symmetry, the particulate nature of matter, waves, interactions, and fields, and systems, models and their limitations.
2. Demonstrate competency in applying basic laws of physics in classical and quantum mechanics, electricity and magnetism, thermodynamics and statistical mechanics and special relativity, and the applications of these laws in areas such as optics, computational physics, and astronomy.
3. Represent basic physics concepts in multiple ways, including mathematically (including through estimations), conceptually, verbally, pictorially, computationally, by simulation, and experimentally.
4. Demonstrate knowledge of how basic physics concepts are applied in modern technology and apply this knowledge to the solution of applied problems.
5. Solve complex, ambiguous problems in real-world contexts.
6. Show how results obtained relate to the original problem, determine follow-up investigations, and place the results in a larger perspective.
7. Demonstrate instrumentation competency: competency in basic experimental technologies, including vacuum, electronics, optics, sensors, and data acquisition equipment. This includes basic experimental instrumentation abilities, such as knowing equipment limitations; understanding and using manuals and specifications; building, assembling, integrating, operating, troubleshooting, and repairing equipment; establishing interfaces between apparatus and computers; and calibrating laboratory instrumentation and equipment.
8. Demonstrate software competency: competency in learning and using industry-standard computational, design, analysis, and simulation software, and documenting the results obtained from a computation or design.
9. Demonstrate data analytics competency: competency in analyzing data, including with statistical and uncertainty analysis; distinguishing between models; and presenting those results with appropriate tables and charts.
10. Communicate with many different audiences from many different cultures and scientific backgrounds, understand each audience and its needs, and make the communication relevant and maximally impactful for that audience.
11. Obtain information and evaluate its accuracy and relevance through reading (print and online), listening, and discussing.
12. Articulate one's own state of understanding and be persuasive in communicating the worth of one's own ideas and those of others.
13. Communicate in writing about scientific and technical concepts concisely and completely, and revise writing to achieve grammatically-correct and logically-constructed arguments.
14. Organize and communicate ideas using words, mathematical equations, tables, graphs, pictures, animations, diagrams, and other visualization tools.
15. Work collegially and collaboratively in diverse, interdisciplinary teams both as a leader and as a member in pursuing a common goal.

16. Obtain knowledge about existing technology resources relevant for the task at hand. For example: How is the technology made? How does it work? What does it cost? Who tests it? What industries are affected by it? Where are the centers of these industries located? Where can the computational resources needed for the task be found?
17. Demonstrate familiarity with basic workplace concepts. Concepts such as program and project management, including planning, scheduling, tracking progress, adapting, and working within constraints, quality assessment and assurance, and working with and enhancing the safety culture in the workplace.
18. Display awareness of regional and national career opportunities and pathways for physics graduates.
19. Demonstrate critical professional and life skills, including completing work on time, optimism, realism, time management, responsibility, respect, commitment, perseverance, independence, resourcefulness, integrity, ethical behavior, and cultural and social competence

Area	SLO*	ULG**	Measures/Instruments	Results and Evaluations
Physics Specific Skills	1. Demonstrate the ability to apply fundamental, overarching themes in physics, including conservation laws, symmetry, the particulate nature of matter, waves, interactions, and fields, and systems, models and their limitations.	C, Q, W	Major Field Test (given prior to leaving EIU) or possibly some other exam of general physics knowledge	Such assessments are no longer in the budget.
	2. Demonstrate competency in applying basic laws of physics in classical and quantum mechanics, electricity and magnetism, thermodynamics and statistical	C, Q, W	Grades in PHY 4470, PHY 4750, PHY 4855, PHY 4865, PHY 4320, and PHY 4100	The GPA for all of these courses is 3.007 for the period of evaluation. In general the material to be evaluated does seem to be learned at

