**Bachelor of Science in Electrical Engineering**

# Academic Assessment Plan

**Version 2.0**

**(Revised Fall 2018)**

**Adopted by**

**The Electrical Engineering Faculty: 9/19/2018**

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Mission Statement

The Electrical Engineering program at the University of Alaska Anchorage is committed to the University’s mission to discover and disseminate knowledge through teaching, research, engagement, and creative expression.  First, we strive to teach our students the fundamental principles of electrical engineering and important issues in engineering so they may pursue advanced degrees or enter the workplace as productive and competent engineering professionals.   Second, the program seeks to further the profession of electrical engineering through professional activities and public service within the community, state, nation, and society at large.   Finally, the program engages in and disseminates research to advance the development of electrical engineering and provide innovative technological solutions to address the needs of modern society.

Program Introduction

The Electrical Engineering program is housed in University of Alaska Anchorage College of Engineering. A common core curriculum consists of courses in math and physics and electrical engineering courses in circuits, electronics, electro-magnetics, controls and power, digital logic and computer programming and electives in power engineering, communications, arctic engineering, computer engineering and physics.

The Electrical Engineering program is accredited by the Engineering Accreditation Commission of ABET. ABET revised its recommended Program Learning Outcomes in 2018. This revision of the Electrical Engineering Assessment Plan reflects those updates.

Assessment Process Introduction

The Department of Electrical Engineering started the process to achieve ABET accreditation during the 2007 academic year. There have been four visits to date of ABET reviewers and for each review, the electrical engineering program has been accredited. The last visit in the fall of 2016 resulted in no deficiencies or weakness or concerns. The next schedule visit by ABET will be in the fall of 2022.

To facilitate the process of accreditation, the department initially adopted the Program Student Learning Outcomes (PSLO's) suggested by ABET. ABET revised the learning outcomes in 2018. This assessment plan reflects the changes that ABET has made. The PSLO's and assessment process is described in subsequent sections of this assessment plan. As described below, the PSLO's span a broad mastery of skills necessary to be successful in the engineering profession, from technical excellence to communication skills, ethics, and knowledge of the issues facing our modern society. The core of this assessment plan is based upon faculty evaluation via rubrics which capture performance criteria for each of the Program Learning Outcomes.

The core of our assessment plan includes:

* NCEES FE exam results for EE students and graduates.
* Evaluation of student performance in EE 203, EE 308, EE471, EE 307, EE 447, and EE 438.
* Graduate Exit Survey feedback from EE graduates. Survey administered in EE 465.

Program Student Learning Outcomes

At the completion of this program, students will have attained mastery of:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environment, and societal contests.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, and plan tasks and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Table 1: Assessment Measures For Program Student Learning Outcomes

| **Assessment Schedule** | F | S | F | F/S | F/S | F/S | F/S |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Outcomes** | EE203 | EE308 | EE 471 | EE438 | EE 307EE 447 | Exit SurveyEE 465 | FE Exam |
| 1. ability to identify, formulate, and solve complex engineering problems
 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1. ability to apply engineering design to produce solutions that meet specific needs
 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1. ability to communicate effectively with a range of audiences
 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1. ability to recognize ethical and professional responsibilities in engineering situations
 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1. Ability to function effectively on a team
 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1. Ability to develop and conduct appropriate experimentation, analyze and interpret data
 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies
 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |

0 = Course is not used to measure the associated outcome.

1 = Course is used to measure the associated outcome.

Assessment Measures

A description of the tools used in the assessment of the program outcomes and their implementation are summarized in Table 1. The tools and their relationships to the program outcomes are listed in Table 2.

