— B. S. in Electrical Engineering —

2016–17 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 2017.

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.

One hundred and twenty-five students have graduated from the BSEE program since it was first launched in 2007. From these, 38 new BSEE students graduated in the Spring term of 2017. Twenty-four of those completed the Senior Exit Survey, with 83% of respondents reporting having found employment in their field, 10% were admitted or planning on attending graduate school, and 7% are looking for employment after graduation. The reported average annual salary of the first group was $60,777.

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 program outcomes follow ABET's EAC (a)–(k) student outcomes:

(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 life-long 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.

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			•

Table 1: BSEE Outcome Assessment Cycle. Bullets (•) indicate standard assessment cycle, daggers (†) indicates additional assessment done this year.

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 reflected a shift on an institutional level to begin data collection in the spring term. In 2015-16 the Assessment Commission Executive Committee began recommending that programs begin data collection for the upcoming year during Fall term and to do closing-the-loop meetings at Convocation in the Fall of the following year. This recommendation was based on the fact that many programs found that having the assessment period to be different from an academic year created unnecessary confusion and worked poorly with the 9-month appointments for many faculty. The assessment report is completed before the end first term following the assessed academic year.

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 2016–17 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 Targeted Direct Assessment Activities

The sections below describe the 2016–17 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.

3.2.3.1 Outcome (b): Experimentation

An ability to design and conduct experiments, as well as to analyze and interpret data

A targeted direct assessment of this outcome was done in EE 307 *Electricity and Magnetism with Transmission Lines Laboratory*.

Wilsonville, EE 307, Fall 2016, Dr. Aaron Scher

This outcome was assessed by means of a laboratory exercise where students were asked to simulate, build, and test a complete tuned-resonant inductive wireless power transfer system operating at 700 kHz. This involved constructing inductors by wrapping loops of wires around custom jig stands, connecting and fine tuning variable capacitors to adjust LC resonant frequencies, measuring mutual inductance and magnetic coupling coefficients, measuring quality factors, and measuring wireless power transfer efficiencies. The last part of the lab was a design challenge in which student teams constructed inductive impedance matching networks out of additional loops of wire and competed on which team could transfer power to a LED load over the longest distance. The students were asked to turn in a lab report in which they presented their design, measurements, findings, and reflections. For assessment purposes, students were evaluated based on an ABET rubric, which targets different aspects of experimentation, including the ability to design, conduct, and analyze experiments.

A total of eight BSEE students were assessed in Fall 2016 in the course EE 307 Electricity and Magnetism with Transmission Lines Laboratory 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. The results in table 2 indicate that the acceptable performance level was reached in all three performance criteria.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
b1. Design	0	7	1	100%
b2. Conduct	0	2	6	100%
b3. Analyze	0	7	1	100%

Table 2: EE 307 assessment of Outcome (b): Experimentation.

3.2.3.2 Outcome (e): Problem Solving

An ability to identify, formulate, and solve technical problems.

A targeted direct assessment of this outcome was done in EE 323 *Electronics II* and in three sections of ENGR 465 *Capstone Project*.

Web, ENGR 323, Winter 2017, Dr. Cristina Crespo

This outcome was assessed in EE323 - Electronics II in Winter 2017 by means of a design project. The project consisted of designing and implementing an operational amplifier at the transistor level using BJT technology, and then anther one using MOSFET technology. Students were to experimentally build and test the BJT transistor (only simulation required for the MOSFET transistor). Students were provided with a set of design guidelines, as well as some general specifications that their designs should adhere to. After completing their designs, students were required to characterize their circuits based on a set of performance parameters, and compare the performance of each one of their op-amps, as well as a standard 741 op-amp. Students were asked to generate a project report following the IEEE Transactions journal template. In their report, students were supposed to identify and formulate the problem they were solving, as well as describe their solution (design), and report their results.

