Physics and Engineering

Program Learning Outcome Assessment

2021-22

Program Learning Outcomes

Physics and Engineering

Graduates from the Physics B.S. and B.A. programs will demonstrate the following learning outcomes:

- Students will develop an understanding of the fundamental principles of physics.
- Students will apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems.
- Students will design and conduct experiments as well as analyze and interpret data.
- Students will effectively communicate complicated technical information orally.
- Students will effectively communicate complicated technical information in writing.
- Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.
- Students will effectively collaborate in teams.

Graduates from the Engineering program will demonstrate the following learning outcomes:

- Students will develop an understanding of the fundamental principles of physics and of engineering.
- Students will apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems.
- Students will design and conduct experiments or complete an engineering design project as well as analyze and interpret data.
- Students will effectively communicate complicated technical information orally.
- Students will effectively communicate complicated technical information in writing.
- Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.
- Students will effectively collaborate in teams.

Note: Because these program learning outcomes are very similar and the assessment points for them are the same, assessment data for physics majors and engineering majors have been combined into a single report.

Physics and Engineering

Learning Outcome: Students will develop an understanding of the fundamental principles of physics.

Outcome Measure: Major Field Achievement Test in Physics taken by seniors in the capstone course PHY4072. Note that this measure is being updated as part of the revision of learning outcomes and measures to be commenced in the 2022-23 academic year.

Criteria for Success (how do you judge if the students have met your standards): At least 50% of students will score more than the 40th percentile on the MFAT in Physics. New criteria to be determined based on the revised assessment.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at the 40th percentile									
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Physics MFT	71%	57%	33%	50%	50%	37%	57%	21%	N/A	N/A

Conclusions Drawn from Data: Note that in 2019-20 the department decided to stop using the MFT in Physics. The department was not getting useful data from the expense involved in the exam because it is not well aligned with the learning outcomes of the programs. We are in the process of revising learning outcomes and the related measures.

Generally students are just barely meeting the criteria established and in some years missing it (but the variability is partially the result of a relatively small sample size). Students are typically measured at the end of their senior year. This data suggests that the “typical student” is unable to recall ideas at the time they are taking the exam that we hope they would have.

There is a tendency for averages to be changed significantly by a few individuals, so these averages should perhaps be viewed cautiously. Often students who have reviewed material before the MFAT exam do significantly better. This occurs primarily from students who take the physics GRE, and to a lesser degree individuals who severed as TAs. However, the population doing these activities might naturally score higher on the MFT.

Brief interviews with students indicated that we may not be preparing the students to take this kind of exam very well (i.e. they almost never see multiple choice, and rarely problems that they are not completely working out).

Changes to be Made Based on Data: The majority of the majors in our department are engineering majors so the MFT in Physics is not the best measure of their knowledge. We are discontinuing the use of the test and will be replacing it with other embedded assessments that are part of our overall revision of our assessment processes.

Rubric Used: No rubric used since the results are provided by ETS.

Physics and Engineering

Learning Outcome: Students will apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems.

Outcome Measure: Embedded final exam questions given in upper division mastery class on a rotating basis (EGR/PHY3063, EGR/PHY3043 and PHY4053).

Criteria for Success (how do you judge if the students have met your standards): At least 75% of students will achieve an average score of 2.5 or higher on criteria described in application rubric.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage Over 2.5									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
	PHY431	PHY361	PHY431	PHY361	PHY431	PHY361	PHY431	PHY3063	PHY/EGR3043	PHY/EGR3063
Application Rubric	84%	88%	82%	80%	71%	96%	81%	92%	100%	53%

***** Note the courses were renumbered in the 2019-20 academic year. PHY361 became PHY3063. PHY431 became PHY4053. At that time some courses were cross listed as both engineering and physics.

Conclusions Drawn from Data: Typically, our students are meeting the benchmark. Though not directly measured, we have noticed that occasionally students struggle knowing when computational tools are most appropriate if not prompted in some way. There was a significant drop in the 2021-22 scores and we need to investigate those further.

