– Electronics Engineering Technology –
2016-17 Assessment Report

Aaron Scher & Claudia Torres Garibay

Electrical Engineering & Renewable Energy Department

Contents

1 Introduction

1.1 Program Location

The Bachelor of Science in Electronics Engineering Technology (BSEET) is offered at the Oregon Tech Wilsonville Campus on the south side of the Portland metropolitan area. The campus is situated in a wooded business park setting among several technology companies including Mentor Graphics, Rockwell Collins, and Xerox. The campus is conveniently located off Interstate 5 and a short walk away from the Wilsonville Station on the Westside Express Service (WES) commuter rail line that connects to Beaverton and the MAX Light Rail. In addition, several of the core courses for the degree and technical electives are available at the Willow Creek Center (WCC) in the Portland Westside to better accommodate degree-seeking professionals working for high-tech companies in the Hillsboro and Beaverton area. The WCC is located in the heart of the high-tech industry cluster (Silicon Forest), minutes away from companies such as Intel, Tektronix, MAXIM, Credence, Lattice, Synopsis, TriQuint, and ESI. Some of the core courses and technical electives are also available online.

1.2 Program Goals and Design

The program is designed to prepare graduates to assume engineering and technology positions in the electronics industry. Graduates of the Electronics Engineering Technology program fulfill a wide range of functions within industry. Bachelor's degree graduates are currently placed in positions such as component and system design, test engineering, product engineering, field engineering, manufacturing engineering, sales or market engineering, and quality control engineering. The program also provides a solid preparation for students intending to continue to graduate school to pursue master's degrees in engineering, engineering management, and M.B.A.s. Employers of Electronics Engineering Technology graduates include research and development laboratories, electronic equipment manufacturers, public utilities, colleges and universities, government agencies, medical laboratories and hospitals, electronic equipment distributors, semiconductor companies, and automated electronic controlled processing companies. Recent graduates have been employed at companies such as MAXIM, TriQuint, Tektronix, Biotronik, and Intel.

The BSEET degree at Oregon Tech Wilsonville is especially suited for working professionals with an associate's degree in Electronics Engineering Technology, Microelectronics Technology, or equivalent coursework. Students entering the B.S. degree in Electronics Engineering Technology program by transfer are requested to contact the EET Program Director concerning transfer of technical coursework. An accredited Associate of Applied Science (A.A.S.) degree in Electronics or Microelectronics and Calculus-level math is a perfect preparation to start our upper-division coursework. Alternatively, coursework on DC Circuit Analysis, AC Circuit Analysis, Combinational Logic (Digital Circuits), Sequential Logic (Digital Circuits), Semiconductor Devices, and other technical and general education courses provides adequate preparation. Our BSEET program has articulation agreements with the Electronics and Microelectronics programs at Portland Community College, Clackamas Community College, Chemeketa Community College, and Columbia Gorge Community College. It is recommended that students start the advising process with Oregon Tech right after they complete the first year of their A.A.S. degree.

1.3 Program Brief History

The BSEET program at Oregon Tech was first accredited by ABET in 1970. The last ABET accreditation visit took place in Fall 2014.

Oregon Institute of Technology has offered a Bachelor of Science in Electronics Engineering Technology (BSEET) degree since 1970. The EET program served a need in the state for many years and was successful and highly regarded. Since the 1990's industries' needs began to shift more towards hiring graduates of full electrical engineering programs and the BSEET program started to experience significant enrollment declines. A department committee, in consultation with the industry advisory board, recommended that the program change from EET to EE in Klamath Falls, but continue as the BSEET program at OIT-Portland to continue serving degree completion students and working professionals with A.A.S. EET degrees. Once the decision to discontinue the BSEET program from Klamath Falls was made, the BSEET program underwent a major revision in order to optimize it to address the needs of working professionals and transfer students at OIT-Portland. These revisions were approved by the Curriculum Planning Commission (CPC) in 2008. In 2011, a decision was made by the department, in consultation with the industry advisory board, to enhance the upper division EET curriculum by converting some of the EET courses to traditional EE courses with a strong lab component. This change was implemented to better achieve the program educational objectives of preparing graduates to assume diverse roles in the engineering and engineering technology fields, as well as improve their access to graduate education. These changes were approved by the Curriculum Planning Commission (CPC) in 2011 and implemented in the 2011-12 academic year.

In Fall 2012 the Oregon Tech Wilsonville campus opened as a result of the consolidation of the university's four Portland metro area sites. The BSEET courses are offered at the Wilsonville campus, and they also continue to be offered at the Willow Creek Center (on the Westside), in order to accommodate professionals working in the high-tech industry cluster in the Beaverton/Hillsboro area.