Twenty-six BSEE (including one BDRE) students were assessed in Winter 2017 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 performance criteria for this program outcome, that is, over 80% of students showed adequate ability to identify, formulate, and solve a technical problem.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
e1. Identify	1	16	9	96%
e2. Formulate	5	15	6	81%
e3. Solve	0	14	12	100%

Table 3: EE323 assessment of Outcome (e): Problem solving.

Wilsonville, ENGR 465, Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, Prof. Allan Douglas

This outcome was assessed by means of the final report for the senior capstone project. The students have worked on this project for three quarters and must submit a final report that details the design, implementation, and validations of their project. The reports were evaluated using a single rubric.

A total of twenty-four BSEE students were assessed in Spring 2017 in the course EE 465 Capstone Project and the results are tabulated in the table 4. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
e1. Identify	2	12	10	92%
e2. Formulate	4	10	10	83%
e3. Solve	1	14	9	96%

Table 4: ENGR 465 assessment of Outcome (e): Problem solving.

3.2.3.3 Outcome (f): Ethics An understanding of professional and ethical responsibility

A targeted direct assessment of this outcome was done in EE 473 *Machine Learning II*.

Klamath Falls, EE 473, Spring 2016, Dr. Mehmet Vurkaç

This outcome was assessed through a required reading (book) on ethical and moral issues in big data, data mining, and Internet technology, and a paper about the issues from the point of view of the IEEE code of ethics. The assessment of the students' ability to display a thorough understanding of professional and ethical responsibility was based on the quality and depth of their analysis and arguments. Students were required to identify at least two ethical questions in the reading, and then analyze one in detail, on the basis of the IEEE code of ethics.

Five BSEE (or dual) students were assessed in the course EE 473 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 5 summarizes the results of this targeted assessment. The results indicate that 80% or more of the students were able to perform at the desired level in terms of demonstrating an understanding of professional ethics and analyzing technological situations from the point of view of the IEEE code of ethics. Outcome (f)'s professional-behavior aspect was not evaluated as part of this assignment.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
f1. Knowledge	1	0	4	80%
f2. Practice	0	4	1	100%
f3. Behavior	N/A	N/A	N/A	

Table 5: EE 472 assessment of Outcome (f): Ethics.

3.2.3.4 Outcome (g): Communication

An ability to communicate effectively.

A targeted direct assessment of this outcome was done in three sections of EE 465 *Capstone Project*.

Wilsonville, ENGR 465, Spring 2017, Prof. Allan Douglas, Dr. Scott Prahl, Dr. Aaron Scher

This outcome was assessed by means of the final report for the senior capstone project. The students have worked on this project for three quarters and must submit a final report that details the design, implementation, and validations of their project. The reports were evaluated using a single rubric.

A total of twenty-two BSEE students were assessed in Spring 2017 in the course EE 465 Capstone Project 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. The results indicate that the acceptable performance level was not reached in two of the three performance criteria.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2	Assessor
g1. Oral	0	2	0	100%	Scher
g2. Acquisition	0	2	0	100%	Scher
g3. Written	0	2	0	100%	Scher
g1. Oral	2	6	4	83%	Douglas
g2. Acquisition	2	5	5	83%	Douglas
g3. Written	3	3	5	75%	Douglas
g1. Oral	0	2	6	100%	Prahl
g2. Acquisition	3	2	3	63%	Prahl
g3. Written	0	4	4	100%	Prahl
g1. Oral	2	10	10	91%	Total
g2. Acquisition	5	9	8	77%	Total
g3. Written	3	9	9	86%	Total

Table 6: ENGR 465 assessment of outcome (g): Communication.

3.2.3.5 Outcome (h): Impact

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

A targeted direct assessment of this outcome was done in EE 473 *Machine Learning* and EE 401 *Communication Systems*.

Klamath Falls, EE 473, Spring 2016, Dr. Mehmet Vurkaç

This outcome's assessment was completed during spring term's EE 473, Machine Learning II, and was assessed by means of a research-paper assignment.