In establishing this learning outcome, review of the curriculum tended to show that we had previously not focused as much on applications within courses. The computational piece has been strengthened by utilizing tools such as MATLAB through several courses from freshman through senior level.

The adjusted curriculum (starting Fall 2019) includes more labs and thus more opportunities for “hands on” work and computations.

Changes to be Made Based on Data: Increased use of computational techniques including introductory physics lab, modern physics, and various upper division classes. The degree to which students evaluate their solution is also varied. Typically, this has not explicitly been a required part of problems being solved. It is recommended that at least periodically an evaluation of their solutions be an explicit part of problems rather than the hope that students have learned the good habit of evaluating their solution when they have finished it and assume that this is taking place.

Physics and Engineering Application Rubric

(PHY/EGR3063, PHY4053)

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Demonstrates relevant physical principles	☐ Identifies all the appropriate physical principals necessary to solve the problem and can provide clear reasoning why these principals are applicable and useful	☐ Identifies all physical principles necessary to solve the problem but cannot clearly articulate why each principle is applicable and helpful in arriving at a solution	☐ Identifies most of the relevant physics	☐ Cannot identify relevant physics
Correctly applies physical principals	☐ Efficiently uses identified physical principals to move toward solution	☐ Uses identified physical principles to move toward solution	☐ Application of physical principles contains few errors	☐ Application of physical principles contains many errors
Applies mathematical techniques, concepts and processes	☐ Mathematical techniques are used correctly and efficiently to move toward a solution	☐ Mathematical techniques are used correctly with few or no errors	☐ Mathematical techniques are used correctly with several errors	☐ Mathematical techniques contain many errors
Demonstrates knowledge of computational techniques	☐ Can articulate why a particular computational technique or tool is useful	☐ Can identify relevant computational tools and techniques	☐ Identifies some computational tools or techniques which may work	☐ Cannot identify computational techniques applicable to the problem
Application of computational techniques	☐ Uses appropriate tools to formulate a complete solution efficiently and correctly	☐ Arrives at a solution which is correct	☐ Arrives at a solution which may contain some minor errors	☐ Does not arrive at a solution
Evaluation of solution	☐ Can evaluate solution for correctness either using alternate methods or reasonableness using physical principals	☐ Can evaluate the solution generally based on physical principals	☐ Rough evaluation of solution without clear reasoning	☐ Cannot provide any evaluation of correctness of solution

Physics and Engineering

Learning Outcome: Students will design and conduct experiments or complete engineering design projects as well as analyze and interpret data.

Outcome Measure: Assessment of design as part of EGR/PHY4082 Senior Project.

Criteria for Success (how do you judge if the students have met your standards): At least 75% of students will achieve an average score of 2.5 or higher on criteria described in experimental rubric.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students scoring 2.5 or higher									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Design Rubric	75%	N/A	88%	93%	89%	86%	100%	69%	80%	78%

*Note that 2019-20 and 2020-21 were COVID years.

In 2013-14 students did not complete an individual project, but rather reported on a particular topic, but did participate in lab rotations.

Conclusions Drawn from Data: Students are observed to be strong at certain features on the rubric (error analysis, reach appropriate conclusions) while typically weaker in others (developing procedures independently). Perhaps not surprisingly, students are strongest in aspects that they have practiced the most.

An analysis of the data for 2019-20 shows that the students who did not meet the basic benchmark of an average score of 2.5 across all areas of the rubric showed weakness in:

- Develop adequate physics/engineering background to carry out novel experiments
- Devise a procedure for achieving the goals of the experiment or project

In 2020-21 and 2021-22 the scores improved and there were no notable areas of shortfall.

Changes to be Made Based on Data: Upon establishing this learning outcome and developing the rubric, the department recognized that we did not provide many opportunities for students to develop their own procedures (many procedures were described for them).

