

## 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*
ETS Proficiency Profile Level 2 Critical Thinking	100%	100%	75%	77%	89%	73%	73%	60%	71%

\*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.

**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:** PHY4072 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*
Oral Presentation Rubric Scores	88%	100%	100%	100%	100%	93%	75%	100%	88%

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

## Physics and Engineering

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

**Outcome Measure:** PHY4072 and PHY4082 Senior Project Written Report.

ETS Proficiency Profile Exam

**Criteria for Success (how do you judge if the students have met your standards):**  
PHY4072/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:**

PHY4072:

	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*
Written Report Rubric	75%	N/A	100%	100%	84%	64%	100%	No Data	80%

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*
ETS Proficiency Profile Level 2 Writing	100%	100%	75%	62%	94%	73%	87%	60%	86%

\*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 in 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. However improvement was seen in 2020-21.

The reports that students are writing in the senior lab 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.

**Changes to be Made Based on Data:** The department will be undergoing program review in the coming year and will look at the alignment between the ETS exam and the written report expectations. It is clear that the students are not fully understanding the expectations for the final lab report that is being used in this class.

**Rubric Used:** ETS: No Rubric.

Written Report Rubric: On the next page.

### PHY-ENG Written Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
<b>Structural pieces</b>	<input type="checkbox"/> Abstract is a clear and concise summary of all relevant results and descriptions in the order emphasized in the paper	<input type="checkbox"/> Abstract could be made clear and/or concise with minor changes	<input type="checkbox"/> Abstract is missing some information and/or contains unnecessary information	<input type="checkbox"/> Abstract does not contain necessary information
	<input type="checkbox"/> Introduction indicates precise subject, scope, and purpose	<input type="checkbox"/> Introduction is missing one of the following: precise subject, scope or purpose	<input type="checkbox"/> Introduction is missing two of the following: precise subject, scope or purpose	<input type="checkbox"/> Introduction does not give precise subject, scope and purpose
	<input type="checkbox"/> Main body is well organized, logical and contains all necessary information without extra information	<input type="checkbox"/> Main body lacks some organization	<input type="checkbox"/> Main body is missing some important pieces and/or is not well organized	<input type="checkbox"/> Main body is not well organized, lacks logical arguments and relevant data
	<input type="checkbox"/> Conclusion appropriately sums up, gives conclusions, and recommendations	<input type="checkbox"/> Conclusion does two of the following: sums up, gives conclusions, and recommendations	<input type="checkbox"/> Conclusion does one of the following: sums up, gives conclusions, and recommendations	<input type="checkbox"/> Conclusion does not provide any summation, conclusions, or recommendations
	<input type="checkbox"/> Multiple references from reputable sources	<input type="checkbox"/> Most references from distinct reputable sources	<input type="checkbox"/> Some references from reputable sources	<input type="checkbox"/> No bibliography or all references from untrusted sources
	<input type="checkbox"/> References cited in the body of the document	<input type="checkbox"/> Some citations of reference in the body	<input type="checkbox"/> Limited citation references	<input type="checkbox"/> No citation of references
<b>Data</b>	<input type="checkbox"/> Data is clearly presented in properly formatted tables, figures and graphs where appropriate	<input type="checkbox"/> Some data could be presented more clearly	<input type="checkbox"/> Data is poorly presented and some key data is missing	<input type="checkbox"/> Several pieces of key data are missing
	<input type="checkbox"/> All uncertainties are shown and error propagation is carried out where appropriate	<input type="checkbox"/> Most uncertainties are shown and propagation of error carried out	<input type="checkbox"/> Many uncertainties are missing and/or propagation or error not carried out correctly	<input type="checkbox"/> No uncertainties of measurements are shown
<b>Grammar, spelling and style</b>	<input type="checkbox"/> No grammatical or spelling errors	<input type="checkbox"/> Few grammatical and spelling errors	<input type="checkbox"/> Some grammatical and spelling errors	<input type="checkbox"/> Many grammatical and spelling errors
	<input type="checkbox"/> Equations well formatted and variables introduced as needed	<input type="checkbox"/> A few errors in formatting equations	<input type="checkbox"/> Poorly formatted equations	<input type="checkbox"/> Incorrect equations
	<input type="checkbox"/> Appropriate style (no first-person, past tense when reporting was done)	<input type="checkbox"/> A few informal statements and/or tense	<input type="checkbox"/> Several areas which are too informal and tense errors	<input type="checkbox"/> Very informal and/or use of future tense where not appropriate
	<input type="checkbox"/> Clear sentences and ideas are presented in a way that won't be misunderstood	<input type="checkbox"/> A few unclear sentences	<input type="checkbox"/> Many complex and unclear sentences	<input type="checkbox"/> Many sentences are unclear and have overly complex construction
	<input type="checkbox"/> Concise and quantitative as subject matter permits	<input type="checkbox"/> A few unnecessary words and ideas	<input type="checkbox"/> Frequent extra and inexact words	<input type="checkbox"/> Many vague, inexact, and/or idle words
	<input type="checkbox"/> Arguments are complete and logical	<input type="checkbox"/> Most arguments are complete	<input type="checkbox"/> Several arguments are difficult to follow	<input type="checkbox"/> 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:** PHY4072 Senior Lab Written Technical Report.

**Criteria for Success (how do you judge if the students have met your standards):**

PHY4072/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*
Written Report Rubric IL	25%	N/A	63%	86%	53%	43%	44%	No Data	80%

\*COVID-19 Year

**Conclusions Drawn from Data:** The students are not achieving the benchmark. 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 I may simply be a matter of the variation created by a relatively small sample size.

**Changes to be Made Based on Data:** The department needs to work with students to clarify expectations for the use and citation of material in technical write-ups. This will be part of the curricular adjustments made as the result of program review.

**Rubric Used:** PHE Written Report Rubric

### PHY-ENG Written Presentation Rubric

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

**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*
ETS Proficiency Profile Level 2 Math	100%	100%	100%	100%	100%	91%	100%	70%	86%

\*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. It may also be partially 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.