Five BSEE (or dual) 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 both the performance criteria for this program outcome.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
h1. Identification	1	4	0	80%
h2. Contexts	1	0	4	80%

Table 7: ENGR 473 assessment of Outcome (h): Impact.

Klamath Falls, EE 401, Spring 2016, Dr. Mehmet Vurkaç

This outcome was re-assessed in EE 401, Communication Systems during the spring term of 2016 in order to complete the two assessments of outcome (h) in Klamath Falls for the 2015–16 assessment year. The outcome was assessed by means of a research paper on communication systems that have had significant environmental, societal, health-related, economic, political, or cultural impacts, and the societal dimensions of such technology, focusing on the possibility of negative impacts, and viewed from the point of view of manufacturing, culture, economics, law, education, health, or the environment. The papers were also required to include a brief technical explanation of the technology to be discussed. The reports were required to be 6–8 pages long, in-depth, well thought-out, well-researched discussions of the pros and cons of the aforementioned impacts and ethical controversies, and a discussion of the gray areas and how some of them may be resolved. Students were required to provide at least four credible, attributable, and non-ephemeral references. The list of suggested topics included GPS-tracking technology, RFID and identity theft, radioactive power sources, medical implants, and social networking. Since the students were familiar with the requirements, concept, and rubric of the "impact paper" from EE 323, the assignment handout took the form of a mini sample paper, written in a whimsical way to pique student interest. This seems to have succeeded; students' paper topics ranged from hearing aids to the socio-political cost of rare-earth metals and their mining.

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.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
h1. Identification	2	5	7	86%
h2. Contexts	3	5	6	79%

Table 8: EE 401 assessment of Outcome (h): Impact

3.2.3.6 Outcome (i): Independent Learning A recognition of the need for, and an ability to engage in, life-long learning.

A targeted direct assessment of this outcome was done in EE 430 *Linear Systems and Digital Signal Processing*.

Web, EE 430, Spring 2017, Dr. Mateo Aboy

This outcome was assessed using a project which required students to engage in independent learning and research (a key aspect of lifelong learning). The assessment project involved the design of a digital signal processing (DSP) system to perform automatic beat detection in intracranial pressure signals (ICP). The students were required to implement the DSP system in MATLAB and assess its performance with real ICP signals. Such DSP system requires the implementation of several digital filters (FIR & IIR), performing spectral analysis and time-frequency analysis (using spectrograms), and event detection in order to achieve automatic detection of the percussion peak in ICP signals. Given that students lack familiarity with the application domain or biomedical signal processing, they had to engage in independent learning involving reading of background references and peer-reviewed papers on the topic of beat detection. This project is used to assess whether students are able to engage in independent learning using peer-reviewed papers (as the ability to engage in independent learning is one of the key aspects of lifelong learning). Students were also required to write a complete report following the guidelines of the IEEE Transactions Journals describing their algorithm design and assessment study. The project also requires mastery of DSP techniques and use of modern CAD tools for DSP (i.e., MATLAB).

A total of six BSEE students were assessed in Spring 2017 in the course EE 430 Linear Systems and Digital Signal Processing 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. The results as shown in table 9 indicate that the acceptable performance level was reached in two of the three performance criteria.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
i1. Needed	0	0	6	100%
i2. Gathering	0	5	1	100%
i3. Continuous	N/A	N/A	N/A	

Table 9: EE 430 assessment of Outcome (i): Independent learning.

3.2.3.7 Outcome (j): Contemporary Issues

A knowledge of contemporary issues.

