Electrical Engineering
2015–2016 Assessment Report

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Contents

1 Introduction

1.1 Program Design and Goals

The Bachelor of Science in Electrical Engineering program at Oregon Institute of Technology (Oregon Tech) aims to impart a thorough grounding in the theory, concepts, and practices of electrical engineering. Emphasis is on practical applications of engineering knowledge. The goal of our program design is to graduate engineers who require minimal on-the-job training while providing them with sufficient theoretical background to enable success in graduate education in engineering.

1.2 Program History

In 2007, Oregon Tech began offering its new Bachelor of Science in Electrical Engineering (BSEE) program at its Klamath Falls campus. In Fall 2012, the BSEE degree started to also be offered at the Wilsonville campus. The BSEE degree is a traditional EE degree that was created to prepare graduates for careers in various fields associated with Electrical Engineering. These include, but are not limited to, analog integrated circuits and systems, digital integrated circuits and microcontroller systems, signal processing, communication systems, control systems, semiconductors, optoelectronics, renewable energy, and biomedical fields as stated in the Oregon Tech catalogs for 2007 through 2015.

The BSEE program prepares graduates to enter careers in the field of electrical engineering in positions such as design engineers, test engineers, characterization engineers, applications engineers, field engineers, hardware engineers, process engineers, control engineers, power engineers, semiconductor-processing engineers, controls and signal-processing engineers, energy system-integration engineers, analog-systems engineers, digital-systems engineers, and embedded-hardware engineers, among others. Graduates of the program will be able to pursue a wide range of career opportunities, not only within the more traditional areas of Electrical Engineering, but also within emerging fields, such as Renewable Energy Engineering and Optical Engineering.

Seventy-two students have graduated from the BSEE program since it was first launched in 2007. From these, nineteen new BSEE students graduated in the Spring term of 2015. Thirteen of those participated in the Spring senior exit survey, with 54% of respondents reporting having found employment in their field, 23% were admitted to graduate school, and 23% are looking for employment after graduation. The reported average annual salary of the first group was $66,273.

1.3 Industry Relationships

The BSEE program has strong relationships with industry, particularly through its program-level Industry Advisory Board (IAB), and through its alumni. These relationships with our constituents allow the BSEE program to meet the institutional goal of maintaining the currency of our degree programs.

The IAB has been a mainstay in the development of the EE program since its early roots. The IAB provides advice and counsel to the EE program with respect to curriculum content, instructional resources, career guidance and placement activities, accreditation reviews, and professional-development assistance. In addition, each advisory-committee member serves as a vehicle for public-relations information and potentially provides a point of contact for the development of specific opportunities with industry for students and faculty.

1.4 Program Locations

The BSEE program is located at both Oregon Tech campuses (Klamath Falls and Wilsonville), serving a large portion of rural Oregon and California, as well as the Portland metropolitan area. Oregon Tech is the only university offering multiple classical engineering degrees at the Bachelor's (and some at the Master's) level in a region ranging from Corvallis, Oregon, in the north, to Chico, California, in the south, and from the Pacific coast in the west to Boise, Idaho, in the east.

The Klamath Falls campus includes a large solar facility and the Oregon Renewable Energy Center (OREC) with exceptional opportunities for students to gain experience in the subfields of power, energy, and renewable energy. OREC, as stated on its website, "promotes energy conservation and renewable[-]energy use in Oregon and throughout the Northwest through applied research, educational programs, and practical information." These resources give students access to research *and* practical experience in geothermal, solar, wind, biofuel, waste, fuel-cell, and other sources of green energy.

The Wilsonville campus offers excellent access to internships and other technological collaboration with the Silicon Forest (as the semiconductor industry in the Portland metropolitan area is known).

This arrangement satisfies the needs of the state of Oregon by placing a traditional EE program in the southern, rural part of the state to serve that region as well as providing a small-school EE program to students who desire a low student-to-faculty ratio and small classes.

2 Program Mission, Educational Objectives and Outcomes

2.1 Program Mission

The mission of the Electrical Engineering Bachelor of Science degree program is to provide a comprehensive program of instruction that will enable graduates to obtain the knowledge and skills necessary for immediate employment and continued advancement in the field of electrical engineering. The program will provide high-quality career-ready candidates for industry as well as teaching and research careers. Faculty and students will engage in applied research in emerging technologies and provide professional services to their communities.