The BSEET program also has strong relationships with industry, particularly through its program-level Industry Advisory Board and alumni from the EET program. These relationships allow the BSEET program to meet a third institutional mission objective, "Develop and maintain partnerships with public and private institutions, business and industry, and government agencies to ensure quality programs that meet the needs of students and the organizations that employ them."

2 Program Mission, Educational Objectives, and Outcomes

2.1 Program Mission

The mission of the EET 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 electronics. The department will be a leader in providing career ready candidates for various electronics technology fields. Faculty and students will engage in applied research in emerging technologies and provide professional services to their communities.

2.2 Program Educational Objectives

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The Program Educational Objectives of Oregon Tech's Bachelor of Science in Electronics Engineering Technology are:

- The graduates of the program will possess a strong technical background as well as analytical and problem solving skills, and will contribute in a variety of technical roles within the electronics and high-tech industry. Within three years of graduation, BSEET graduates are expected to be employed as test engineers, characterization engineers, applications engineers, field engineers, hardware engineers, process engineers, and similar engineering technology positions within this industry.
- The graduates of the program will be working as effective team members with excellent oral and written communication skills, assuming technical and managerial leadership roles throughout their career.
- The graduates of the program will be committed to professional development and lifelong learning by engaging in professional and/or graduate education in order to stay current in their field and achieve continued professional growth.

2.3 Relationship Between Program Educational Objectives and Institutional Mission Statement

These program objectives support Oregon Tech's institutional mission statement, which states:

> Oregon Institute of Technology, an Oregon public university, 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 Oregonians and provides information and technical expertise to state, national and international constituents.

2.4 Program Outcomes

The BSEET Program Outcomes include ABET's ETAC $a-k$ outcomes as well as the electronics specific $l-m$ outcomes.

These are listed below:

- a an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.
- b an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies.
- c an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.
- d an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives.
- e an ability to function effectively as a member or leader on a technical team.
- f an ability to identify, analyze, and solve broadly-defined engineering technology problems.
- g an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.
- h an understanding of the need for and an ability to engage in self-directed continuing professional development.
- i an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.
- j a knowledge of the impact of engineering technology solutions in a societal and global context.
- k a commitment to quality, timeliness, and continuous improvement.
- l the ability to analyze, design, and implement control systems, instrumentation systems, communications systems, computer systems, or power systems.
- m the ability to apply project management techniques to electrical/electronic(s) systems.
- n the ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems.

3 Cycle of Assessment for Program Outcomes

3.1 Introduction and Methodology

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 from previous years (see Table 2 for the old assessment cycle). 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.

The assessment cycle was changed during the 2014/15 assessment year to begin 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 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 for a spring term faculty meeting to review the results and make recommendations for actions.

In 2016/17, the institution shifted back to an assessment cycle starting in the fall, as advised by the Assessment Commission Executive Committee. In accordance with this recommendation, effective 2016/17, the cycle of assessment for the BSEET program outcomes begins in the fall.

3.2 Assessment Cycle

Table 1: BSEET Outcome Assessment Cycle. Check marks (√) indicate standard assessment cycle, daggers (†) indicate additional assessment done this year.

Outcome	2014/15	2015/16	2016/17
a. Fundamentals	–	–	√
b. Application	√	–	–
c. Experimentation	–	√	–
d. Design	√	–	–
e. Teamwork	√	–	–
f. Problem Solving	–	–	√
g. Communication	–	–	√
h. Lifelong Learning	–	–	√
i. Ethics	–	√	†
j. Impact	–	√	–
k. Continuous Improvement	√	–	–
l. Electronic Systems	–	√	†
m. Project Management	–	–	√
n. Advanced Mathematics	√	–	†

Table 2: Old BSEET Outcome Assessment Cycle

Outcome	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14
a. Fundamentals	–	√	–	–	√	–
b. Application	√	–	–	√	–	–
c. Experimentation	–	–	√	–	–	√
d. Design	√	–	–	√	–	–
e. Teamwork	√	–	–	√	–	–
f. Problem Solving	–	–	√	–	–	√
g. Communication	–	–	√	–	–	√
h. Lifelong Learning	–	–	√	–	–	√
i. Ethics	–	√	–	–	√	–
j. Impact	–	√	–	–	√	–
k. Continuous Improvement	–	–	√	–	–	√
l. Electronic Systems	–	√	–	–	√	–
m. Project Management	–	–	√	–	–	√
n. Advanced Mathematics	√	–	–	√	–	–

3.3 Summary of Assessment Activities & Evidence of Student Learning

3.3.1 Introduction

The Electronics Engineering Technology faculty members conducted formal assessment of nine Program Outcomes during the 2016-2017 assessment year using direct measures such as comprehensive ABET Projects and ABET Assignments[1] and targeted ABET Program Outcome Exam Questions. Additionally, the Program Educational Objectives were assessed

[1] ABET Projects and ABET Assignments refer to projects and assignments especially designed by Oregon Tech BSEET faculty to go beyond the assessment of course outcomes in order to assess more general program-level outcomes including the ABET $a - n$ outcomes.

using indirect measures, namely, surveys of employers and alumni.