A targeted direct assessment of this outcome was done in EE 323, *Electronics II*

Wilsonville, EE 323, Winter 2017, Dr. Cristina Crespo

This outcome was assessed in EE323 - Electronics II in Winter 2017 by means of a presentation. The purpose of the assignment was for students to gain familiarity with contemporary issues pertinent to the field of electronics. To this end, students were asked to research a particular problem that engineers in the field of electronics are currently trying to solve (i.e., a contemporary issue in the field of electronics), as well as the solutions that are being proposed (their advantages, disadvantages, difficulties of implementation, socioeconomic aspects, broader impact, etc.). Students then had to prepare and deliver a slide presentation (10–20 slides, 10–12 minutes) on their chosen topic to an audience of peers (i.e., with a similar level of electronics knowledge as themselves), record a video of their presentation, and post it to the class discussion forum. In addition, each student was required to watch video presentations from at least two other classmates, and contribute a meaningful comment or question to their presentation in the discussion forum, indicating their understanding of the topics presented. Students were given some guidance for resources available to learn about current trends in electronics. It was expected that through the process of topic selection, in-depth research of a chosen topic, and contribution to presentations of at least two other topics, students would get reasonable exposure to contemporary issues in different aspects of the electronics field.

Twenty-six BSEE (including one BDRE) students were assessed in Winter 2017 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 10 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, that is, over 80% of students showed adequate knowledge of contemporary issues.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
j1. Knowledge	0	8	18	100%
j2. Temporal	0	15	11	100%
j3. Context	0	9	17	100%

Table 10: EE 323 assessment of Outcome (j): Contemporary Issues.

3.2.3.8 Outcome (k): Engineering Tools

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

A targeted direct assessment of this outcome was done in EE 320 *Advanced Circuit Systems Analysis*.

Wilsonville, EE 320, Fall 2016, Dr. Aaron Scher

This outcome was assessed by means of a project. Small student groups were asked to design, build, and test a capacitive proximity detector circuit according to various guidelines and constraints. Students first researched and chose their own practical circuit. They then turned in a project proposal, which had to be approved by the instructor. Students then designed a detailed schematic of their circuit, conducted LTspice simulations, and turned in a description of how their circuit functions, including any important or governing mathematical relationships. Next students used PCB design tools of choice (such as KiCad or Eagle) to design their board layout and generate gerber files. Students were required to hand-solder their own components on to the board. Students built their boards and demonstrated their work to the class. Finally, students turned in short video explanations of their working boards and the underlying principles.

A total of eight BSEE students were assessed in Fall 2016 in the course EE 320 Advanced Circuit Systems Analysis. The results are summarized in table 11.

Criteria	1 Developing	2 Accomplished	3 Exemplary	Students ≥ 2
k1. Proficiency	2	6	0	75%
k2. Hardware	0	4	4	100%
k3. Communication	2	2	4	75%

Table 11: EE 320 assessment of Outcome (k): Engineering tools.

3.2.3.9 Summary of all targeted direct assessments

	Total Students	Number Students ≥ 2	Percentage Students ≥ 2
(b) Experimentation (Wilsonville)			
b1. Design	8	7	100%
b2. Conduct	8	2	100%
b3. Analyze	8	7	100%
(e) Problem Solving (Wilsonville,Web)			
e1. Identify	50	47	94%
e2. Formulate	50	41	82%
e3. Solve	50	49	98%
(f) Ethics (Klamath Falls)			
f1. Knowledge	5	4	80%
f2. Practice	5	5	100%
(g) Communication (Wilsonville)			
g1. Oral	22	20	91%
g2. Acquisition	22	17	77%
g3. Written	22	18	86%
(h) Impact (Klamath Falls)			
h1. Identification	19	16	84%
h2. Contexts	19	15	79%
(i) Independent Learning (Web)			
i1. Needed	6	6	100%
i2. Gathering	6	5	100%
(j) Contemporary (Web)			
j1. Knowledge	26	26	100%
j2. Temporal	26	26	100%
j3. Context	26	26	100%
(k) Engineering tools (Wilsonville)			
k1. Proficiency	8	6	75%
k2. Hardware	8	8	100%
k3. Communication	8	8	75%

Table 12: Overall totals for each assessed outcome during 2016–17. The total number of students assessed, the number of students scoring 2 (accomplished) or 3 (exemplary) and the percentage of students scoring 2 or 3 is shown.