2.2 Program Educational Objectives

In support of this mission, the Program Educational Objectives for the BSEE program are:

- The graduates of the BSEE program will possess a strong technical background as well as analytical, critical-thinking, and problem-solving skills that enable them to excel as professionals contributing to a variety of engineering roles within the various fields of electrical engineering and the high-tech industry.
- The graduates of the BSEE program are expected to be employed in electrical engineering positions including (but not limited to) design engineers, test engineers, characterization engineers, applications engineers, field engineers, hardware engineers, process engineers, control engineers, and power engineers.
- The graduates of the BSEE program will be committed to professional development and lifelong learning by engaging in professional or graduate education in order to stay current in their field and achieve continued professional growth.
- The graduates of the BSEE program will be working as effective team members possessing excellent oral and written communication skills, and assuming technical and managerial leadership roles throughout their career.

2.3 Relationship between Program Objectives and the Institutional Mission

The Oregon Tech mission statement is as follows. "Oregon Institute of Technology offers innovative and rigorous applied degree programs in the areas of engineering, engineering technologies, health technologies, management, and the arts and sciences. To foster student and graduate success, the university provides an intimate, hands-on learning environment, focusing on application of theory to practice. Oregon Tech offers statewide educational opportunities for the emerging needs of Oregon's citizens and provides information and technical expertise to state, national and international constituents."

The core themes of Oregon Tech are as follows.

- Applied Degree Programs
- Student and Graduate Success
- Statewide Educational Opportunities
- Public Service

The "strong technical background" of PEO 1 corresponds to the rigor required by the institutional mission of Oregon Tech's degree programs.

PEO 2 is aligned with the institution's core themes of both public service and graduate success. The Oregon Tech BSEE program prepares students to take their place in the work force as design engineers, test engineers, characterization engineers, applications engineers, field engineers, hardware engineers, process engineers, control engineers, and power engineers, serving the needs of Oregon, the nation, and the world.

Furthermore, the institution's mission emphasizes graduate success along with student success, and this is where the commitment to lifelong learning (PEO 3) aligns with the mission. Moreover, the mission statement's specification that "[t]o foster student and graduate success, the university provides and intimate, hands-on learning environment, focusing on application of theory to practice" is also in strong alignment with the BSEE program due to the prominence of small classes, the hands-on focus of the program, and faculty-taught laboratories.

2.4 Program Outcomes

The BSEE student outcomes follow ABET's EAC (a)–(k) student outcomes.

The BSEE Student Outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in lifelong (independent) learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

3 Cycle of Assessment for Program Outcomes

3.1 Introduction, Methodology, and the Assessment Cycle

Assessment of the program outcomes is conducted over a three-year cycle. Table 1 shows the minimum outcomes assessed each year. The assessment cycle was changed during the 2014-15 assessment year. This change was implemented at an assessment coordination meeting on February 2, 2014. At this meeting, assessment coordinators representing each program within the Electrical Engineering and Renewable Energy (EERE) Department aligned their assessment cycles so that each program assesses similar outcomes on the same years. The intention for this change is to better organize the assessment process and produce more meaningful data for comparison between different programs in the EERE Department.

Effective the 2014-15 academic year, the assessment cycle begins in the Spring. In previous years, the assessment cycle started in the Fall. This change reflects a shift on an institutional level to begin data collection in the spring term. In 2012-13 the Assessment Commission Executive Committee began recommending that programs begin data collection for the upcoming year during Spring term. This recommendation was based on the fact that many programs found the best courses to embed assessment often fell in Spring term, yet this made it difficult to gather the data, review the results and make recommendations for actions, and generate the assessment report by the end of the academic year.

Table 1: BSEE Outcome Assessment Cycle

Student Outcome	2014-15	2015-16	2016-17
a) Fundamentals	●		
b) Experimentation		●	
c) Design	●		
d) Teamwork	●		
e) Problem solving			●
f) Ethics		●	
g) Communication			●
h) Impact		●	
i) Independent learning			●
j) Contemporary Issues	●		
k) Engineering tools			●

In addition to the outcomes scheduled for a particular year, assessment is also performed for Oregon Tech's Essential Student-Learning Outcomes (ESLOs) that are scheduled for that particular year by the Executive Committee of the Assessment Commission.