3.3.2 Methodology for Assessment of Program Outcomes

The BSEET mapping process links specific tasks within engineering assignments to ABET program outcomes and on to program educational objectives in a systematic way based on ABET rubrics[2]. The program outcomes are evaluated as part of the course curriculum primarily by means of comprehensive ABET assignments specifically designed to measure program-level outcomes in addition to course-level outcomes. These assignments typically involve a short project or lab requiring the student to apply math, science, and engineering principles learned in the course to solve a particular problem requiring the use of modern CAD tools and engineering equipment, working in teams, writing a project report, and giving an oral presentation. ABET assignments are designed to assess several fundamental program outcomes at once. An ABET multi-outcome rubric is used to perform direct assessment of these assignments. A systematic, rubric-based process is then used to quickly assess tasks within assignments and link them directly to a group of program outcomes. Evaluations of these outcomes are then gathered and accounted in outcome-specific tables, analyzed and then individually summarized. Summaries for all outcomes are then compiled into a comprehensive program outcome summary for each course. The outcome summary is then evaluated for relevance with respect to the program objectives. The summary of outcomes is formatted and organized such that it is suitable for inclusion in an ABET review document.

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 ABET-relevant ("a" through "n") 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.

By assessing multiple outcomes per assignment, the number of assessed assignments may be reduced and assignments become more relevant to the program outcomes, since the assignments are designed with the general program outcomes in mind. Additionally, incorporating multiple outcomes in a single assignment provides for a richer assignment, one that takes into account a wider range of engineering issues.

3.3.3 2016-2017 Targeted Assessment Activities

The sections below describe the 2016-2017 targeted assessment activities and detail the performance of students for each of the assessed outcomes. The tables report the number 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.

[2]ABET rubrics refer to rubrics especially designed by Oregon Tech BSEET faculty to assess ABET Projects based on program-level outcomes.

3.3.4 Targeted Assessment for Outcome a: an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.

This outcome was assessed in EE 320 - Advanced Circuits and Systems in Fall 2016 and ENGR 465 - Capstone Project in Spring 2017.

Outcome (a) : EE 320, Fall 2016, Dr. Aaron Scher

This outcome was assessed in EE 320 - Advanced Circuits and Systems in Fall 2017 by means of a design project. The project consisted of designing, constructing, characterizing, and demonstrating a capacitive proximity sensor. Student's worked in teams of two to three students and were required to construct their circuit on a two-layer printed circuit board (PCB). Design constraints on cost, materials allowed, and function were imposed to make the project challenging and fit within the scope of the course. Five BSEET students were assessed in Fall 2016 using the performance criteria listed in Table 3. 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 were able to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.

Outcome (a) : ENGR 465, Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

This outcome was assessed in the ENGR 465 - Capstone Project, in Spring 2017. The Capstone Project is a year-long (three-term) project that students complete in their senior year, which involves a major design experience. Throughout the year, students are required to complete the definition, design, implementation, and verification of a major engineering design project. During the initial stage, students work under the supervision of their capstone project advisor to select a project of adequate scope, and submit a project proposal.The proposal typically includes an explanation of the project relevance, a project definition or specification, a timeline with major milestones, a list of resources needed to complete the project, and a projected cost analysis. Once the proposal is approved by the academic advisor, students go through the different phases of design, implementation, and verification of their project. During this time, students have regular meetings with their project advisor in order to report progress, notify of plan changes if needed, present results, and perform prototype demonstrations. Once the design, implementation, and verification process is completed, and there is a final working prototype, students are required to generate a poster for inclusion in the annual Student Project Symposium, deliver an oral presentation, and submit a formal written report. A total of nine students were assessed in Spring 2017 using the performance criteria listed in Table 3.

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 were able to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.

Table 3: Targeted Assessment for Outcome a: 1) Criterion 1 - an ability to select and apply electronics concepts to broadly-defined engineering technology problems., 2) Criterion 2- an ability to select and apply electronics skills to broadly defined engineering technology problems, and 3) Criterion 3 - an ability to select and apply modern tools to broadly-defined engineering technology problems.

Outcome (a) : EE 320, Fall 2016, Dr. Aaron Scher

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Concepts	0	2	3	100%
2 - Skills	0	2	3	100%
3 - Tools	1	3	1	80%

Outcome (a) : ENGR 465, Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Conepts	1	0	8	89%
2 - Skills	1	2	6	89%
3 - Tools	1	6	2	89%

3.3.5 Targeted Assessment for Outcome f: an ability to identify, analyze, and solve broadly-defined engineering technology problems.