3.2.4 Indirect Assessments

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 2016–17 data collected in spring 2017 was used in this assessment report, which covers the period of spring 2016 through spring 2017. (The 2015–16 survey covered spring 2015 to winter 2016.)

Twenty-four BSEE graduating seniors completed the Senior Exit Survey out of a total of 38 graduating. Of the twenty-four respondents, 15 were from Wilsonville and 9 were from Klamath Falls. In this survey, question 32 asked students, "Please rate your proficiency in the following areas" and listed the ABET Student Outcomes.

More than 80% of the respondents rated themselves, upon completion of the BSEE program, they were "Proficient" or "Highly Proficient" in all but three categories. Outcome (k) was self-assessed at 79% but was deemed by the faculty as close enough to 80% to be accepted without change because of the small data set. This outcome will be monitored in the 2017-18 assessment cycle. The exception is Outcome (j) in which (18/24) or only 75% of the students felt proficient or highly proficient.

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.

Outcome Outcome	Limited Proficiency	Some Proficiency	Proficient	Highly Proficient	Proficient & Highly Proficient
(a) Knowledge	1	1	10	12	92%
(b) Experimentation	1	1	7	15	92%
(c) Design	1	5	10	8	75%
(d) Teamwork	1	2	9	12	88%
(e) Problem solving	1	2	7	14	88%
(f) Ethics	2	1	12	9	88%
(g) Communication	1	3	11	9	83%
(h) Impact	2	2	12	8	83%
(i) Independent learning	2	1	8	13	88%
(j) Contemporary issues	2	4	10	7	74%
(k) Engineering tools	2	3	7	12	79%

Table 13: Results of the indirect assessment of proficiency for ABET outcomes from the Senior Exit Survey (2016–17).

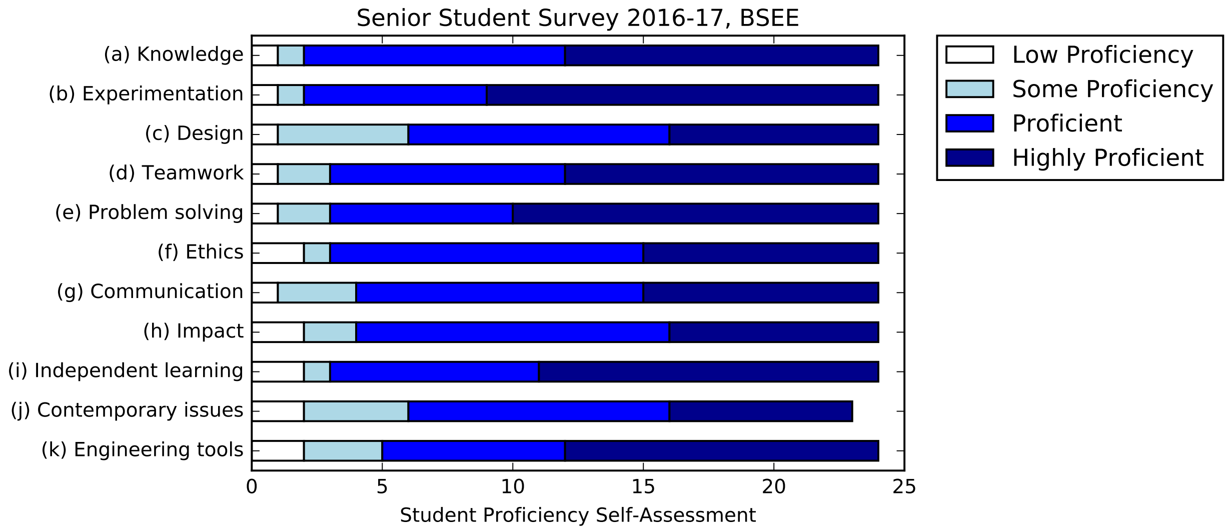

Figure 1: Self-assessment of proficiency at ABET outcomes by the students as reported in the Senior Exit Survey (2016–17). One student did not respond to the question about Outcome (j): Contemporary Issues.