3.2 Summary of Assessment Activities & Evidence of Student Learning

3.2.1 Introduction

The BSEE faculty conducted formal assessment during the 2015–16 academic year using direct measures, such as designated assignments and evaluation of coursework normally assigned. Additionally, the student outcomes were assessed using indirect measures, primarily results from a graduate exit survey.

3.2.2 Methodology for Assessment of Student Outcomes

At the beginning of the assessment cycle, an assessment plan is generated by the Assessment Coordinator in consultation with the faculty. This plan includes the outcomes to be assessed during that assessment cycle (according to Table 1), as well as the courses and terms where these outcomes will be assessed.

The BSEE mapping process links specific tasks within BSEE course projects and assignments to program outcomes and on to program educational objectives in a systematic way. The program outcomes are evaluated as part of the course curriculum primarily by means of assignments. These assignments typically involve a short project requiring the student to apply math, science, and engineering principles learned in the course to solve a particular problem requiring the use of modern engineering methodology and effectively communicating the results.

The mapping process aims to systemize the assessment of engineering coursework, and to provide a mechanism that facilitates the design of engineering assignments that meet the relevant outcomes, particularly those that are more distant from traditional engineering coursework. Rather than considering how the outcomes match the assignment, the assignment is designed to map to the program outcomes.

A systematic, rubric-based process is then used to assess the level of attainment of a given program outcome, based on a set of performance criteria. The work produced by each student is evaluated according to the different performance criteria, and assigned a level of 1-developing, 2-accomplished, or 3-exemplary. The results for each outcome are then summarized in a table, and reviewed by the faculty at the annual closing-the-loop meeting.

The standard acceptable performance level is to have at least 80% of the students obtain a level of accomplished or exemplary in each of the performance criteria for any given program outcome. It has been accepted in past closing-the-loop meetings that faculty can set a different threshold if required by the type of assignment or outcome, but must do so prior to the assessment.

If any of the direct assessment methods indicates performance below the established level, that triggers the process of continuous improvement where all the direct and indirect assessment measures associated with that outcome are evaluated by the faculty, and based on the evidence, the faculty decides the adequate course of action. The possible courses of action are these:

- Collect more data (if there is insufficient data to reach a conclusion as to whether the outcome is being attained or not); this may be the appropriate course of action when assessment was conducted on a class with low enrollment, and it is recommendable to re-assess the outcome on the following year, even if it is out-of-cycle, in order to obtain more data.

- Make changes to the assessment methodology (if the faculty believe that missing the performance target on a specific outcome may be a result of the way the assessment is being conducted, and a more proper assessment methodology may lead to more accurate numbers); for example, this could be the suggested course of action if an outcome was assessed in a lower-level course, and the faculty decide that the outcome should be assessed in a higher-level course before determining whether curriculum changes are truly needed.
- Implement changes to the curriculum (if the faculty conclude that a curriculum change is needed to improve attainment of a particular outcome). A curriculum change will be the course of action taken when the performance on a given outcome is below the target level, and the evidence indicates that there is sufficient data and an adequate assessment methodology already in place, and therefore there is no reason to question the results obtained.

If the faculty decide to take this last course of action and implement curriculum changes, the data from the direct assessments is analyzed and the faculty come up with a plan for continuous improvement, which specifies what changes will be implemented to the curriculum to improve outcome performance.

In addition to direct assessment measures, indirect assessment of the student outcomes is performed on an annual basis through a senior exit survey.

The results of the direct and indirect assessment, as well as the conclusions of the faculty discussion at the closing-the-loop meeting are included in the annual BSEE assessment report, which is reviewed by the department chair and the director of assessment for the university. The suggested changes to the curriculum are presented and discussed with all the department faculty at the annual convocation meeting in the fall, as well as with the Industry Advisory Board at the following IAB meeting. If approved, these changes are implemented in the curriculum and submitted to the University Graduate Council (if catalog changes are required) for the following academic year.

