— B. S. in Electrical Engineering —

2021–22 Assessment Report

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Contents

1 Introduction

1.1 Background

The BS Electrical Engineering (BSEE) program is offered by the Electrical Engineering & Renewable Energy (EERE) department. The BSEE program is designed to prepare professionals who can perform a wide range of functions within the electrical engineering industry, while also providing solid preparation for students intending to continue to graduate school to pursue master's degrees in engineering, engineering management, MBAs, or JDs. Specifically, the BSEE program lectures and laboratories equip students with a solid theoretical foundation in math, science and engineering, as well as problem solving abilities and immediately useable practical skills.

The engineering topics included in the BSEE program provide students with a strong foundation in the fundamental areas of electrical engineering, including circuits, analog electronics and solid state devices, digital circuits and systems, microcontrollers and embedded systems, linear systems and DSP, communication systems , control systems, and computer programming. To increase flexibility the program includes some technical elective courses. Engineering design is introduced early and emphasized in most engineering courses. The broad education component of the program is provided through the general education curriculum, which includes courses in communication, humanities, social sciences, and management. This helps reinforce some of the program outcomes, such as effective communication with a range of audiences, critical thinking, ability to analyze ethical issues, and a broader understanding of social, economic, and environmental issues in a global context.

The BSEE program culminates with a three-term capstone design project. This year-long project is intended to encompass a major engineering design experience incorporating appropriate engineering standards and multiple constraints, as well as using the knowledge and skills acquired in earlier coursework.

1.2 Program History

The Bachelor of Science in Electrical Engineering (BSEE) program at the Oregon Institute of Technology (Oregon Tech) was launched in Fall 2007. The program was designed as a classical electrical engineering degree, complementing the portfolio of engineering degrees on campus, namely Civil Engineering, Mechanical Engineering, and Renewable Energy Engineering. All engineering programs at Oregon Tech are currently ABET EAC accredited. The BSEE program received its first ABET general review visit and accreditation in 2012. The last ABET general review visit took place in 2016. At that time, no deficiencies or weaknesses were identified. The next ABET general review visit is scheduled for AY2022-23.

1.3 Program Locations

The BSEE program is located at both Oregon Tech campuses (Klamath Falls and Portland Metro), serving a large portion of rural Oregon and California, as well as the Portland metropolitan area.

The Klamath Falls campus is a residential campus located in Klamath Falls, a city of around 40,000 residents in Southern Oregon. Nestled on the eastern slope of the Cascade Mountains, the 190-acre campus offers spectacular views, an average of 300 days of sunshine per year, and ample opportunities to enjoy the great outdoors. This location also has access to exceptional natural energy resources, such as solar and geothermal. The Oregon Renewable Energy Center (OREC) and the affiliated Geo-Heat center are located here, providing exceptional opportunities for students to gain hands-on experience in the fields of power, energy, and renewable energy.

The Portland Metro campus is an urban non-residential campus located in Wilsonville, on the south of the greater Portland metro area, 15 miles south of downtown Portland. The campus is situated in a wooded business park setting among several technology companies, and offers excellent access to internships and other technological collaborations with the Silicon Forest (as the semiconductor industry in the Portland metropolitan area is known).

1.4 Program Constituencies and Industry Relationships

To maintain a program that is current with the needs of industry and of sufficient technical rigor requires input from many different constituents. Some of the constituents are industrial and some academic. The various constituents that are used in the program assessment process include BSEE graduates and students, Industry Advisory Board (IAB) members, employers and faculty. Input from these constituents is gathered and reviewed in a periodic manner to ensure the PEOs remain aligned with the direction of industry, as well as the university´s mission and resources.

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.

The IAB and the program faculty meet once or twice per year (typically Fall and Spring terms). At these meetings, faculty have an opportunity to provide and update on the state of the department and its programs, as well as receiving input and feedback from the IAB on any new departmental initiatives in light of the current industry trends and needs. The IAB periodically reviews the program PEOs and SOs to ensure they remain relevant and responsive to the needs of industry. Program changes are also reviewed by the IAB before implementation.