This outcome was assessed in ENGR 465 - Capstone Project in Spring 2017.

Outcome (f) : ENGR 465, Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

This outcome was assessed in the ENGR 465 - Capstone Project, in Spring 2017. The Capstone Project is a year-long (three-term) project that students complete in their senior year, which involves a major design experience. Throughout the year, students are required to complete the definition, design, implementation, and verification of a major engineering design project. During the initial stage, students work under the supervision of their capstone project advisor to select a project of adequate scope, and submit a project proposal.The proposal typically includes an explanation of the project relevance, a project definition or specification, a timeline with major milestones, a list of resources needed to complete the project, and a projected cost analysis. Once the proposal is approved by the academic advisor, students go through the different phases of design, implementation, and verification of their project. During this time, students have regular meetings with their project advisor in order to report progress, notify of plan changes if needed, present results, and perform prototype demonstrations. Once the design, implementation, and verification process is completed, and there is a final working prototype, students are required to generate a poster for inclusion in the annual Student Project Symposium, deliver an oral presentation, and submit a formal written report.

A total of eight students were assessed in Spring 2017 using the performance criteria listed in 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. The results indicate that the acceptable performance level was reached in two of the three performance criteria (i.e. Criteria 1 and 2). The performance level for Criteria 3 is 75%, which is very close to the minimum acceptable performance level of 80%. These results suggest that most students in the program have an ability to identify, analyze, and solve broadly-defined engineering technology problems.

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, that is, over 80% of students were able to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.

Table 4: Targeted Assessment for Outcome f: 1) Criterion 1 - an ability to identify broadly defined engineering technology problems, 2) Criterion 2- an ability to analyze broadly-defined engineering technology problems, and 3) Criterion 3 - an ability to solve broadly defined engineering technology problems.

Outcome (f) : ENGR 465, Winter 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Identify	0	5	3	100%
2 - Analyze	1	4	3	88%
3 - Solve	2	3	3	75%

3.3.6 Targeted Assessment for Outcome g: an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.

This outcome was assessed in ENGR 465 - Capstone Project in Spring 2017.

Outcome (g) : ENGR 465, Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

This outcome was assessed in the ENGR 465 - Capstone Project, in Spring 2017. The Capstone Project is a year-long (three-term) project that students complete in their senior year, which involves a major design experience. Throughout the year, students are required to complete the definition, design, implementation, and verification of a major engineering design project. During the initial stage, students work under the supervision of their capstone project advisor to select a project of adequate scope, and submit a project proposal.The proposal typically includes an explanation of the project relevance, a project definition or specification, a timeline with major milestones, a list of resources needed to complete the project, and a projected cost analysis. Once the proposal is approved by the academic advisor, students go through the different phases of design, implementation, and verification of their project. During this time, students have regular meetings with their project advisor in order to report progress, notify of plan changes if needed, present results, and perform prototype demonstrations. Once the design, implementation, and verification process is completed, and there is a final working prototype, students are required to generate a poster for inclusion in the annual Student Project Symposium, deliver an oral presentation, and submit a formal written report.

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, that is, over 80% of students were able to demonstrate an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.

Table 5: Targeted Assessment for Outcome g: 1) Criterion 1 - an ability to apply written communication, 2) Criterion 2- an ability to apply oral communication, 3) Criterion 3 - an ability to apply graphical communication, 4) Criterion 4 - an ability to apply and identify appropriate technical literature, 5) Criterion 5 - an ability to communicate with technical and nontechnical audiences

Outcome (g) : ENGR 465, Winter 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Written	0	5	3	100%
2 - Oral	0	5	3	100%
3 - Graphical	0	5	3	100%
4 - Literature	0	7	1	100%
5 - Audience	0	3	5	100%

3.3.7 Targeted Assessment for Outcome h: an understanding of the need for and an ability to engage in self-directed continuing professional development.

This outcome was assessed in ENGR 267 - Engineering Programming in Spring 2017 and EE 430 - Linear Systems and Digital Signal Processing in Spring 2017.

Outcome (h) : ENGR 267 and EE 430, Spring 2017, Dr. Mateo Aboy

This outcome was assessed in ENGR 267 - Engineering and Programming and EE430 - Digital Signal Processing in Spring 2017 by requiring students to write an essay explaining the importance of independent learning, how they plan on staying current in their field and industry through independent learning, and how this relates to the need for continual professional development. A total of 12 students were assessed. Table 6 summarizes the results of this targeted assessment, and corresponding criteria used for the assessment. 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 reached in all of the performance criteria. This suggests most students in the program have an understanding of the need for and an ability to engage in self-directed continuing professional development.