EGR/PHY4082 has improved students' abilities, but a stronger thread through the curriculum appears necessary. Building a more scaffolded approach, where they practice an increasing amount of independence would be helpful. To address this issue, our program review concluded that a curriculum that had more labs would be helpful with the junior and senior level labs

involving a greater level of independence. These new labs are being added to the curriculum but the students in the 2019-20 course were not the beneficiaries of that curricular change. The students who took the class in 2020-21 are the first cohort to have an increased number of labs and based on data, there seems to possibly be some positive impact. However, these most recent cohorts of students had a bit less lab experience due to shorter labs/online labs caused by COVID protocols.

Physics and Engineering Experimental Rubric
(PHY/EGR4072)

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Develop adequate physics/engineering background to carry out novel experiments	Demonstrates the background for carrying out novel experiments.	Can carry out novel experiments with a small amount of guidance.	Struggles with carrying out novel experiments.	Cannot carry out novel experiments.
Establish and communicate the purpose of an experiment or project	Clearly communicates the purpose of the experiment or project.	Communicates the purpose of the experiment or project with minor errors or missing details.	Communicates a vague sense of the purpose of the project or experiment.	Cannot communicate the purpose of the experiment or project.
Operate and troubleshoot complex physical apparatus	The student can operate and troubleshoot the equipment.	The student can operate and troubleshoot the equipment most of the time.	The student can do one of operating or troubleshooting the equipment.	The student cannot operate the equipment and cannot troubleshoot.
Devise a procedure for achieving the goals of the experiment or project	The procedure will achieve the goals.	The procedure will mostly address the goals of the project.	The procedure will partially address the goals of the project.	The procedure is not connected to the goals.
Reach appropriate conclusions from data	The conclusions are clearly connected to the data.	The conclusions are mostly connected to the data.	The conclusions are partially connected to the data.	The conclusions are not connected to the data.

Physics and Engineering

Learning Outcome: Oral Communication: Students will effectively communicate complicated technical information orally.

Outcome Measure: EGR/PHY4082 Senior Project technical talk.

Criteria for Success (how do you judge if the students have met your standards): At least 75% of students will achieve an average score of 2.5 or higher on criteria on the Oral Presentation rubric in a talk juried by department faculty.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or higher									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	2020-21*	2021-22
Oral Presentation Rubric Scores	88%	100%	100%	100%	100%	93%	75%	100%	88%	100%

*COVID-19 Year

Conclusions Drawn from Data: The students are generally achieving the benchmark.

Changes to be Made Based on Data: In the future the department will analyze the data based on individual components of the Oral Presentation Rubric rather than using a single average score for each student. This should provide a deeper look at the areas where students are showing weaknesses.

PHY-ENG Oral Presentation Rubric Update

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Command of material	☐ Clearly knows material	☐ Knows most key facts	☐ Reads some, knows some	☐ Reads many sentences from slides
	☐ Expands on PowerPoint slides	☐ Some expansion on slides	☐ No expansion on slides	☐ Dependent on notes
	☐ Content appropriate for audience	☐ Partial adaptation for audience	☐ Little adaptation of content for audience	☐ Lacks adaptation of content to audience
Organization	☐ Clear and concise outline	☐ Clear outline	☐ Some sense of outline	☐ No clear sense of outline
	☐ Relevant graphics and key text items on slides	☐ Too much information on slides (not concise)	☐ Too much information and detail	☐ Slides are in paragraphs; too much detailed information on one slide
	☐ Plus/minus 30 seconds of time limit	☐ Plus/minus 60 seconds of time limit	☐ Plus/minus 1.5 minutes of time limit	☐ Plus/minus 2 minutes of time limit
Presentation skills	☐ Clearly has practiced several times; smooth transitions	☐ Practiced, but transitions are not smooth	☐ Practiced, but no transitions between slides	☐ Not practiced, doesn't anticipate content of next slide
	☐ Free of uhms and the like	☐ Few uhms and the like	☐ Many uhms and the like	☐ Uhms and the like detract from the presentation
	☐ Clearly heard and used inflection for emphasis	☐ Understood much of the time and some inflection	☐ Some difficulty hearing and little inflection	☐ Cannot be heard and/or speaks in a monotone
	☐ Engages audience with eye contact	☐ Some engagement with eye contact	☐ Infrequent eye contact	☐ No eye contact
	☐ Engages audience with gestures	☐ Some engagement with gestures	☐ Some distracting gestures	☐ Frequent distracting gestures
Presentation tools	☐ PPT background is matched to content, legible font, graphics, seamless transitions	☐ Appropriate background, font, transitions	☐ Distracting backgrounds, transitions, fonts hard to read	☐ No attention to backgrounds, transitions, fonts very hard to read
	☐ Appropriate graphics used	☐ Some graphics used to enhance presentation	☐ Graphics do not enhance presentation	☐ Distracting use of graphics