1.5 Program Enrollment and Graduation Data

Table 1 presents the BSEE program enrollment from Fall 2016 to Fall 2020. Table 2 presents the number of BSEE degrees awarded over the same time span. Based on a rolling average of survey data collected for the BSEE graduating classes of 2017-2019, 89% of BSEE graduates are employed and 5% involved in continued education six months after graduation. The median salary of BSEE graduates is reported as $64,000. Current employers of BSEE graduates include Lawrence Livermore National Laboratory, Black & Veatch, ASML, Intel, and Quorvo, Inc.

Table 1: BSEE enrollment in the last five academic years (headcount of both full and part-time students in week 4 of the Fall term)

	2017-18	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Klamath Falls	75	90	86	76	58
Portland Metro	118	104	101	85	63
Total	193	194	187	161	121

Table 2: BSEE degrees awarded for the last five academic years.

	2017-18	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Klamath Falls	14	18	17	16	14
Portland Metro	25	31	16	17	12
Total	39	49	33	33	26

2 Program Mission, PEOs and SOs

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 (PEOs) for the BSEE program are:

1. 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.
2. 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.
3. 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.
4. 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 PEOs and Institutional Mission

The Oregon Tech mission statement is as follows: "Oregon Institute of Technology ("Oregon Tech"), Oregon's public polytechnic university, offers innovative, professionally-focused undergraduate and graduate degree programs in the areas of engineering, health, business, technology, and applied arts and sciences. To foster student and graduate success, the university provides a hands-on, project-based learning environment and emphasizes innovation, scholarship, and applied research. With

a commitment to diversity and leadership development, Oregon Tech offers statewide educational opportunities and technical expertise to meet current and emerging needs of Oregonians as well as other national and international constituents."

The mission statement was approved by the Oregon Tech Board of Trustees on May 30, 2019 and reviewed by the Higher Education Coordinating Commission (HECC) on August 8, 2019.

The BSEE PEOs are in alignment with the university's mission. Specifically, PEO1 relates to graduates having a strong technical background in electrical engineering, as well as analytical, critical-thinking and problem solving skills that will allow them to succeed as professionals, whereas This links to the university's mission of offering "innovative, professionally-focused degree programs" in engineering, with an emphasis on "hands-on education".

PEO2 specifies the types of careers and engineering positions that graduates of the program should be ready to fulfill, which are consistent with the needs of the electrical engineering industry in the state of Oregon and nationwide. PEO3 has a focus on professional development and lifelong learning so that graduates will stay current in the evolving field of electrical engineering. These PEOs are in alignment with the universtiy's mission to meet "current and emerging needs".

PEO4 focuses on graduates being effective collaborators and communicators, assuming technical and managerial leadership roles throughout their careers. This is consistent with the university's mission to be committed to leadership development.

2.4 Program Student Outcomes

The student outcomes (SOs) of the BSEE program correspond to the ABET EAC (1)-(7) student outcomes. At the time of graduation, BSEE students must demonstrate:

1. (**Problem Solving**) an ability to identify, formulate, and solve engineering problems problems by applying principles of engineering, science, and mathematics
2. (**Design/Broader Factors**) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (**Communication**) an ability to communicate effectively with a range of audiences
4. (**Ethics**) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (**Teamwork**) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. (**Experimentation**) an ability to develop and conduct appropriate experimentation, interpret data analyze and interpret data, and use engineering judgement to draw conclusions

7. (**Independent Learning**) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

2.5 Relationship between PEOs and SOs

The mission and program educational objectives (PEOs) describe the capabilities of the graduates after they have entered their chosen career. The student outcomes (SOs) are used to develop the necessary foundation of knowledge and skills that a graduate will need to accomplish these objectives as they mature in their disciplines. It is the student outcomes that allow graduates to excel at the educational objectives.

Table 3 shows a map of the BSEE student outcomes to the program education objectives. As the table indicates, the student learning outcomes correlate strongly with the education objectives, with each SO mapping to at least one PEO.