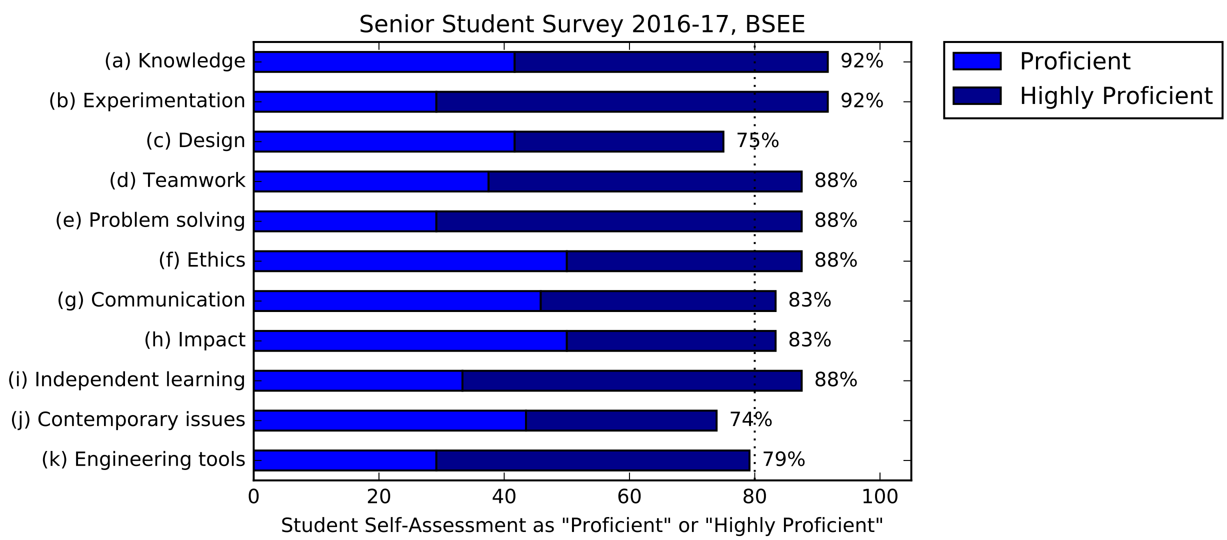

Figure 2: Self-assessment as "Proficient" or "Highly Proficient" for ABET outcomes as reported in the Senior Exit Survey (2016–17).

4 Changes Resulting from Assessment

This section describes the changes resulting from the assessment activities carried out during the academic year 2016–17. 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 October 12, 2017 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 refsummary provides a summary of the 2016–17 assessment results. Table refhistory shows how these assessments relate to those from previous assessment cycles.

The results of the 2016–17 assessment indicate that the minimum acceptable performance level of 80% was not met on every performance criterion for every assessed outcome. Below is a detailed report of the discussions from the closing-the-loop meeting.

4.1 Outcome (b): Experimentation

Results: The direct assessment results show that the threshold of attainment of this outcome was exceeded in all performance criteria in both the direct and indirect assessments. This was a significant improvement upon the last assessment in 2015-16 and is thought to be directly attributable to include more scaffolding into the lab work as noted in the previous closing-the-loop meeting.

Recommendation: The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

4.2 Outcome (c): Design

Results: The *indirect* assessment result for his outcome was not met. Only 75% of students assessed themselves as "Proficient" or "Highly Proficient."

Recommendation: The faculty identified that this is a concern and decided to wait for results from the direct assessment of Outcome (c) during the 2017-18 assessment cycle before recommending or implementing changes.

4.3 Outcome (e): Problem Solving

Results: The direct and indirect assessment results show that the threshold of attainment of this outcome was exceeded in all performance criteria.