3.2.3 2015-16 Targeted Direct Assessment Activities

The sections below describe the 2015–16 targeted assessment activities and detail the performance of students for each of the assessed outcomes. Unless otherwise noted, the tables report the percentage of students performing at a developing level, accomplished level, and exemplary level for each performance criteria, as well as the percentage of students performing at an accomplished level or above.

3.2.4 Targeted Assessment of Outcome (b): an ability to design and conduct experiments, as well as to analyze and interpret data

This outcome was assessed in EE323 – Electronics II in Klamath Falls, EE 335 – Advanced Microcontroller Engineering in Wilsonville , and EE 419 – Power Electronics in Klamath Falls.

Assessment (b) 1: Klamath Falls, EE 323, Winter 2016, Dr. Klopf

This outcome was assessed in EE323 – Electronics II, in the winter term of 2016 by means of open-ended (student-designed) experimental steps in a lab experiment. Students were asked to design an additional investigation, carry it out, and interpret the results.

As a part of lab 2, students were asked to build and measure β values for transistors using a standard amplifier configuration, to build a one-transistor current source, and then to use two transistors with reasonably well matched βs to build a current mirror where a potentiometer was used as one of the resistors in this circuit. Once the current mirror was constructed, they were then required to vary the resistance value of the potentiometer in order to observe the effect on current on either side of the mirror, and record their observations. As a final part of this lab (and the portion which is being used for this assessment assignment), students were asked to devise an extra measurement to take using their working circuits, conduct said measurement, and interpret the findings.

Fifteen BSEE students[1] were assessed using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 2 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on one of the three performance criteria for this program outcome. Overwhelmingly, students were capable of conducting experimental procedures using the appropriate equipment, but evidence in students' reports of the design and interpretation aspects of this task was lacking.

Table 2: Targeted Assessment for Outcome (b)

Outcome (b): an ability to design and conduct experiments, as well as to analyze and interpret data				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Designing	9	5	1	40%
2: Conducting	2	12	1	86.67%
3: Analyzing	8	7	0	46.67%

[1] The number of assessed BSEE students include those who are also pursuing a concurrent Bachelor of Science in Renewable Energy Engineering (BSREE) degree.

Assessment (b) 2: Wilsonville, EE 335, Winter 2016, Prof. Douglas

This outcome was assessed in EE 335 – Advanced Microcontroller Engineering in the winter term of 2016 by means of a design project in which they were to build a robot capable of remote control and autonomous operation. Students were responsible for purchasing the required lab components, meeting a budget, and at the end of the term, demonstrating the performance of their robots by navigating an obstacle course.

Twenty five BSEE students were assessed using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 3 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all of the performance criteria for this program outcome.

Table 3: Targeted Assessment for Outcome (b)

Outcome (b): an ability to design and conduct experiments, as well as to analyze and interpret data				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Designing	0	8	17	100%
2: Conducting	0	10	15	100%
3: Analyzing	5	8	12	80%

Assessment (b) 3: Klamath Falls, EE 419, Fall 2015, Prof. Hossain

This outcome was assessed in EE 419 – Power Electronics in the fall term of 2015 by means of a lab experiment with a design component. This course is required for REE students, and is an upper-division elective for EE students. The students were given a series-voltage-regulator lab where the object was to understand the design and operation of a series voltage regulator, measure the regulated DC output voltage, and test the regulator performance over various load currents.

Sixteen students were assessed in fall 2015 using the performance criteria listed below. The assessment information for the nine BSEE (or dual) students is given here. The minimum acceptable performance level was to have 80% of the students performing at the accomplished or exemplary level in each performance criterion.

Table 4 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome. Most students met or exceeded expectations; they demonstrated their abilities to conduct experiments in a laboratory setting using industry-standard test equipment, collect data, and analyze and interpret results.

Table 4: Targeted Assessment for Outcome (b)

Outcome (b): an ability to design and conduct experiments, as well as to analyze and interpret data				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Designing	0	0	9	100%
2: Conducting	0	1	8	100%
3: Analyzing	0	3	6	100%

3.2.5 Targeted Assessment of Outcome (f): an understanding of professional and ethical responsibility

This outcome was assessed in EE 355 – Control System Design, and EE 430 – Linear Systems and Digital Signal Processing in Wilsonville.