	mechanics and special relativity, and the applications of these laws in areas such as optics, computational physics, and astronomy.			an appropriate level.
	3. Represent basic physics concepts in multiple ways, including mathematically (including through estimations), conceptually, verbally, pictorially, computationally, by simulation, and experimentally.	C, Q, W	Grades in PHY 1371, PHY 1372, PHY 3150, PHY 4711, PHY 4712	The experimental portion of these courses show growth as the GPAs go from 3.229 for 1371 and 1372 to 3.200 for 3150 to 3.661 for 4711 and 4712. This shows clear growth in the concepts and experimental knowledge.
	4. Demonstrate knowledge of how basic physics concepts are applied in modern technology and apply this knowledge to the solution of applied problems.	C, Q, W	Grades in PHY 3150, PHY 4713	The GPA of 3.200 for 3150 demonstrates knowledge in this area. And the GPA of 3.875 for 4713 indicates growth and maturity.
Scientific Technical Skills	5. Solve complex, ambiguous problems in real-world contexts.	C, S, R	Grades in PHY 4713, PHY 2601, PHY 4601	End of semester research talks have demonstrated

				a general ability to problem solve in research contexts.
	6. Show how results obtained relate to the original problem, determine follow-up investigations, and place the results in a larger perspective.	C, Q	Grades in PHY 4713, PHY 2601, PHY 4601	The average grade in these courses is 3.883 which indicates that our faculty have faith in the student's abilities in this area.
	7. Demonstrate instrumentation competency: competency in basic experimental technologies, including vacuum, electronics, optics, sensors, and data acquisition equipment. This includes basic experimental instrumentation abilities, such as knowing equipment limitations; understanding and using manuals and specifications; building, assembling, integrating, operating, troubleshooting,	NA	Grades in PHY 3150, PHY 4470, PHY 4711, PHY 4712, PHY 4713	The GPA for these courses is 3.451 which indicates that students are learning experimental techniques and technologies.

	and repairing equipment; establishing interfaces between apparatus and computers; and calibrating laboratory instrumentation and equipment.			
	8. Demonstrate software competency: competency in learning and using industry-standard computational, design, analysis, and simulation software, and documenting the results obtained from a computation or design.	C, Q, W	Grades in PHY 3270, PHY 4320	The GPA for these courses is 3.108 and indicates that students are competent in the software that is currently in the instruction system.
	9. Demonstrate data analytics competency: competency in analyzing data, including with statistical and uncertainty analysis; distinguishing between models; and presenting those results with appropriate tables and charts.	C, Q, W	Grades in PHY 1372, PHY 3150, PHY 4711, PHY 4712	Grades for these courses show a 3.466 GPA indicating that error analysis is taught and understood by the students.

Communications Skills	10. Communicate with many different audiences from many different cultures and scientific backgrounds, understand each audience and its needs, and make the communication relevant and maximally impactful for that audience.	W, S, R	EWP Report	EWP reports indicate that our students write and communicate at a level that is above the College average.
	11. Obtain information and evaluate its accuracy and relevance through reading (print and online), listening, and discussing.	W, S	Professor's Evaluation of PHY 1001	Students are exposed to strategies for improving learning in this course. Critical Thinking as well as critical analyzing of word problems are also addressed in this course.
	12. Articulate one's own state of understanding and be persuasive in communicating the worth of one's own ideas and those of others.	S	Speaking Report	This report is problematic because of small number statistics the score on this is at the top and demonstrates competence but maybe not for the

				whole program.
	13. Communicate in writing about scientific and technical concepts concisely and completely, and revise writing to achieve grammatically-correct and logically-constructed arguments.	C, W	Grades in PHY 3410, PHY 3420, PHY 4855, PHY 4865	The GPA for these courses is 3.158 which indicates that students are able to achieve good levels of writing in technical and scientific modes.
	14. Organize and communicate ideas using words, mathematical equations, tables, graphs, pictures, animations, diagrams, and other visualization tools.	W, Q	Grades in PHY 4000 and Speaking Report	Students demonstrate growth in their ability to organize and present material in Powerpoint. Faculty are satisfied with the current results. The Speaking Report corroborates this evaluation.
Professional/Workplace Skills	15. Work collegially and collaboratively in diverse, interdisciplinary teams both as a leader and as a member in pursuing a common goal.	R	Exit Interview	Exit Interviews were not done due to budget constraints.

	16. Obtain knowledge about existing technology resources relevant for the task at hand. For example: How is the technology made? How does it work? What does it cost? Who tests it? What industries are affected by it? Where are the centers of these industries located? Where can the computational resources needed for the task be found?	S, W	Grades in PHY 3150, PHY 4713	These discussions are a part of the final project for these courses. It is not necessarily reflected in the grades because the course covers so much more. However, instructors report that the students do get exposure to all of these concepts throughout the courses.
	17. Demonstrate familiarity with basic workplace concepts. Concepts such as program and project management, including planning, scheduling, tracking progress, adapting, and working within constraints, quality assessment and assurance, and working with and enhancing the safety culture in the workplace.	R	Alumni Survey	Expense of Alumni Survey is not in the budget.