Table 2: Program Outcomes Assessment Measures and Administration

| **Measure** | **Description** | **Frequency/ Start Date** | **Collection Method** | **Administered by** |
| --- | --- | --- | --- | --- |
| Evaluation of student coursework | A rubric is used to evaluate student coursework in the context of a particular outcome. Currently work is used from:EE 203, EE 308, EE 471, EE307, EE 447., EE 438. | Yearly for 1/2 of the PLO's (See Table 1) | Faculty collection | Instructor of course |
| Exit Survey | Graduating students are asked to directly provide feedback on the effectiveness of the entire program. | Each semester | Administered in a required class | Instructor of course |
| NCEES FE Exam | Alaska administrated standardized exam with national data comparisons with UAA students and graduates. | Twice a year, spring and fall | Optional student involvement | NCEES |

Assessment Implementation & Analysis for Program Improvement

General Implementation Strategy

Implementation of our assessment plan revolves around faculty evaluation of student work, analysis of FE exam results and a Graduate Exit Survey. Faculty members in selected courses will choose student artifacts (e.g. papers, assignments, presentations) that relate to a particular outcome and will evaluate the work based on a rubric. Evaluation is independent of the grade assigned for the course. In some cases multiple faculty members may evaluate the same outcome. For example, faculty members attending a presentation may all evaluate a student’s ability to communicate effectively. The scores from all evaluators are averaged together in the final analysis.

One course in particular is key to our assessment efforts. EE 438, Senior Design, requires students to work in groups, work with a client in some cases to elicit and state requirements, and to implement an engineering project. All of these activities map to PSLO’s. EE 438 is the electrical engineering capstone course, it requires students to research, specify, design, and implement a project of moderate complexity and present their work in a presentation and project report. This course touches upon a number PSLO’s.

Method of Data Analysis and Formulation of Recommendations for Program Improvement

Once a year, usually at the beginning of the fall semester, the faculty meets to discuss data that was collected the previous academic year and aggregated in the previous spring. The data is simply averaged as we move up to higher levels of analysis. However, we will retain the low-level data if we need to drill down to see specific sub-outcomes that may need to be addressed.

For example, consider the following rubric for Program Student Learning Outcome 1:

**Outcome 1: An ability to apply knowledge of mathematics, science, and engineering**

| **Performance Criteria** | **Poor 1** | **Developing 2** | **Satisfactory 3** | **Excellent 4** |
| --- | --- | --- | --- | --- |
| 1. Recognizes functional relationships between variables
 | Is unable to recognize functional relations. | Is able to recognize relationships with simple engr. problems. | In most cases is able to recognize functional relationships. | Far exceeds expectations in recognizing variables. |
| 1. Applies mathematical and physical models to engineering problems
 | Needs help to develop mathematical models. | I able to develop models for simple problems.. | Is usually able without help to apply mathematical models and perform analysis. | Always applies the appropriate model and mathematical analysis to developing solutions. |
| 1. Interprets mathematical results in terms of gained insight.
 | Has difficulty interpreting results, relating results to models, and does not gain insight. | For simple engineering problems is able to interpret and describe insight learned. | For most engineering problems, gains insight by interpreting mathematical models | Often exceeds expectations in gaining insight from models and interpreting results. |

The instructor performing the assessment based upon the tools used, for example, performance on a comprehensive examination, will evaluate each student's performance and place the student into one of the categories described by the rubric.

Using the weighting, Poor = 1, Developing = 2, Satisfactory = 3 and Excellent = 4, an average is determined and used to summarize and report on the overall performance for that particular assessment. The raw data is retained and used by the faculty at its annual meeting to discuss the student's performance and determine if any changes are warranted to try and improve their mastery of the outcome.

Data is collected in the fall and spring semesters, aggregated at the end of the spring semester, discussed at the beginning of the following fall semester, and recommendations implemented that fall or spring if possible. The assessment cycle schedule is shown below.

Electrical Engineering Assessment Cycle

A proposed programmatic change may be any action or change in policy that the faculty deems as being necessary to improve performance relative to programs objectives and outcomes. Recommended changes should also consider workload (faculty, staff, and students), budgetary, facilities, and other relevant constraints. A few examples of changes that have been made in the electrical engineering program include:

* major changes in curriculum content, scheduling, sequencing, prerequisites, etc.
* introduction of lab design projects at all levels
* introduction of rigorous lab report guidelines and grading rubrics
* specific course content upgrades, ENGR 302, or new requirements, PHIL 305
* changes in advising methods and requirements
* addition and/or replacement of equipment
* changes to facilities
* addition of new faculty with power backgrounds

Modification of the Assessment Plan

The faculty, after reviewing the collected data and the processes used to collect it, may decide to alter the assessment plan. Changes may be made to any component of the plan, including the objectives, outcomes, assessment tools, or any other aspect of the plan. The changes are to be approved by the faculty of the program. A significantly modified assessment plan is to be forwarded to the Dean’s office, the College of Engineering Curriculum Committee, the Faculty Senate Academic Assessment Committee, and the Office of Academic Affairs.