	2013–14	2014–15	2015–16	2016-17
(b) Experimentation				
			$N = 56$	$N = 8$
b1. Designing			71%	100%
b2. Conducting			84%	100%
b3. Analyzing			64%	100%
(e) Problem Solving				
	$N = 12$			$N = 50$
e1. Identify	92%			94%
e2. Formulate	75%			82%
e3. Solve	25%			98%
(f) Ethics				
			$N = 18$	$N = 5$
f1. Knowledge			94%	100%
f2. Dimensions			89%	100%
f3. Behavior			80%	100%
(g) Communication				
	$N = 19$			$N = 22$
g1. Oral	80%			91%
g2. Acquisition	90%			77%
g3. Written	90%			86%
(h) Impact				
			$N = 28$	$N = 19$
h1. Identification			100%	84%
h2. Context			100%	79%
(i) Independent Learning				
	$N = 19$			$N = 6$
i1. Needed	89%			100%
i2. Gathering	100%			100%
i3. Continuous	89%			
(j) Contemporary Issues				
		$N = 36$		$N = 26$
j1. Knowledge		69%		100%
j2. Temporal		67%		100%
j3. Context		58%		100%
(k) Engineering tools				
	$N = 19$			$N = 8$
k1. Proficiency	100%			75%
k2. Hardware	100%			100%
k3. Communication	78%			75%

Table 14: Comparison of results with those from previous assessment years. The percentage of students scoring 2 (accomplished) or 3 (exemplary) is shown for 2016-17 and the previous assessment year. Sample size and results includes combined total of students for each outcome evaluated within the assessed year.

Recommendation: The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

4.4 Outcome (f): Ethics

Results: The direct and indirect assessment results show that the threshold of attainment of this outcome was exceeded in all performance criteria.

Recommendation: The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

4.5 Outcome (g): Communication

Results: The direct assessment results show that the threshold of attainment (80%) of this outcome was exceeded in two of three performance criteria. The last criterion "Acquiring information from various sources" had only 77% of the students assessed as "Accomplished" or "Exemplary."

Recommendation: The faculty identified that the failed criterion was the result of incomplete instructions on the assignment by one instructor in particular. This instructor will update his guidelines to emphasize what constitute acceptable sources and the need for citations.

4.6 Outcome (h): Impact

Results: The direct and indirect assessment results show that the threshold of attainment of this outcome was exceeded in one performance criterion and nearly reached (79%) in the second.

Recommendation: Given the (1) small number of students sampled, (2) how close the second result (79%) was to the 80%, (3) the passing results from the 2015-16 cycle, and (4) that the indirect assessment also passed, the faculty decided to recommended no changes at this time.

4.7 Outcome (i): Independent Learning

Results: The direct and indirect assessment results show that the threshold of attainment of this outcome was exceeded in all performance criteria.

Recommendation: The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

4.8 Outcome (j): Contemporary Issues

Results: The direct assessment results of this outcome reached the 80% threshold for all performance criteria. The indirect assessment indicated that only 75% of students felt "Proficient" or "Highly Proficient" at a knowledge of contemporary issues.

Recommendation: The direct assessment of this outcome was met this year which supports the changes implemented by the faculty following last year's closing-the-loop meetings. The faculty also acknowledged that the students feel less comfortable with this outcome than they should be and that this is a continuing issue (2015-16 indirect assessment result was 77%). The faculty decided to make no changes because this outcome will be assessed again (directly and indirectly) next year.

4.9 Outcome (k): Engineering Tools

Results: The direct assessment results of this outcome reached the 80% threshold in one of three performance criteria. Furthermore, the indirect assessment of this outcome also did not reach the 80% threshold.

Recommendation: Since only eight students were assessed, faculty thought that it would be best to gather more data. Specifically the faculty decided to assess (directly and indirectly) this outcome in the 2017-18 academic year on both the Wilsonville and Klamath Falls campus.