	18. Display awareness of regional and national career opportunities and pathways for physics graduates.	NA	Exit Interview, Alumni Survey	Expense of Alumni Survey is not in the budget.
	19. Demonstrate critical professional and life skills, including completing work on time, optimism, realism, time management, responsibility, respect, commitment, perseverance, independence, resourcefulness, integrity, ethical behavior, and cultural and social competence	R	Exit Interview, Alumni Survey	Expense of Alumni Survey is not in the budget.
* Student Learning Objectives				
** University Learning Goals -	C = Critical Thinking			
	W = Writing and Critical Reading			
	S = Speaking and Listening			
	Q = Quantitative Reasoning			
	R = Responsible Citizenship			
	NA = Not Applicable			

Improvements and Changes Based on Assessment

1. Provide a short summary (1-2 paragraphs or bullets) of any curricular actions (revisions, additions, and so on) that were approved over the past two years as a result of reflecting on the student learning outcomes data. Are there any additional future changes, revisions, or interventions proposed or still pending?
   a. Implemented a new course as an elective for upper level students. PHY 4780, Plasma Physics was taught for the first time in Spring 2023. The course will add to student's knowledge of Electricity and Magnetism as well as some Mathematical Methods (a course that was deleted from the curriculum in our streamlining of the program).
   b. Utilized PHY 1001 to be more career oriented. We go over resume writing, professional letter writing, and career ideas now. We continue to expound the benefits of studying in technical fields as well as hints for better classroom performance.
   c. Implemented a recitation section in our introductory majors Physics course in the spring of 2023. This is to supplement topics from the usual lecture and give the students further experience in problem solving. It does work to give students additional problem solving skills.
   d. We updated our software by purchasing COMSOL which is a simulation package for modeling physical systems. This is both to give computational physics students better software for modeling and to give them additional up to date software to work with. It further enhances our abilities for mentored research because COMSOL is currently widely used.
2. Please provide a brief description or bulleted list of any improvements (or declines) observed/measured in student learning. Be sure to mention any intervention made that has not yet resulted in student improvement (if applicable).
   a. Students seem to have been hindered in their education from the COVID years. We find that incoming students are not as prepared as in the past. Since 2022 the Department has recorded about 40 incoming students but the introductory majors class had 15 students. More than half of the incoming majors were not prepared to take calculus based Physics.
   b. In general GPA numbers have been going down over the past few years. We believe that this is a side effect of COVID education.
   c. One intervention is the recitation section mentioned above.

3. Using the form below, please document annual faculty and committee engagement with the assessment process (such as the review of outcomes data, revisions/updates to assessment plan, and reaffirmation of SLOs).

History of Annual Review		
Date of Annual Review	**Individuals/Groups who Reviewed Plan**	**Results of the Review (i.e., reference proposed changes from #1 above, revised SLOs, etc...)**
9/1/23	Whole Department	Recitation Section proposed for General Physics I.
9/9/24	Whole Department	Continue current activities and evaluate outcomes later.

Dean Review & Feedback

The Department of Physics 2-year assessment report is comprehensive and measures 19 distinctive student learning outcomes, most of which are aligned with EIU's undergraduate learning goals. The program assesses SLOs using multiple data points including a major field test, exit interviews, an alumni survey, speaking and critical thinking analyses, and course grades. Assessment results were shared with the faculty in fall 2023 & 2024 and led to several curricular and programmatic changes including the implementation of a recitation section in the introductory majors course and the purchase of a simulation software package to assist with modeling physical systems. While assessment results over the last few years indicate that students are less prepared to take calculus-based Physics coursework, the department has responded in part by implementing the recitation section noted above. While the department has made positive progress in their assessment enterprise, I urge the Physics faculty to consider standardized methods in addition to course grades to assess several key SLOs in their program. Perhaps this could be accomplished by expanding the scope of the exit interviews and/or alumni survey.

11/26/24

Dean or designee **Date**