This document reflects changes that ABET has instituted in their guidelines for assessment. Year 2018-2019 assessment activity by the faculty will be presented in the format specified by this document.

Program Educational Objectives

The EE program has also established educational objectives that are required for ABET accreditation. Educational Objectives are items that our graduates are expected to be able to perform as they find their first employment and practice their profession. ABET does not require assessment of the objectives per se, but does require a process in which they are reviewed periodically with the department's Advisory Board. For completeness, the Program's Educational Objectives are as follows;

Program Educational Objectives

 1. To produce electrical engineering graduates with the training and skills to enter the job market or to continue their education by attending graduate school.

2. To produce graduates who will become business and community leaders in Alaska and throughout the world.

3. To produce graduates who will, through their training in electrical engineering and their commitment to their continuing education, become the entrepreneurs driving Alaska's growth in the future.

4. To produce graduates in electrical engineering who conduct themselves and practice their profession with the highest of professional standards.

The electrical engineering program has an Advisory Board made up of the following constituents, employers, previous students, and faculty, that meets periodically to review these Program Objectives, provides feedback on graduate performance, suggests changes to the curriculum and/or introduction of new programs in the department.

Assessment Database

The following sections of this assessment plan detail the three methodologies the faculty uses to perform course level assessment, use of the Graduate Exit Survey and data from the FE exam. Since 2011 the assessment coordinator has maintained a database of all relevant documents relating to assessment including the raw data, student work, analyses and recommendations for each assessment performed. Graduate Exit Survey data and FE exam results have also been collected and entered into the database going back to 2011.

Using the data from the assessment database, each spring at the end of the academic year, the assessment coordinator summarizes assessment activities and results in the Annual PSLO’s Assessment Report. Copies of this report are sent to the Dean of Engineering and to the Office of Academic Affairs, (OAA). The report serves as the bases for the fall assessment meeting that the faculty uses to kick-off the new academic year’s activities.

Appendix A: Program Student Learning Outcomes

Appendix A: Faculty Review of Student Artifacts

**Measure Description:**

The student artifacts selected for assessment will vary depending upon the course and instructor but include assignments, exam questions, presentations, papers, design documents, requirements documents, and software.

Rubrics for each outcome are shown below as well as the rubric for evaluation of EE 438 projects.

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Recognizes functional relationships between dependent and independent variables in engineering problems. (K)
 | Is unable to recognize functional relationships. Requires coaching to establish relationships. | Is able to recognize relationships with simple engineering problems.  | In most cases, is able to recognize functional relationships. | Far exceeds expectations in recognizing relationships between variables in engineering problems.  |
| 1. Applies mathematical and physical models to obtain numerical and graphical solutions to engineering problems

 (A) | Needs help to develop mathematical models to engineering problems. | Is able to develop models for simple engineering problems. | Is usually able without help to apply mathematics and physical models and perform the analysis for most engineering problems. | Always applies the appropriate model and mathematical analysis to developing solutions to engineering problems. |
| 1. Interprets mathematical results in terms of gained physical insight.

 (E) | Has difficulty interpreting results, relating results to the models, does not gain insight from the results. | For simple engineering problems, is able to interpret results, and describe insight learned. | For most engineering problems, gains insight by interpreting mathematical results. | Often exceeds expectations in gaining insight from mathematical models and interpreting results. |

Table A.1: Outcome 1. An ability to apply knowledge of mathematics, science and engineering.