Table 6 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on criterion 1 for this program outcome, that is, over 80% of students were able to demonstrate an ability to engage in independent learning. Criterion 2 was not directly assessed due to an error in a new assessment software package that was piloted this term, and abandoned.

Table 6: Targeted Assessment for Outcome h: 1) Criterion 1- an ability to engage in independent learning, and 2) recognize the need for continual professional development

Outcome (h) : ENGR 267, Spring 2017, Dr. Mateo Aboy

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Ability	1	7	3	91%
2 - Recognition	NA	NA	NA	NA

Outcome (h) : ENGR 430, Spring 2017, Dr. Mateo Aboy

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Ability	0	1	0	100%
2 - Recognition	NA	NA	NA	NA

3.3.8 Targeted Assessment for Outcome i: an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.

This outcome was assessed in is EE 320 - Advanced Circuits and Systems in Fall 2016.

Outcome (i) : EE 320, Fall 2016, Dr. Aaron Scher

This outcome was assessed by means of an essay assignment using the IEEE code of ethics. For the first part of the assignment, the students were asked to list three provisions in the professional ethics code that they thought were important, explain why they though the provision was important, and give an example of how their chosen provisions might be applied in a professional situation. For the second part of the assignment, the students were presented with an ethics scenario they might encounter in the workplace. The students were asked to describe the ethical issue(s) involved, describe the parties who are or should be involved in the issue(s), discuss their point(s) of view, describe and analyze possible/alternative approaches to the issue(s), and choose one of the approaches they think is best and explain the benefits and risks. Students were evaluated based on an ABET rubric, which targets different aspects of professional and ethical responsibilities, such as the ability to use the code of ethics for describing ethical issues, describe parties involved and their points of view, analyze possible alternative approaches to an ethical problem, and choose an approach and explain the benefits and risks.

A total of five BSEET students were assessed in Fall 2016 in the course EE 320 Advanced Circuits and Systems using the performance criteria listed in Table 7. 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 reached in all three performance criteria. These results suggest that most students in the program have an effective understanding and commitment to professional and ethical responsibilities including a respect for diversity.

Table 7: Targeted Assessment for Outcome i: 1) Criterion 1-an ability to use a code of ethics to identify and describe ethical issues, 2) Criterion 2-an ability to identify the different parties involved and understand their points of view, and 3) Criterion 3-an ability to analyze possible alternative approaches and explain their benefits and risks.

Outcome (i) : EE 320 Fall 2016, Dr. Aaron Scher

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Code of Ethics	0	2	3	100%
2 - Parties	1	1	3	80%
3 - Risks & Benefits	1	1	3	80%

3.3.9 Targeted Assessment for Outcome l: the ability to analyze, design, and implement control systems, instrumentation systems, communications systems, computer systems, or power systems.

This outcome was assessed in EE 325 - Electronics III in Spring 2017.

Outcome (l) : EE 325, Spring 2017, Dr. Cristina Crespo

This outcome was assessed in EE 325 - Electronics in Spring 2017 using a project. The project involved the design, simulation, implementation, and characterization of an electronic circuit. Students were required to select an application of interest, and submit a project proposal. Once the project proposal was approved, the students were to design and simulate their electronic circuit, build it on a PCB layout, and experimentally verify and characterize the functionality of their design.

A total of four students were assessed in Spring 2017 using the performance criteria listed in Table 8. 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. This level was not reached for performance criteria 3.

Table 8: Targeted Assessment for Outcome l: 1) Criterion 1 - an ability to analyze electronic systems, 2) Criterion 2 - an ability to design electronic systems, and 3) - an ability to implement electronic systems.

Outcome (l) : EE 325 Spring 2017, Dr. Cristina Crespo

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Analyze	0	3	1	100%
2 - Design	0	3	1	100%
3 - Implement	2	1	1	50%

3.3.10 Targeted Assessment for Outcome m: the ability to apply project management techniques to electrical/electronic(s) systems.

This outcome was assessed in the ENGR465 - Capstone Project sequence in Fall 2016, Winter 2017, and Spring 2017.