Table 3: Mapping between BSEE SOs (1)–(7) and PEOs

Student Outcome	PEO1	PEO2	PEO3	PEO4
(1) Problem Solving	•	•		
(2) Design/Broader Factors	•		•	
(3) Communication				•
(4) Ethics	•	•		•
(5) Teamwork		•		•
(6) Experimentation	•	•		
(7) Independent Learning			•	

2.6 Process for Establishment and Revision of PEOs and SOs

The PEOs were developed by the program faculty in consultation with the IAB. The BSEE student outcomes were set in accordance to the current ABET criteria (Criterion 3) for accrediting engineering programs. The BSEE SOs include ABET EAC outcomes (1)-(7), which are the general outcomes for all baccalaureate engineering programs.

The PEOs and SOs are periodically reviewed to ensure they stay relevant. The revision process

involves different constituents. At the annual EERE Convocation meeting in the Fall, the EERE faculty have an opportunity to review the PEOs and SOs for each program in light of the results from the assessment activities conducted the previous year (i.e., direct assessments collected in program courses, as well as indirect assessment from senior exit survey), results of graduate surveys provided by Career Services, the input gathered from IAB members and employers during the previous academic year, as well as any changes to the institutional or college mission, or the ABET criteria (if any have occurred). Based on the discussion, the EERE faculty may approve to make no changes to the program SOs or make recommendations for proposed changes. The results are determined by a simple majority vote.

During the academic year, one or two meetings are held with the IAB (typically Fall and Spring). These meetings provide an opportunity for faculty to present program updates, assessment results, etc., as well as gather input from the IAB to inform strategic direction of the program. If changes to the SOs have been proposed by the faculty at the Fall Convocation meeting, these are discussed with the IAB members. The IAB members may approve the changes or propose alternative changes. The results are determined by a simple majority vote.

As part of the assessment cycle, the BSEE program faculty have a Closing-the-Loop meeting. This meeting is typically scheduled in the Fall term, prior to 31 October. At this meeting, the program faculty discuss the results of the assessment activities carried out during the previous academic year and have an opportunity to review the SOs. If any changes to the SOs have been approved by the faculty and the IAB, these are announced at the Closing-the-Loop meeting and included in the annual Assessment Report, which is submitted to the Director of Assessment for the university, and if approved, the new SOs are published on the BSEE program website and submitted for inclusion in the catalog for the following academic year. Table 4 summarizes the process for review of the BSEE program student outcomes.

Table 4: BSEE PEO and SO Review Process

Event	**Task**
Convocation	EERE faculty review PEOs and SOs in light of assessment data and other feedback collected in previous academic year. Faculty may propose and approve changes to PEOs or SOs
IAB meeting	If changes to PEOs or SOs have been proposed and approved by EERE faculty, they are presented to IAB for consideration and approval or revision.
Closing the Loop (CTL) meeting	If PEO or SO changes have been approved by EERE faculty and IAB, they are announced and included in Assessment Report. New PEOs or SOs are submitted for update on the website and catalog for the following academic year.

2.7 Institutional Assessment and ISLOs

In addition to program-level student outcomes, Oregon Tech has defined and regularly assesses university-wide student outcomes. These are commonly referred to as Institutional Student Learning Outcomes (ISLOs) and are linked to the general education requirements which are common to all majors. A description of the ISLOs can be found at https://www.oit.edu/academic-excellence/GEAC/essential-studies/eslo.

Oregon Tech's ISLOs support the university's mission. They reflect the common expectations about the knowledge, skills, and abilities that Oregon Tech students will acquire and are reflected in the General Education requirements that lay the foundation upon which the major curricula build. Engaging in these ISLOs will support Oregon Tech graduates in developing the habits of mind and behaviors of professionals and lifelong learners.

Institutional Student Learning Outcomes: Oregon Tech students will

- (ISLO1) **communicate** effectively orally and in writing;
- (ISLO2) engage in a process of **inquiry and analysis**;
- (ISLO3) make and defend reasonable **ethical judgements**;
- (ISLO4) collaborate effectively in **teams** or groups;
- (ISLO5) demonstrate **quantitative literacy**;
- (ISLO6) explore **diverse perspectives**.