TableA.2: Outcome 2. An ability to apply engineering design to produce solutions that meet specific needs

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Selects appropriate equipment, test apparatus, model, etc. for measuring variables in question (C)
 | Is unable to select the appropriate equipment, test apparatus or model for measuring variables in question.  | Is able to select appropriate equipment, test apparatus, or model for simple variable measurements  | In most cases, selects the appropriate equipment, test apparatus, or model for variable measurements  | Far exceeds expectations in selecting the appropriate equipment, apparatus or model in variable measurements  |
| 1. Uses modern data collection techniques (i.e. data logging)

 (A) | Is unable to use modern data collection techniques  | Is able to use available tools for collection of data in simple applications  | Is usually able to apply available tools for data collection  | Always applies the most current available tools to simplify and assist in data collection  |
| 1. Combines information or data for experiment from multiple sources

 (S) | Has difficulty combining or integrating experimental data from multiple sources | For simple experiments is able to combine and interpret data from multiple sources | For most experiments is able to integrate and interpret data from multiple sources  | Exceeds expectations in ability to integrate and data information from multiple sources or devices.  |
| 1. Considers public health, safety, and welfare as well as cultural, social and economic factors
 | Is not aware or taken in account any of these factors in their design | Is aware of these factors but has accounted for them in a very limited manner | Is aware of these factors and has taken some of hem into account | Fully evaluates design and includes these factors in their final design |

TableA.3: Outcome 3. An ability to communicate effectively.

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Paraphrases of summarizes information in oral presentations (C)
 | Is unable to paraphrase or summarize information in oral presentations  | Is sometimes able to summarize information in oral presentations  | Is usually able to summarize information in oral presentations | Is exceptional at summarizing information in oral presentations  |
| 1. Illustrates concepts using graphics. Slides and charts in written and oral presentations (An)
 | Does not effectively use graphics to illustrate concepts  | Is sometimes able to effectively use graphics to illustrate concepts | Is usually able to effectively use graphics to illustrate concepts | In highly effective in the use of graphics to illustrate concepts  |
| 1. Listens carefully and responds to question appropriately (Ev)
 | Has difficulty listening and responding appropriately to questions  |  For basic questions is able to listen and respond appropriately  | Is usually able to listen and respond appropriately to questions  | Excels at listening and always responds appropriately to questions  |
| 1. Writes comprehensive technical reports and papers
 | Is unable to follow technical report guidelines | Follows technical report guidelines meeting minimum requirements | Usually produces good technical reports with explanations and graphics | Excels in technical writing integrating graphs and charts and clear explanations  |

Table A.4: Outcome 4. An understanding of professional and ethical responsibilities.

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Demonstrates knowledge of the codes of conduct that guide professional engineering (K)
 | Is unaware of codes of conduct that guide professional engineering  | Is generally aware of codes of conduct that guide professional engineering  | Has some knowledge of codes of conduct that guide professional engineering | Has full knowledge of codes of conduct that guide professional engineering  |
| 1. Identifies where additional knowledge is needed in order to make informed ethics decisions (An)

  | Has trouble identifying what additional knowledge may be need to make informed ethics decisions  | In some instances is able to identify what additional knowledge may be needed to make informed ethics decisions  | Is usually able to identify what additional knowledge may be needed to make informed ethics decisions | Excels at identifying the essence of an ethical dilemma and what additional knowledge may be needed to make informed decisions |
| 1. Evaluates the value and credibility of information and the various sources used in order to make sound judgments

 (E) | In unable to make sound ethics judgments based on the value or credibility of information and the sources | In cases is able to make sound ethics judgments based on the value or credibility of information and the sources | Is usually able to make sound ethics judgments based on the value or credibility of information and the sources | Almost always makes sound ethics judgments based on the value or credibility of information and the sources |

**Table A.5: Outcome 5. An ability to function effectively on a team**

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Exhibits specific behaviors and skills that support team effectiveness (C)
 | Is unable to identify specific behaviors and skills that support team effectiveness  | In some cases is able to identify and exhibit specific behaviors and skills that support team effectiveness  | Is usually able to exhibit specific behaviors and skills that support team effectiveness | Is a role model in exhibiting specific behaviors and skills that support team effectiveness |
| 1. Applies principles of constructive conflict management to interactions with others (Ap)
 | In unable to apply principles of conflict management to effectively interact with others | In some cases is able to apply principles of conflict management to effectively interact with others  | In most cases is able to apply principles of conflict management to effectively interact with others  | Excels at applying conflict resolution to improve interactions with others.  |
| 1. Respects differences in style, culture, experience and knowledge (V)
 | Does not respect differences in style, culture, experience and knowledge | In some cases respects differences in style, culture, experience and knowledge  | In most cases respects differences in style, culture, experience and knowledge  | Values and appreciates differences in style, culture, experience and knowledge  |