Outcome (m) : ENGR 465, Fall 2016, Winter 2017, and Spring 2017, Dr. Aaron Scher, Dr. Scott Prahl, and Prof. Allan Douglas

This outcome was assessed in the ENGR 465 - Capstone Project, in Fall 2016, Winter 2017, and Spring 2017. The Capstone Project is a year-long (three-term) project that students complete in their senior year, which involves a major design experience. Throughout the year, students are required to complete the definition, design, implementation, and verification of a major engineering design project. During the initial stage, students work under the supervision of their capstone project advisor to select a project of adequate scope, and submit a project proposal. The proposal typically includes an explanation of the project relevance, a project definition or specification, a timeline with major milestones, a list of resources needed to complete the project, and a projected cost analysis. Once the proposal is approved by the academic advisor, students go through the different phases of design, implementation, and verification of their project. During this time, students have regular meetings with their project advisor in order to report progress, notify of plan changes if needed, present results, and perform prototype demonstrations. Once the design, implementation, and verification process is completed, and there is a final working prototype, students are required to generate a poster for inclusion in the annual Student Project Symposium, deliver an oral presentation, and submit a formal written report.

A total of eight students were assessed over the course of three terms (Fall 2016, Winter 2017, and Spring 2017) using the performance criteria listed in Table 9. 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 reached in two of the three performance criteria (i.e. Criteria 1 and 3). The performance level for Criteria 3 is 77.8%, which is very close to the minimum acceptable performance level of 80%. These results suggest that most students in the program have an ability to apply project management techniques to electrical/electronic(s) systems.

Table 9: Targeted Assessment for Outcome m: 1) Criterion 1-an ability to apply project management techniques, 2) Criterion 2- an ability to manage design flow, and 3) Criterion 3-an ability to document and present designs.

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Apply	1	4	3	87.5%
2 - Manage	2	3	3	75%
3 - Document	1	3	4	87.5%

3.3.11 Targeted Assessment for Outcome n: the ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems.

This outcome was assessed in EE 320 - Advanced Circuits and Systems in Fall 2014.

Outcome (n) : EE 320, Fall 2016, Dr. Aaron Scher

This outcome was assessed using questions from the final exam. Students were required to represent an snubber circuit in the s-domain, as well as find the transfer function (using the Laplace Transform), frequency response, impulse response, and steady-state sinusoidal response of an RC filter.

Five students were assessed in Spring 2017 in the course EE 320 - Advanced Circuits and Systems using the performance criteria listed in Table 10. 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.

Table 10: Targeted Assessment for Outcome n: 1) Criterion 1- ability to identify appropriate and relevant concepts of mathematics to solve problems related to electrical/electronic(s) systems, 2) Criterion 2- an ability to apply mathematics to solve problems related to electrical/electronics systems

Outcome (n) : EE 320, Fall 2016, Dr. Aaron Scher

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% Students ≥ 2
1 - Identify	1	3	1	80%
2 - Apply	1	3	1	80%

3.3.12 2016-2017 Indirect Assessment

In addition to direct assessment measures, the student outcomes a – n were indirectly assessed through a senior exit survey.

Question 38 in the survey presents the program student learning outcomes and asks "Please rate your proficiency in the following areas". Table 11 shows the results of the indirect assessment of the BSEET student outcomes for the 2016-2017 graduating class. Four BSEET graduating seniors completed the survey.

The results show that for outcome (e) - an ability to function effectively as a member or leader on a technical team, 25% of the respondents indicated limited proficiency, while the majority (75%) indicated at least some proficiency. For all other outcomes, 100% respondents indicated that after completing the BSEET program they have at least some proficiency. One one hand, these results suggest that the majority of BSEET graduating students feel at least some proficiency in all BSEET student outcomes. However, the sample size is very low (four survey responses), which may not accurately reflect the proficiency of our recent graduates. The BSEET Program Director has brought this issue to the attention of the Office of Academic Excellence and Assessment, and will be discussing ways to increase the response rate for next year.

4 Changes Resulting From Assessment

This section describes the changes resulting from the assessment activities carried out during the year 2016-2017. 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 BSEET faculty met on Oct. 12, 2017 to review the assessment results and determine whether any changes are needed to the BSEET curriculum or assessment methodology based on the results presented in this document. The objective set by the BSEET 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 12 provides a summary of the 2016-17 assessment results for the outcomes which were directly assessed. This data is separated into outcomes and courses assessed.

Table 11: Table of results of the indirect assessment for the BSEET Student Outcomes as reported in the Senior Exit Survey (AY 2016-17)

Question	High proficiency	Proficiency	Some proficiency	Limited proficiency
a. An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.	0	4	0	0
b. An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies.	1	3	0	0
c. An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	1	3	0	0
d. An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives.	0	4	0	0
e. An ability to function effectively as a member or leader on a technical team.	0	2	1	1
f. An ability to identify, analyze, and solve broadly-defined engineering technology problems.	0	4	0	0
g. An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	0	3	1	0
h. An understanding of the need for and an ability to engage in self-directed continuing professional development.	0	4	0	0
i. An understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.	0	3	1	0
j. A knowledge of the impact of engineering technology solutions in a societal and global context.	0	3	1	0
k. A commitment to quality, timeliness, and continuous improvement.	0	4	0	0
l. The ability to analyze, design, and implement control systems, instrumentation systems, communications systems, computer systems, or power systems.	0	3	1	0
m. The ability to apply project management techniques to electrical/electronic(s) systems.	0	2	2	0
n. The ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems.	0	1	3	0

Table 12: Summary of BSEET direct assessment for AY2016-17.