Assessment (f) 1: Wilsonville, EE 355, Fall 2015, Prof. Rytkonen

This outcome was assessed in EE 355 – Control System Design in the fall term of 2015 by means of a homework assignment. The assignment consisted of two parts: discussion of important provisions in the National Society of Professional Engineers Code of Ethics, and analysis of a case study. Students were required to visit the NSPE website to learn about this code of ethics and the ethical dimensions of each of the canons. They then had to select three canons they felt were important and discuss them, providing examples for each. In the case study, they had to analyze the ethical dimensions and demonstrate or recognize ethical practices that could have prevented an explosion at a petroleum refinery. Students were provided with excerpts from the final investigative report by the Chemical Safety Board relevant to the course topic of control systems. Finally, the students were required to write a complete report.

Five BSEE students were assessed using the performance criteria listed in the table below. A sixth student failed to submit the assignment. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 5 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome.

Table 5: Targeted Assessment for Outcome (f)

(f) an understanding of professional and ethical responsibility				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Knowledge of code	1	0	4	80%
2: Ethical dimensions of practice	1	2	2	80%
3: Professional behavior	1	1	3	80%

Assessment (f) 2: Wilsonville, EE 430, Winter 2016, Dr. Scher

This outcome was assessed in the EE 430 – Linear Systems and Digital Signal Processing, in the winter term of 2016 through an ethics homework assignment involving both the explicit listing and interpretation of three provisions from the IEEE code of ethics, along with examples on the professional relevance of each, and an ethics scenario, which the students were asked to analyze and interpret in terms of the issues and points of view involved, possible alternate approaches, and their risks and benefits.

Thirteen BSEE students were assessed using the performance criteria listed in Table 6. The minimum acceptable performance level was to have above 80 % percent of the students performing at the accomplished or exemplary level in all performance criteria. The results indicate that the minimum acceptable performance level of 80 % was met on all performance criteria. Outcome (f)'s professional-behavior aspect was not evaluated as part of this assignment.

Table 6: Targeted Assessment for Outcome (f)

(f) an understanding of professional and ethical responsibility				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Knowledge of code	0	5	8	100%
2: Ethical dimensions of practice	1	5	7	92.31%

3.2.6 Targeted Assessment of Outcome (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

This outcome was assessed in the two offerings of EE 323 – Electronics II in Wilsonville.

Assessment (h) 1: Wilsonville, EE 323, Winter 2016, Professor Bryant Baker

This outcome was assessed in EE 323 - Electronics II in the winter term of 2016. Students were asked to research and study a past or current engineering or technology solution of their choice, and write a report describing the particular solution and its societal impact. Students were encouraged to use sources such as technology journals (e.g., IEEE Spectrum magazine or IEEE technology and Society magazine), patents related to new products and technologies (available through the US Patent and Trademark Office), or others (newspaper science sections, the Internet, etc.). The report included a description of the engineering or technology solution, an explanation of the technical problem the particular technology was intended to solve, and a discussion of the societal impact or potential impact brought about by any intended or unintended consequences associated with this technology.

Seventeen BSEE students were assessed using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 7 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome. In fact, 100% of the students assessed showed the required level of proficiency.

Table 7: Targeted Assessment for Outcome (h)

Outcome (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Identification	0	7	10	100%
2a: Context (societal)	0	8	9	100%
2b: Context (global)	0	7	10	100%

Assessment (h) 2: Wilsonville, EE 323, Winter 2016, Dr. Nardin

This outcome was assessed in EE 323 – Electronics II, in the winter term of 2016 by means of a paper on engineering or technology solutions that have had significant societal impacts as well as unintended consequences.

Eleven BSEE students were assessed using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in both performance criteria.

Table 8 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome.

Table 8: Targeted Assessment for Outcome (h)

Outcome (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1: Identification	0	0	11	100%
2: Context	0	4	7	100%

3.3 Indirect Assessment for 2015–16

In addition to direct assessment measures, the student outcomes (a) through (k) were indirectly assessed through a senior exit survey. Senior exit surveys are conducted every year in the spring term. The 2014–15 data collected in spring 2015 was used in the last assessment report, which covers the period of spring 2014 through winter 2015. The indirect assessment data used in the 2014–'15 report was collected after the end of the corresponding assessment year. In order to avoid this inconsistency, and to ensure integrity in data collection, in this and subsequent annual assessment reports, we will use indirect assessment data collected during the spring term in the respective assessment year. To this end, the 2014–'15 academic-year senior exit survey, conducted in the spring of 2015 will be used again in the present report, which covers the terms of spring 2015 through winter 2016.