TableA.6: Outcome 6. An ability to design and conduct experiments, as well as to analyze and interpret data.

| Performance Criteria | Unsatisfactory1 | Developing2 | Satisfactory3 | Excellent4 |
| --- | --- | --- | --- | --- |
| 1. Selects appropriate equipment, test apparatus, model, etc. for measuring variables in question (C)
 | Is unable to select the appropriate equipment, test apparatus or model for measuring variables in question.  | Is able to select appropriate equipment, test apparatus, or model for simple variable measurements  | In most cases, selects the appropriate equipment, test apparatus, or model for variable measurements  | Far exceeds expectations in selecting the appropriate equipment, apparatus or model in variable measurements  |
| 1. Uses modern data collection techniques (i.e. data logging)

 (A) | Is unable to use modern data collection techniques  | Is able to use available tools for collection of data in simple applications  | Is usually able to apply available tools for data collection  | Always applies the most current available tools to simplify and assist in data collection  |
| 1. Combines information or data for experiment from multiple sources

 (S) | Has difficulty combining or integrating experimental data from multiple sources | For simple experiments is able to combine and interpret data from multiple sources | For most experiments is able to integrate and interpret data from multiple sources  | Exceeds expectations in ability to integrate and data information from multiple sources or devices.  |

TableA.7: Outcome7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

| **Performance Criteria** | **Unsatisfactory****1** | **Developing****2** | **Satisfactory****3** | **Excellent****4** |
| --- | --- | --- | --- | --- |
| 1. **Identifies the tools needed in order to conduct research and develop independent learning skills (K)**
 | Has difficulty identifying the tools needed in order to conduct research and develop independent learning skills  | In some instances is able identify the tools needed in order to conduct research and develop independent learning skills | Is usually able to identify the tools needed in order to conduct research and develop independent learning skills  | Has exceptional independent learning skills needed to conduct research  |
| 1. **Explains facts, formulas, theories or concepts in own words (C)**

 | Is unable to adequately explain facts, formulas, theories or other concepts in own words  | Has some difficulty explaining facts, formulas, theories or other concepts in own words | Can usually explain facts, formulas, theories or other concepts in own words  | Almost always provides a clear articulate explanation to describe facts, formulas, theories or other concepts  |
| 1. **Integrates new information with previously learned information (S)**

 | Has difficulty integrating new with previously learned information  | In some cases is able to integrate new information with previously learned information  | Is usually able to integrate new information with previously learned information  | Excels at integrating new information with previously learned information  |

**EE 438 Project Faculty Evaluation Form**

Project team name if available

Evaluate each student team for each of the Program Outcomes in the table below. Mark the appropriate box. Add any of your thoughts to the *Issues and Observations* on the last page that are relevant to improving the student experience in 438.