Physics and Engineering

Learning Outcome: Written Communication: Students will effectively communicate complicated technical information in writing.

Outcome Measure: EGR/PHY4082 Senior Project Written Report.

ETS Proficiency Profile Exam.

Criteria for Success (how do you judge if the students have met your standards):
EGR/PHY4082: At least 75% of students will achieve an average score of 2.5 or higher on criteria on the Written Report rubric.

ETS: 75% of the students will be marginal or proficient at Level 2 Writing.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

EGR/PHY4082:

	Percentage of Students at 2.5 or higher									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	2020-21*	2021-22**
Written Report Rubric	75%	N/A	100%	100%	84%	64%	100%	No Data	80%	67%

Note that in 2021-22 the students who did not score 2.5 or higher, scored 2.46 so with rounding this would have been 100%.

ETS:

	Percentage of Students Marginal or Proficient									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	2020-21*	2021-22
ETS Proficiency Profile Level 2 Writing	100%	100%	75%	62%	94%	73%	87%	60%	86%	79%

*COVID-19 Year

Conclusions Drawn from Data: The students are consistently hitting the benchmarks in both the written report and the ETS exam. The dip in the ETS exam in 2015-16 was due to small sample size (if one student had a slightly higher score the benchmark would have been met). However, there was a significant drop in 2019-20 in the ETS score. This may be attributable to COVID or to the students not taking the exam particularly seriously because of not taking it in a classroom setting. Note that improvement was seen in 2020-21 and 2021-22.

The reports that students are writing in the senior project have been uneven. Examining the data from 2017-18, the main areas of weakness are:

- Information literacy (multiple references and the references cited)
- A well-written conclusion
- Uncertainties and error propagation discussed in the paper

In 2018-19 the students met the benchmarks. In 2019-20, the year of the COVID-19 outbreak, spring writing data was not gathered. Data was again gathered in the 2020-21 year. In the 2021-22 year, all of the students missed the benchmark but by a very small amount. All of them had a score of 2.46 so just short of the 2.5 benchmark.

Changes to be Made Based on Data: The department believe that the ETS exam is not meeting the department's needs since ETS is focused on the mechanics of writing such as grammar. We will be assessing this skill using the department's writing rubric alone.

Rubric Used: ETS: No Rubric.

Written Report Rubric: On the next page.