An initial comparison of the ISLOs to the BSEE SOs reveals good alignment between the two sets of outcomes. Both the program level and institutional level outcomes support and complement each other in a synergistic manner. This also facilitates the coordination of assessment and continuous improvement efforts at the program and institutional level. Table 5 shows a tentative map of the BSEE student outcomes to the ISLOs. As the table indicates, the student learning outcomes correlate strongly with the ISLOs, with each SO mapping to at least one ISLO.

Table 5: Mapping between BSEE SOs (1)–(7) and ISLOs

Student Outcome	**ISLO1:** Communication	**ISLO2:** Inquiry and Analysis	**ISLO3:** Ethical Judgements	**ISLO4:** Teamwork	**ISLO5:** Quantitative Literacy	**ISLO6:** Diverse perspectives
(1) Problem Solving		•				
(2) Design/Broader Factors						•
(3) Communication	•					
(4) Ethics			•			
(5) Teamwork				•		
(6) Experimentation					•	
(7) Lifelong Learning		•				

2.8 Mapping of BSEE Curriculum to SOs and ISLOs

Table 6 shows the mapping of the BSEE curriculum to the student outcomes (SOs) (1)-(7), as well as the institutional ISLOs. For each course, the table indicates whether the outcome is covered at the foundational (F), practice (P), or capstone (C) level. In the case of electives, the student outcomes covered are dependent on the specific elective course selected by the student. They have been marked with X.

Table 6: Mapping between BSEE courses and student outcomes

BSEE Student Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ISLOs	**ISLO2**	**ISLO6**	**ISLO1**	**ISLO3**	**ISLO4**	**ISLO5**	**ISLO2**
Communication							
SPE 111: Public Speaking	F		F				
SPE 321: Small Group & Team Comm.			P		F		
WRI 121: English Composition	F		F				
WRI 227: Technical Report Writing	P		P				

Table 6: Mapping between BSEE courses and student outcomes

BSEE Student Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ISLOs	**ISLO2**	**ISLO6**	**ISLO1**	**ISLO3**	**ISLO4**	**ISLO5**	**ISLO2**
WRI 3xx/4xx: Adv. Writing Elective	P		C				
Math/Science							
CHE 201/4: General Chemistry & Lab	F				F	F	
MATH 251: Differential Calculus	F					F	
MATH 252: Integral Calculus	P					P	
MATH 253: Sequences and Series	P					P	
MATH 254: Vector Calculus I	C					C	
MATH 321: Applied Differential Eq. I	C					C	
MATH 341: Linear Algebra I	C					C	
MATH 465: Mathematical Statistics	C					C	
PHY 221: General Physics w/ Calculus	F				F	F	
PHY 222: General Physics w/ Calculus	P				F	P	
PHY 223: General Physics w/ Calculus	C				F	C	
Math/Science Elective	P					P	
General Engr. & Programming							
CST 116: C++ Programming I	F					F	
ENGR 101: Intro. to Engineering I	F	F	F	F	F		F
ENGR 102: Intro. to Engineering II	F	F	F	F	F		F
ENGR 267: Engineering Programming	P					P	
Electrical Engineering							
EE 131: Digital Electronics I	F	F			F	F	F
EE 133: Digital Electronics II	F					F	F
EE 221: Circuits I	F		F		F	F	F
EE 223: Circuits II	F		F		F	F	F
EE 225: Circuits III	P		P		P	P	P
EE 321: Electronics I	P	F	P		P	P	P
EE 323: Electronics II	P	F	P		P	P	P
EE 325: Electronics III	C	P	C		C	C	C
EE 331: Digital Sys. Design w/ HDL	P					P	P

Table 6: Mapping between BSEE courses and student outcomes

BSEE Student Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ISLOs	**ISLO2**	**ISLO6**	**ISLO1**	**ISLO3**	**ISLO4**	**ISLO5**	**ISLO2**
EE 333: Microcontroller Engineering	P					P	P
EE 335: Adv. Microcontroller Engr.	C	P	P	P	C	C	C
EE 341: Elec. and Mag. w/ Trans. Lines	P					P	P
EE 343: Solid-State Electronic Devices	P					P	P
EE 401: Communication Systems	C	C				C	C
EE 430: Linear Systems & DSP	C	C			C	C	C
EE 461: Control Systems Design	C					C	C
Engineering Electives (varies)	X	X	X	X	X	X	X
ENGR 465: Capstone Project	C	C	C	C	C	C	C
Business and General Education							
MGT 345: Engineering Economy		F		P		F	
Humanities Electives (varies)	X	X	X	X	X	X	X
Social Science Electives (varies)	X	X	X	X	X	X	X