	Total Students	Students ≥ 2	% Students ≥ 2
a - Fundamentals - EE 320 (Scher)			
1 - Concepts	5	5	100%
2 - Skills	5	5	100%
3 - Tools	5	4	80%
a - Fundamentals - ENGR 465 (Scher, Prahl, Douglas)			
1 - Concepts	9	8	89%
2 - Skills	9	8	89%
3 - Tools	9	8	89%
f - Problem solving - ENGR 465 (Scher, Prahl, Douglas)			
1 - Identify	8	8	100%
2 - Analyze	8	7	88%
3 - Solve	8	6	75%
g - Communication - ENGR 465 (Scher, Prahl, Douglas)			
1 - Written	8	8	100%
2 - Oral	8	8	100%
3 - Graphical	8	8	100%
4 - Literature	8	8	100%
5 - Audience	8	8	100%
h - Lifelong learning - ENGR 267 (Aboy)			
1 - Ability	10	9	91%
2 - Recognition	NA	NA	NA%
h - Lifelong learning - EE 430 (Aboy)			
1 - Ability	1	1	100%
2 - Recognition	NA	NA	NA%
i - Ethics - EE 320 (Scher)			
1 - Code of ethics	5	4	100%
2 - Parties	5	4	80%
3 - Risks and benefits	5	4	80%
l - Electronic systems - EE 325 (Crespo)			
1 - Analyze	4	4	100%
2 - Design	4	4	100%
3 - Implement	4	2	50%
m - Project management - ENGR 465 (Scher, Prahl, Douglas)			
1 - Apply	8	7	87.5%
2 - Manage	8	6	75%
3 - Document	8	7	87.5%
n - Advanced Mathematics - EE 320 (Scher)			
1 - Identify	5	4	80%
2 - Apply	5	4	80%

Table 13: Comparison of results with previous assessment year. Shown are % students ≥ 2 for 2016-17 and the previous year the outcome was assessed. Sample size and results includes combined total of students for each outcome evaluated within the academic year.

	Current	Previous
a - Fundamentals	2016-17 Sample size =14	2012-13 Sample size =21
1 - Concepts	93%	95.2%
2 - Skills	93%	90.5%
3 - Tools	86%	85.7%
f - Problem solving	2016-17 Sample size =8	2013-14 Sample size = 11
1 - Identify	100%	100
2 - Analyze	88%	100
3 - Solve	75%	81.8
g - Communication	2016-17 Sample size =8	2013-14 Sample size =18
1 - Written	100%	77.8%
2 - Oral	100%	94.4%
3 - Graphical	100%	88.9%
4 - Literature	100%	77.8%
5 - Audience	100%	72.2%
h - Lifelong learning	2016-17 Sample size =10	2013-14 Sample size =15
1 - Ability	90%	87%
2 - Recognition	NA	87%
i - Ethics	2016-17 Sample size =5	2015-16 Sample size =4
1 - Code of ethics	100%	100%
2 - Parties	80%	75%
3 - Risks and benefits	80%	100%
l - Electronic systems	2016-17 Sample size =4	2015-16 Sample size =9
1 - Analyze	100%	80%
2 - Design	100%	60%
3 - Implement	50%	80%
m - Project management	2016-17 Sample size =8	2013-14 Sample size =18
1 - Apply	87.5%	88.9%
2 - Manage	75%	77.8%
3 - Document	87.5%	88.9%
n - Advanced Mathematics	2016-17 Sample size =5	2014-15 Sample size =7
1 - Identify	80%	100%
2 - Apply	80%	100%

4.1 Changes Resulting from the 2016-2017 Assessment

The results of the 2016-17 Assessment indicate that the minimum acceptable performance level of 80% was not met on all performance criteria for all assessed outcomes. Areas of improvement to the curriculum were discussed during the Closing the Loop Meeting in October 2017 with respect to these results. These areas include:

- **Outcome a (Fundamentals):**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are consistent with those obtained the last time this outcome was assessed in the 2012-13 assessment cycle.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.
- **Outcome f (Problem Solving):**
  - **Results:** The results indicate that the acceptable performance level was reached in two of the three performance criteria (i.e. Criteria 1 and 2). The performance level for Criteria 3 is 75%, which is very close to the minimum acceptable performance level of 80%. Overall, these results are comparable to those obtained the last time this outcome was assessed in 2013 - 14. These results suggest that most students in the program have an ability to identify, analyze, and solve broadly-defined engineering technology problems.
  - **Recommendation:** The faculty noted that the results were close to the threshold, and that the resolution of these measurements is effected by the low sample size (i.e., a single measurement moving from the 1 to the 2 category would have yielded a result above the threshold). Due to the low sample size and measured performance close to threshold, these results do not warrant any significant changes to the program. Instead the faculty have been advised that some students may need additional support and experience solving broadly-defined engineering technology problems. One idea is to better encourage students to utilize Oregon Tech's Peer Consulting Services. Peer Consulting is a free academic support service available to all students that can help clarify and reinforce problem solving skills that students are learning in class.
- **Outcome g (Communication):**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results show an improvement over those obtained the last time this outcome was assessed in the 2013-14 assessment cycle.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.
- **Outcome h (Lifelong Learning):**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are consistent with those obtained the last time this outcome was assessed in the 2013-14 assessment cycle.

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

- **Outcome i (Ethics):**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are generally consistent with those obtained the last time this outcome was assessed in the 2015-16 assessment cycle.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

- **Outcome l (Electronic Systems):**
  - **Results:** The results indicate that the acceptable performance level was reached in two of the three performance criteria (i.e. Criteria 1 and 2). The performance level for Criteria 3 is 50%, which is under the minimum acceptable performance level of 80%.
  - **Recommendation:** Since the sample size is very low (4 students), the faculty decided to reassess this outcome next year to increase the sample size. However, the 50% score for the implement performance criteria does reflect a need for more design skills and experience that has already been noticed by the EET faculty, and was discussed at the previous year's Closing the Loop meeting. In response, the faculty are actively developing and assigning more design based assignments and projects. For example, EE 320 (Advanced Circuits Systems and Analysis) is a calculus-based circuits course that most EET students take in the Fall after transferring into Oregon Tech. A new design project has been developed for EE 320 where student teams design and implement a capacitive proximity sensor system, while following design constraints imposed by the instructor. For this project, teams must implement their circuit on a printed circuit board, which involves laying out the board using an EDA tool like KiCad, sourcing and purchasing materials, soldering components to the board, testing, and troubleshooting. The goal is that by giving EET students practical experience designing electronic systems in their first term at Oregon Tech, they will be better prepared for upcoming design projects in more advanced electronics and capstone courses.

- **Outcome m (Project Management):**
  - **Results:** The results indicate that the acceptable performance level was reached in two of the three performance criteria (i.e. Criteria 1 and 3). The performance level for Criteria 2 is 75%, which is very close to the minimum acceptable performance level of 80%. These results suggest that most students in the program have an ability to apply project management techniques to electrical/electronic(s) systems. These results are consistent with those obtained the last time this outcome was assessed in the 2013-14 assessment cycle.
  - **Recommendation:** The faculty noted that the results were close to the threshold, and that the resolution of these measurements is effected by the low sample

size (i.e., a single measurement moving from the 1 to the 2 category would have yielded a result above the threshold). Due to the low sample size and measured performance close to threshold, these results do not warrant any significant changes to the program. Instead the faculty have been advised that some students may need additional support and experience managing design flow. One idea is to encourage EET students to take systems engineering and technical management (SEM) courses. Certain SEM courses are available to EET students as upper division engineering technical electives.

- **Outcome n (Advanced Mathematics):**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are consistent with those obtained the last time this outcome was assessed in the 2014-15 assessment cycle.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

4.2 Changes to Assessment Methodology

At the 2017 BSEET Closing the Loop meeting, the EET faculty noticed that several assessments had low sample sizes, which makes the results less conclusive. This has prompted the faculty to propose a change to the assessment methodology in which low sizes are handled differently. Starting this assessment cycle and going forward, a low sample size will be considered to be a sample size of equal to or less than than 10 students (i.e. a sample size ≤ 10). Such a sample size will be classified as "low", since a single measurement moving from one category to another would yield a change to the results greater than or equal to 10%. This could give one student a disproportionate amount of weight when considering programmatic changes based on assessment data. For low sample sizes, if the results are below 70% (which is a full 10% below the minimum threshold of 80%) for any performance criteria, then this will result an an automatic re-assessment of the respective learning outcome the next academic year. The two years of data will be combined to generate a larger sample size, and the net results will be examined at the next Closing the Loop meeting. If a low sample size yields results under the minimum threshold of 80%, but greater than 70%, then that learning outcome will not necessarily result an an automatic re-assessment. For such borderline cases, the EET faculty will be advised that the minimum performance criteria was not met and that some students may need additional support in the respective learning outcome. Areas of improvement will be discussed at the Closing the Loop meeting in the context of a low sample size, and results will be closely compared with those from previous assessment years.