PHY-ENG Written Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Structural pieces	☐ Abstract is a clear and concise summary of all relevant results and descriptions in the order emphasized in the paper	☐ Abstract could be made clear and/or concise with minor changes	☐ Abstract is missing some information and/or contains unnecessary information	☐ Abstract does not contain necessary information
	☐ Introduction indicates precise subject, scope, and purpose	☐ Introduction is missing one of the following: precise subject, scope or purpose	☐ Introduction is missing two of the following: precise subject, scope or purpose	☐ Introduction does not give precise subject, scope and purpose
	☐ Main body is well organized, logical and contains all necessary information without extra information	☐ Main body lacks some organization	☐ Main body is missing some important pieces and/or is not well organized	☐ Main body is not well organized, lacks logical arguments and relevant data
	☐ Conclusion appropriately sums up, gives conclusions, and recommendations	☐ Conclusion does two of the following: sums up, gives conclusions, and recommendations	☐ Conclusion does one of the following: sums up, gives conclusions, and recommendations	☐ Conclusion does not provide any summation, conclusions, or recommendations
	☐ Multiple references from reputable sources	☐ Most references from distinct reputable sources	☐ Some references from reputable sources	☐ No bibliography or all references from untrusted sources
	☐ References cited in the body of the document	☐ Some citations of reference in the body	☐ Limited citation references	☐ No citation of references
Data	☐ Data is clearly presented in properly formatted tables, figures and graphs where appropriate	☐ Some data could be presented more clearly	☐ Data is poorly presented and some key data is missing	☐ Several pieces of key data are missing
	☐ All uncertainties are shown and error propagation is carried out where appropriate	☐ Most uncertainties are shown and propagation of error carried out	☐ Many uncertainties are missing and/or propagation or error not carried out correctly	☐ No uncertainties of measurements are shown
Grammar, spelling and style	☐ No grammatical or spelling errors	☐ Few grammatical and spelling errors	☐ Some grammatical and spelling errors	☐ Many grammatical and spelling errors
	☐ Equations well formatted and variables introduced as needed	☐ A few errors in formatting equations	☐ Poorly formatted equations	☐ Incorrect equations
	☐ Appropriate style (no first-person, past tense when reporting was done)	☐ A few informal statements and/or tense	☐ Several areas which are too informal and tense errors	☐ Very informal and/or use of future tense where not appropriate
	☐ Clear sentences and ideas are presented in a way that won't be misunderstood	☐ A few unclear sentences	☐ Many complex and unclear sentences	☐ Many sentences are unclear and have overly complex construction
	☐ Concise and quantitative as subject matter permits	☐ A few unnecessary words and ideas	☐ Frequent extra and inexact words	☐ Many vague, inexact, and/or idle words
	☐ Arguments are complete and logical	☐ Most arguments are complete	☐ Several arguments are difficult to follow	☐ Arguments are incomplete, illogical, and may contain unnecessary information and specialized jargon

Physics and Engineering

Learning Outcome: Information Literacy: Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.

Outcome Measure: EGR/PHY4082 Senior Project Written Report.

Criteria for Success (how do you judge if the students have met your standards):
EGR/PHY4082: At least 75% of students will achieve an average score of 2.5 or higher on criteria on the information literacy portion of the Written Report rubric.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or higher									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*	2020-21*	2021-22
Written Report Rubric IL	25%	N/A	63%	86%	53%	43%	44%	No Data	80%	100%

*COVID-19 Year

Conclusions Drawn from Data: The students' performance in this area has been very uneven. It is clear from looking at the individual scores in the writing rubrics, that this is the weakest category for students. For example in 2018-19, 100% of the students hit the overall benchmark for writing, but when information literacy is considered separately, only 44% of the students have achieved the target. In 2019-20 due to COVID-19 writing data was not gathered. In 2020-21 the student scores bounced back. We are still analyzing the data, but it may simply be a matter of the variation created by a relatively small sample size.

Changes to be Made Based on Data: The department has worked with students to clarify expectations for the use and citation of material in technical writing.

Rubric Used: PHE Written Report Rubric.