3 Cycle of Assessment of Student Outcomes

3.1 Introduction, Methodology, and the Assessment Cycle

The BSEE faculty conducts periodic assessment of student outcomes. Assessment of program student outcomes is conducted over a three (3) year cycle, which is shown in Table 7. For each outcome, assessment data is collected via direct and indirect assessment measures.

In addition to the program outcomes scheduled for a particular year, assessment is also performed for Oregon Tech's Institutional Student-Learning Outcomes (ISLOs) that are scheduled for that particular year by the Executive Assessment Committee. More information on institutional assessment was presented in section 2.7 (Institutional Assessment and ISLOs).

The correspondence between programmatic student outcomes (1)-(7) and institutional ISLOs is presented in Table 7. In order to streamline the assessment process, effective 2022-23 the BSEE program assessment will be modified to match the current university ISLO assessment cycle. The last three columns of Table 7 show the new assessment cycle, with the BSEE SO outcome assessment (shown as (•)) overlaps with the ISLO outcome assessment (shown as (x)).

Table 7: BSEE Outcome Assessment Cycle. Year of current report is shaded. Bullets (•) indicate BSEE SO (1)-(7) assessment cycle. Crosses (x) indicate ISLO assessment cycle.

Student Outcome	2019-20	2020-21	**2021-22**	2022-23	2023-24	2024-25
(1) Problem Solving		•			•	
ISLO2 Inquiry & Analysis		x			x	
(2) Design/Broader Factors		•		•		
ISLO6 Diverse Perspectives	x			x		
(3) Communication	•		•			•
ISLO1 Communication			x			x
(4) Ethics			•			•
ISLO3 Ethical Reasoning			x			x
(5) Teamwork			•			•
ISLO4 Teamwork			x			x
(6) Experimentation			•		•	
ISLO5 Quantitative Literacy		x			x	
(7) Independent Learning	•				•	
ISLO2 Inquiry & Analysis		x			x	

3.2 Methodology for Assessment of Student Outcomes

At the beginning of Fall term, 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 (refer to Table 7), as well as the courses and terms where these outcomes will be assessed. For each outcome, two direct assessment activities are typically planned from two different campus locations.

Direct assessment of student outcomes is performed as part of the course curriculum by means of assignments, exams and course projects. 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.

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 are reviewed by the faculty at the annual closing-the-loop meeting, which takes place at the beginning of Fall term in the following academic year. 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 the assessment data indicates performance below the established level for any student outcome, that triggers the process of continuous improvement. Based on the evidence, the faculty decides on an adequate action plan. The possible courses of action are:

- 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.

Degree completion, retention and equity data are also collected by the university and annually reviewed by the program faculty as part of an initiative to identify and close equity gaps. This is done through the use of the university's dashboards, which allow to track the 6-year graduation rates as well as the 1-year retention rates, and sort this data along different demographic categories such as gender, race and socio-economic status. At the closing-the-loop meeting, program faculty review the equity data for their program to identify trends or equity gaps. Potential ways to address these are discussed and appropriate action plans are developed as needed.

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 submitted to the Office of Academic Excellence for review by the Executive Assessment Committee. If action plans include suggested changes to the curriculum, these are presented and discussed with all the department faculty, as well as with the Industry Advisory Board. If approved, these changes are submitted to the Curriculum Planning Commission and updated in the catalog for the following academic year.