Question 16 in the survey asked students "Below are the ABET student outcomes for the BSEE program. Please indicate how well the BSEE program prepared you in each of the following areas". Figures 1 and 2 show the results of the indirect assessment of the BSEE student outcomes for the 2014-2015 graduating class.

Thirteen BSEE graduating seniors (7 from Wilsonville, 6 from Klamath Falls) completed the survey, with 80% or more of the respondents indicating that as a result of completing the BSEE program they feel prepared or highly prepared in each of the student outcomes, except for outcome (j) A knowledge of contemporary issues, where only 77% of the students felt prepared or highly prepared. These results align with the direct assessment results, where outcome (j) had the lowest attainment levels. Potential changes to improve attainment of this outcome were discussed at the closing-the-loop meeting, and the results are summarized in the next section.

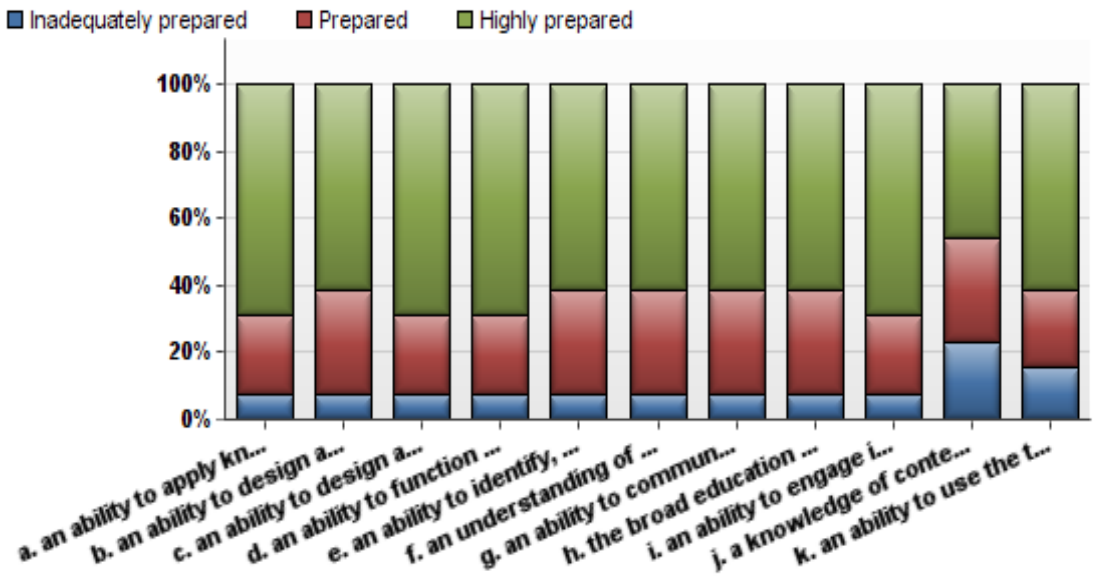

Figure 1 - Graph of results of the indirect assessment for the BSEE outcomes as reported in the Senior Exit Survey (2014–15)

Outcome	Inadequately prepared	Prepared	Highly prepared
a. an ability to apply knowledge of mathematics, science, and engineering	1	3	9
b. an ability to design and conduct experiments, as well as to analyze and interpret data	1	4	8
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	1	3	9
d. an ability to function on multi-disciplinary teams	1	3	9
e. an ability to identify, formulate, and solve engineering problems	1	4	8
f. an understanding of professional and ethical responsibility	1	4	8
g. an ability to communicate effectively	1	4	8
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	1	4	8
i. an ability to engage in independent learning and recognize the need for continual professional development	1	3	9
j. a knowledge of contemporary issues	3	4	6
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	2	3	8

Figure 2 - Results of the indirect assessment for the BSEE outcomes as reported in the Senior Exit Survey (2014–15)

4 Changes Resulting from Assessment

This section describes the changes resulting from the assessment activities carried out during the academic year 2015–16. It includes any changes that have been implemented based on assessment in previous assessment cycles, from this or last year, as well as considerations for the next assessment cycle.