| **Program Outcome** | **Unsatisfactory** | **Developing** | **Satisfactory** | **Excellent** |
| --- | --- | --- | --- | --- |
| 2. ability to apply engineering design to produce solutions that meet specific needs | * Team was unable to select appropriate equipment for creating/analyzing prototype
* Team seemed unaware of modern data collection/fabrication techniques in their area
* No evidence that team combined or integrated information from multiple sources
 | * Team was able to select appropriate equipment for creating/analyzing prototype only to a limited extent
* Team was able to use available data collection/fabrication techniques to a limited extent
* Team combined or integrated information from multiple sources to a limited extent
 | * Team was able to select appropriate equipment for creating/analyzing prototype
* Team was able to use available data collection/fabrication techniques
* Team was able to combine or integrate information from multiple sources
 | * Team exceeded expectations in seeking out and selecting appropriate equipment for creating/analyzing prototype
* Evidence of analysis of design went well beyond expectations
* Team exceeded expectations in their ability to combine or integrate information from multiple sources
 |
| 3..An ability to communicate effectively with a range of audiences | * Team was unable to paraphrase or summarize information from their slides, or slides were especially poor
* Team members displayed especially poor speaking skills
* Team did not make effective use of graphics to illustrate concepts
* Team had difficulty listening and responding appropriately to questions
 | * Team had limited ability to summarize information on slides, or slides were not satisfactory
* Some team members’ speaking skills were unsatisfactory
* Team made limited use of graphics to illustrate concepts
* Team was only able to listen and respond appropriately to very basic questions
 | * Team was able to summarize information on slides, and slides were satisfactory
* Team members’ speaking skills were satisfactory
* Team made effective use of graphics to illustrate concepts
* Team was able to listen and respond appropriately to most questions
 | * Team was exceptional in ability to speak from slides, and slides went beyond expectations
* Team members’ speaking skills were exceptional
* Team was highly effective in the use of graphics to illustrate concepts
* Team excelled at listening and always responded appropriately to questions
 |
| 5. An ability to function on a team  | * No evidence that team developed a reasonable design strategy
* No evidence that team gathered information on their design problem, including specifications and objectives
* Team did not create a physical product or process for testing and evaluation
 | * Limited evidence of a reasonable design strategy, including subtasks, timetables, and evaluation of progress
* Team gathered limited information on design problem, defined limited specifications and objectives
* Team was only able to create physical product or process with much guidance
 | * Team developed a reasonable design strategy, including subtasks, timetables and evaluation of progress
* Team gathered sufficient information on design problem, defined clear specifications and objectives
* Team was able to create physical product or process for testing or evaluation
 | * Team excelled at developing a design strategy, including subtasks, timetables and evaluation of progress
* Team exceeded expectations at gathering information on design problem and defining specifications and objectives
* Team produced an exceptional physical product or process
 |
| 7. An ability to acquire and apply new knowledge as needed  | * Team is unable to distinguish what was known and unknown regarding design problem
* Team did not analyze elements of design problem completely or consistently
* Team was unable to assess validity of solution due to lack of physical, mathematical or engineering insight
 | * Team distinguished what was known and unknown in their design problem only to a limited extent
* Team’s analysis of elements of their design problem was limited and/or simplistic
* Team offered limited assessment into the validity of their solution based on physical, mathematical or engineering insight
 | * To a large extent, team was able to distinguish between known and unknown elements in their design problem
* In most cases, team provided appropriate analysis of elements of their design
* In most cases, team was able to assess validity of their solution based on physical, mathematical or engineering insight
 | * Team excelled at identifying relevant known and unknown information in their design problem
* Team exceeded expectations regarding analysis of the elements of their design
* Team excelled at assessing the validity of their solution based on physical, mathematical or engineering insight
 |

**Factors that affect the collected data:**

* Time and energy requirements. Significant work is required to collect and analyze the data.
* Bias associated with the grading philosophy of a single faculty. This is somewhat mitigated by use of the rubrics and by aggregation across several courses, student artifacts, and instructors.

**Tabulating, Interpretation, and Reporting Results**

A score of 1-4 is assigned to evaluations corresponding to Poor, Developing, Satisfactory, or Excellent. We will average data across each outcome and will drill down to averages and/or histograms of sub-outcomes as needed. An average score of “Poor” or “Developing” warrants remedial action while continuous improvement is possible for higher scores. The results will be discussed with the program faculty during the assessment meeting.

Appendix B: NCEES FE Exam

**Measure Description:**

The content of the NCEES FE exam reflects the basic knowledge and understanding gained in the core undergraduate curriculum in electrical engineering. The tests are conducted by the state of Alaska and are several hour, multiple-choice examinations designed to assess mastery of concepts and principles as well as knowledge expected of students at the conclusion of a major in EE. They go beyond measurement of factual knowledge, however, because they also evaluate students' ability to analyze and solve problems, understand relationships, and interpret material.

Each exam, fall and spring, delivers two aggregated student score reports, one for current students and one for graduated students for each exam category, plus the mean scale score and standard deviation for the group of students tested from ABET accredited institutions.