PHY-ENG Written Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Structural pieces	☐ Abstract is a clear and concise summary of all relevant results and descriptions in the order emphasized in the paper	☐ Abstract could be made clear and/or concise with minor changes	☐ Abstract is missing some information and/or contains unnecessary information	☐ Abstract does not contain necessary information
	☐ Introduction indicates precise subject, scope, and purpose	☐ Introduction is missing one of the following: precise subject, scope or purpose	☐ Introduction is missing two of the following: precise subject, scope or purpose	☐ Introduction does not give precise subject, scope and purpose
	☐ Main body is well organized, logical and contains all necessary information without extra information	☐ Main body lacks some organization	☐ Main body is missing some important pieces and/or is not well organized	☐ Main body is not well organized, lacks logical arguments and relevant data
	☐ Conclusion appropriately sums up, gives conclusions, and recommendations	☐ Conclusion does two of the following: sums up, gives conclusions, and recommendations	☐ Conclusion does one of the following: sums up, gives conclusions, and recommendations	☐ Conclusion does not provide any summation, conclusions, or recommendations
	☐ Multiple references from reputable sources	☐ Most references from distinct reputable sources	☐ Some references from reputable sources	☐ No bibliography or all references from untrusted sources
	☐ References cited in the body of the document	☐ Some citations of reference in the body	☐ Limited citation references	☐ No citation of references
Data	☐ Data is clearly presented in properly formatted tables, figures and graphs where appropriate	☐ Some data could be presented more clearly	☐ Data is poorly presented and some key data is missing	☐ Several pieces of key data are missing
	☐ All uncertainties are shown and error propagation is carried out where appropriate	☐ Most uncertainties are shown and propagation of error carried out	☐ Many uncertainties are missing and/or propagation or error not carried out correctly	☐ No uncertainties of measurements are shown
Grammar, spelling and style	☐ No grammatical or spelling errors	☐ Few grammatical and spelling errors	☐ Some grammatical and spelling errors	☐ Many grammatical and spelling errors
	☐ Equations well formatted and variables introduced as needed	☐ A few errors in formatting equations	☐ Poorly formatted equations	☐ Incorrect equations
	☐ Appropriate style (no first-person, past tense when reporting was done)	☐ A few informal statements and/or tense	☐ Several areas which are too informal and tense errors	☐ Very informal and/or use of future tense where not appropriate
	☐ Clear sentences and ideas are presented in a way that won't be misunderstood	☐ A few unclear sentences	☐ Many complex and unclear sentences	☐ Many sentences are unclear and have overly complex construction
	☐ Concise and quantitative as subject matter permits	☐ A few unnecessary words and ideas	☐ Frequent extra and inexact words	☐ Many vague, inexact, and/or idle words
	☐ Arguments are complete and logical	☐ Most arguments are complete	☐ Several arguments are difficult to follow	☐ Arguments are incomplete, illogical, and may contain unnecessary information and specialized jargon

Physics and Engineering

Learning Outcome: Students will effectively collaborate in teams.

Outcome Measure: Teamwork survey used for students to rate their teammates. This survey and evaluation is done in PHY3004L.

Criteria for Success (how do you judge if the students have met your standards): At least 75% of students will achieve an average score of 2.5 or higher on criteria described in teamwork rubric.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage scoring 2.5 or higher								
	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Teamwork Rubric (teams)	86%	95%	94%	94%	91%	86%	100%	100%	100%

Conclusions Drawn from Data: This is a highly cooperative class and the students' ratings are consistent with observed behavior. Overall students tend to rate each other very highly.

Changes to be Made Based on Data: The measurement instrument was changed after the first year. The second year a more detailed instrument was used to help shape their ratings of each other.

Physics and Engineering Teamwork Rubric

(PHY3004L)

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Focus on Task	☐ Stays on task all of the time	☐ Stays on task most of the time	☐ Stays on task some of the time with some reminders from group	☐ Hardly ever on task, lets others do task
Extent to which works together	☐ A very strong group member who works hard and helps others in the group	☐ A strong group member who works hard	☐ Sometimes active group member but needs to try harder	☐ Frequently choosing not to help out
Meeting habits	☐ On time to meetings or any assigned tasks	☐ Usually on time and completes any assigned task	☐ Sometimes late for meeting or not completing tasks	☐ Late or absent for many or all meetings
Attitude while listening and discussing	☐ Respectful listener, discusses, and helps direct the group in solving problems	☐ Respectful, listens and asks questions	☐ Has trouble listening with respect and takes over discussions without letting others have a turn	☐ Does not listen or consider other's ideas, blocks group from reaching agreement
Problem solving	☐ Actively seeks and suggests solutions to problems	☐ Improves on solutions and suggestions given by others	☐ Does not offer solutions but is willing to try solutions offered by others	☐ Does not try to solve problems or help others solve problems
Goal completion	☐ Works to complete group goals	☐ Usually helps to complete group goals	☐ Occasionally helps to complete group goals	☐ Does not help to complete group goals