Physics and Engineering

Learning Outcome: Critical Thinking: Students will be able to examine, critique and synthesize information in order to arrive at reasoned conclusions.

Outcome Measure: ETS Proficiency Profile Exam.

Criteria for Success (how do you judge if the students have met your standards): 75% of the students will be marginal or proficient at Level 2 Reading/Critical Thinking.

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 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 Critical Thinking	100%	100%	75%	77%	89%	73%	73%	60%	71%	89%

*COVID-19 Year

Conclusions Drawn from Data: The students are in general achieving the benchmark. However there was a significant drop in 2019-20 and a lower score in 2020-21. 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.

Changes to be Made Based on Data: The variability in the data appears to be the result of relatively small sample sizes. The department does not believe that the ETS exam, which measures critical reading is the best assessment of this competency in the context of physics and engineering and will be creating an embedded assessment to measure this competency.

Rubric Used: No rubric. We use the ETS Proficiency Profile test results.

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: Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature.

Outcome Measure: ETS Proficiency Profile Exam.

Criteria for Success (how do you judge if the students have met your standards): 95% of the students will be marginal or proficient at Level 2 Math.

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 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 Math	100%	100%	100%	100%	100%	91%	100%	70%	86%	79%

*COVID-19 Year

Conclusions Drawn from Data: The students are consistently hitting the benchmark. However in there was a significant drop in 2019-20 and 2020-21 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. The scores did bounce back a bit this year. Some of the variability can be explained by having a relatively small sample.

Changes to be Made Based on Data: None at this time.

Rubric Used: No rubric. We use the ETS Proficiency Profile test results.