**Factors that affect the collected data:**

* Student motivation. At this time, it is optional that electrical engineering students take the FE exam. Successful completion of the FE enables a graduate to take the Professional Engineers test 5 years after graduation. Engineers with FE exam success and ultimately with a PE certificate command a premium in the engineering profession. The number of students taking the exam is less than the number of students graduating. We do not tie the test scores with course grades. There has been discussion at the Electrical Engineering Advisory board to require for graduation that all EE students at least take the exam. This would increase the sample size, now about 30% of our students who take the exam, but it could introduce less motivated students taking the exam and effect the overall scores.
* Cost. Each exam cost is born by the student. If the department requires all students to take the exam, it would be expected that the department reimburse all the students for the cost of the exam.
* Number of graduating students. NCEES reports the data for currently active students and separately for graduated students.
* The data provides a useful snapshot as to our student performance compared to other institutions. In fact, over the period of the past few years, the results had shown that the electrical engineering program was not adequately preparing students in several important areas. Course adjustment have been made to the curriculum in these specific areas and the current results show significant student improvement.

**How to interpret the data:**

The NCEES reports scores on a scale of 0 - 15. Scores are not provided for each individual student. Rather an average score is provided for each exam category for the number of students taking the exam at that time which can then be compared to the national averages using the same scale. Prior to the updates as reflected in this revised document, the FE exam categories, 1 – 18, shown below were used to compute scores for Outcomes a, e and f. The categories tested include;

1. Mathematics Outcome a

2. Probability and Statistics Outcome a

3. Ethics and Professional Practice Outcome a and f

4. Engineering Economics Outcome a

5. Properties of Electrical Materials Outcome a

6. Engineering Science Outcome a

7. Circuit Analysis (DC and AC steady ste) Outcome a

8. Linear Systems Outcome e

9. Signal Processing Outcome e

10. Electronics Outcome e

11. Power Outcome e

12. Electro-magnetics Outcome e

13. Control Systems Outcome e

14. Communications Outcome e

15. Computer Networks Outcome e

16. Digital Systems Outcome e

17. Computer Systems Outcome e

18. Software Development Outcome e

The categories are divided into three groups, the first group used to evaluate Outcome a, the second for Outcome e with one element used for Outcome f. Outcome a categories include mathematics, probability and statistics, engineering economics, properties of electrical materials and engineering science. Outcome e categories include the balance of the sixteen categories.

With the revisions made in this document, all 18 exam categories will be used to compute a score for Outcome 1 and outcome 3. The score computed is an average of the number of points (out of 15) that our EE students score above or below the ABET national average per question on the exam. A plus score represents above the national average, a minus score below the national average.

**Tabulating and Reporting Results:**

The test results will be received twice a year, fall and spring. Annual analysis of the data combines the fall and data scores weighted by the numbers of students taking the exam and compare the results with the national averages. In the past, national averages were for all students from all institutions. Beginning in spring 2014, NCEES changed the format of the exam and now in addition to the new format only provides comparative data for ABET accredited programs.

We chart our student’s performance yearly and compare the performance to that of other departments nationwide using the NCEES national average data supplied. The department will continue to use this important data in its evaluation of student performance.

In the past, this data was used to make changes in the EE curriculum. Most recent changes have been to ENGR 302, Probability and Statistics, where the course content was greatly enhanced and with the additional of PHIL 305, Professional Ethics, as a required General Education Requirement.

Appendix C: Graduate Exit Survey

**Measure Description:**

The exit survey asks graduates of the program to rate their performance relative to the program’s outcomes. Additionally, graduates are asked to rate the program’s delivery of the material related to the objectives from their viewpoint.

Surveys are distributed to students in a required upper course each semester. The students are not required to complete the survey in class. Hence the number of returned surveys is less than the number of graduated seniors but not significantly. The results are tabulated independently of final grades. The data is merged with previous year's data to form a composite of student input for the program both for their mastery of each PSLO and for their opinion on how effective the faculty has been in helping them to achieve their mastery.

Additionally, a set of specific questions is asked that relate to advising, instruction, and facilities. This data is also compiled and reported annually.

The Graduate Exit Survey is found below.

**Factors that affect the collected data:**

A number of factors need to be taken into consideration when analyzing the data. The following factors are those that we have identified.

* Student knowledge. It is expected that students enrolled in upper level required courses have sufficient knowledge of the program to provide thoughtful feedback both on their mastery of the PSLO's and the effectiveness of the faculty in teaching.
* Student effort. The amount of effort students take to accurately complete the survey is not burdensome but the survey remains optional. Completion of the survey is encouraged by the faculty.