The BSEE faculty met on June 24, 2016 to review the assessment results and determine whether any changes are needed to the BSEE curriculum or assessment methodology based on the results presented in this document. The objective set by the BSEE faculty was to have at least 80% of the students perform at the level of accomplished or exemplary in all performance criteria of the assessed outcomes. Table 9 provides a summary of the 2015–16 assessment results for the outcomes which were directly assessed.

Table 9: Summary of BSEE Direct Assessment for 2015–16

	Total Students	Students >= 2	% Students >=2
(b) Experimentation (Klamath Falls, EE 323, Winter 2016, Dr. Klopf)			
1- Designing	15	6	40.00%
2- Conducting	15	13	86.67%
3- Analyzing	15	7	46.67%
(b) Experimentation (Wilsonville, EE 335, Winter 2016, Prof. Douglas)			
1- Designing	25	25	100.00%
2- Conducting	25	25	100.00%
3- Analyzing	25	20	80.00%
(b) Experimentation (Klamath Falls, EE 419, Fall 2015, Prof. Hossain)			
1- Designing	9	9	100.00%
2- Conducting	9	9	100.00%
3- Analyzing	9	9	100.00%
(f) Ethics (Wilsonville, EE 355, Fall 2015, Prof. Rytkonen)			
1- Knowledge	5	4	80.00%
2- Dimensions	5	4	80.00%
3- Behavior	5	4	80.00%
(f) Ethics (Wilsonville, EE 430, Winter 2016, Dr. Scher)			
1- Knowledge	13	13	100.00%
2- Dimensions	13	12	92.31%
3- Behavior	N/A	N/A	N/A
(h) Impact (Wilsonville, EE 323, Winter 2016, Prof. Bryant Baker)			
1- Identification	17	17	100.00%
2- Context (societal)	17	17	100.00%
3- Context (global)	17	17	100.00%
(h) Impact (Wilsonville, EE 323, Winter 2016, Dr. Nardin)			
1- Identification	11	11	100.00%
2- Context	11	11	100.00%

4.1 Changes Resulting from the 2015–16 Assessment

The results of the 2015–16 assessment indicate that the minimum acceptable performance level of 80% was not met on every performance criterion for every assessed outcome. Areas of improvement were discussed, as follows, during the closing-the-loop meeting in June 2016 with respect to these results.

- **Outcome (b) (Experimentation):**
  - **Results:** The desired threshold of performance was reached in one criterion under one assessment, and all three criteria under the other two assessments of this outcome. A possible reason for the divergent performance was that the assignment was far more open-ended in the former case.
  - **Recommendation:** It was also noted that the nature of the lab or term project may affect the outcome, due to varying levels of student interest. The final decision was that scaffolding needs to be built into lab work so that students can build up to the skill of thinking and acting experimentally and scientifically on their own. Since the target assessment coverage is two per outcome per location, this outcome will be evaluated in the following cycle in one Wilsonville course.
- **Outcome (f) (Ethics):**
  - **Results:** The results of the assessment of outcome (f) were fully satisfactory in all cases.
  - **Recommendation:** The only recommendation is that outcome (f) needs to be measured one more time during the current three-year assessment cycle. Since the target assessment coverage is two per outcome per location, this outcome will be evaluated in the following cycle in two Klamath Falls courses.
- **Outcome (h) (Impact):**
  - **Results:** The results of the assessment of outcome (h) were satisfactory in every criterion for three of the four assessments, and also met the threshold in one of the two criteria in the last assessment, as well as almost meeting the threshold in the one remaining criterion. Since the last criterion showed student performance at the 78.57% level, this is within rounding error for Oregon Tech's small classes, and can be considered essentially 80%.
  - **Recommendation:** No changes are recommended at this time. However, a general-purpose suggestion by one faculty member was that for the assessment of soft skills via research-paper assignments, students be required to turn in a self-assessment prior to the final paper, and that the self-assessment be based on the descriptions in the relevant rubric. This is a general-purpose recommendation for outcomes (f) through (j). Since the target assessment coverage is two per outcome per location, this outcome will be evaluated in the following cycle in two Klamath Falls courses.