**How to interpret the data:**

We must consider sample size and the indirect nature of the survey. Student feedback should be considered by the program faculty.

**Tabulating and Reporting Results:**

 The assessment coordinator receives the results and tabulates them for use in outcomes review. The results are charted and tracked separately from the rubric evaluation of student artifacts.

**UAA Electrical Engineering: Graduate Exit Survey**

The Electrical Engineering program implements an outcomes based assessment program to enable continuous improvement and for the University and the Accreditation Board for Engineering and Technology (ABET). As a part of the program, we are surveying graduating students to find ways of improving our program. Your feedback will go a long way in helping us determine how well we are doing and what we can do to better serve our students, alumni, and the engineering community.

 **Today's Date** \_\_\_\_ /\_\_\_\_\_\_/20\_\_\_ **Expected Graduation Date** : FALL / SPRING 20\_\_\_

* Have you accepted a permanent position in the field of electrical engineering, or been accepted to a Graduate Program? Y/N \_\_\_\_\_
* If you plan to seek a post-grad degree, please specify the degree (MSEE, PhD, MD, JD, MBA, etc. ) \_\_\_\_\_\_\_
* Have you passed the FE exam? Y/N \_\_\_\_\_
* If you haven't taken the FE exam, are you planning to take it? Y/N \_\_\_\_\_
* Are you planning on taking the P.E. Exam? Y/N \_\_\_\_\_
* Have you had any Engineering Internships? Y/N \_\_\_\_\_
* Are you a member of a professional society? If so, please list any you belong to.

UAA Electrical Engineering: Graduate Exit Survey

Please identify the Primary Electrical Engineering Field that you hope to work in: (select one)?

| \_\_\_\_\_ Construction | \_\_\_\_\_Network Security |
| --- | --- |
| \_\_\_\_\_ General Electrical | \_\_\_\_\_ Software Development |
| \_\_\_\_\_ General Computer | \_\_\_\_\_ Power Plant Design |
| \_\_\_\_\_ Controls | \_\_\_\_\_ Not working in engineering |
| \_\_\_\_\_ Electronics | \_\_\_\_\_ Other (please describe below) |
| \_\_\_\_\_Communications | \_\_\_\_\_ Undecided |

UAA Electrical Engineering: Graduate Exit Survey

**Expected Outcomes**

The UAA Electrical Engineering program has adopted 7 expected outcomes. Please rate your knowledge/skills

and the program’s effectiveness in teaching you knowledge/skills relative each objective. In this survey, we ask for your opinion relative to each of these objectives. Second, rate each item according to how well you think you are able to function in relation to each objective. Please feel free to use the space after the list to briefly explain any of your responses or for additional comments. The objectives of the UAA Electrical Engineering Program are to produce graduates with the following abilities.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. An ability to identify formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to apply engineering design to produce solutions that meet specified needs with considerations of public health, safety, and welfare, as well as global cultural, social, environmental, and economic factors
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to communicate effectively with a range of audiences
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to recognize ethical and professional responsibilities in engine*ering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contests*.
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |
| 1. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
 | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| What is your understanding now? |  |  |  |  |  |  |
| How well did we do teaching this? |  |  |  |  |  |  |

Comments:

UAA Electrical Engineering: Graduate Exit Survey

The following additional information will help us in the improvement of our program.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Please indicate your satisfaction with each of the following aspects of your experience at UAA. Please feel free to use the space after the list to briefly explain any of your responses, especially if you feel less than satisfied.  | Poor | Fair | Good | Excellent | Outstanding | No Opinion |
| Quality of the Advising? |  |  |  |  |  |  |
| Quality of Instruction? |  |  |  |  |  |  |
| Quality of physical facilities? |  |  |  |  |  |  |
| Quality of computer laboratories? |  |  |  |  |  |  |
| Quality of physical laboratories? |  |  |  |  |  |  |

Comments:

* Please list up to three major strengths of your undergraduate engineering education or

other UAA experiences.

* Please list up to three areas for improvement in our undergraduate engineering

program or other aspects of UAA.

* With respect to the previous question, do you have any suggestions on how UAA

could address these improvements?

* Would you recommend a UAA engineering education to a friend or relative? Y / N / maybe

3. Additional Information

Additional Comments? Please describe.