4 Assessment Data

4.1 Direct Assessment

The following student outcomes were assessed in the 2021-22 academic year in the courses indicated:

- (2) Design/Broader Factors (ISLO6 Diverse Perspectives) : ENGR 465 (PM)
- (3) Communication (ISLO1 Communication): ENGR 465 (KF), ENGR 465 (PM)
- (4) Ethics (ISLO3 Ethical Thinking): EE 401 (KF), ENGR 465 (PM)
- (5) Teamwork (ISLO4 Teamwork): ENGR 465 (KF), EE 325 (PM)
- (6) Experimentation (ISLO5 Quantitative Literacy): EE 333 (KF), EE 323 (PM)

The sections below describe the 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 1 - developing level, 2 - accomplished level, and 3 - exemplary level for each performance criteria, as well as the percentage of students performing at an accomplished level or above (i.e., assessed level ≥ 2).

The target attainment level for all outcomes is 80% of students at or above a level 2 (Accomplished). All direct assessment was performed using the rubrics in section 6 (Rubrics).

4.1.1 Direct Assesssment of Outcome (2) Design/Broader Factors

An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

A total of 4 BSEE students were assessed at the Portland-Metro campus (KF: N = 0; PM: N = 4). The results are presented in Table 9. This outcome was assessed at the Klamath Falls campus in the previous academic year (AY2020-21).

Portland Metro, ENGR 465 – Spring 2022, Aaron Scher

This outcome was assessed in ENGR 465 - Capstone Project. 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 includes an background review of the state of art, explanation of the project relevance and problem addressed, a project definition or specification, a proposed design, 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. Throughout the term, students present status updates of their project to the class and answer questions. Once the design, implementation, and verification process is completed, and there is a final working prototype, students are required to generate and present a poster for the annual Student Project Symposium and submit a formal written report.

The capstone project requires the application of engineering design principles and skills to produce solutions. Beyond the technical specifications, students must consider other factors in their design solution, such as public safety, as well as environmental and economic factors, among others.

Table 8: Results of direct assessment for student outcome (2) Design/Broader Factors

Performance Criteria	**1 Developing**	**2 Accomplished**	**3 Exemplary**	**Students ≥2**
Klamath Falls, N/A, N=0				
2.1 Design	-	-	-	-%
2.2 Broader Factors	-	-	-	-%
Portland Metro, ENGR 465, N=4				
2.1 Design	0	3	1	100%
2.2 Broader Factors	0	4	0	100%

4.1.2 Direct Assessment of Outcome (3) Communication

An ability to communicate effectively with a range of audiences

A total of 9 BSEE students were assessed in Klamath Falls and 4 BSEE students were assessed at the Portland-Metro campus (KF: N = 9; PM: N = 4). The results are presented in Table 9.

Klamath Falls, ENGR 465 – Spring 2022, Feng Shi

This outcome was assessed in ENGR 465 - Capstone project. The capstone project is a year-long (three-term) project that students complete in their senior year, which involves a major design experience. Students are required to work in teams, for some projects the teams are multidisciplinary, including students from different engineering disciplines (e.g., electrical, mechanical, and renewable energy engineering). The student teams are asked to give three presentations throughout the year

to demonstrate their project progress, as well as a submit a final written report at the conclusion of their project. The teams are also required to participate in the student senior project symposium in Spring term. This is an event featuring student projects from different programs at the university. Students, faculty, and members of the public are invited to attend. Participants typically deliver a poster presentation and a working demo. As attendees walk through the event hall, students get an opportunity to explain and demo their project to a broad and diverse audience.

The capstone project provides an opportunity to assess the students' ability for verbal, written, and graphical communication directed to a range of audiences.

Portland Metro, ENGR 465 – Spring 2022, Aaron Scher

This outcome was assessed in ENGR 465 - Capstone Project. 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 a major engineering design project from definition to implementation. Students start by submitting a project proposal, which includes a background review of the state of art, explanation of the project relevance and problem addressed, a project specification, a proposed design, a timeline with major milestones, a list of resources needed and a projected cost analysis. Once the proposal is approved, 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. Throughout the term, students present status updates of their project to the class and answer questions. Once this process is completed, and there is a final working prototype, students are required to generate and present a poster for the annual Student Project Symposium and submit a formal written report.

Student's ability to communicate is assessed through the periodic status update presentations given to the rest of the class, as well as the final project report. Students are evaluated on their ability to communicate in different forms (oral, written, and graphical communication), as well as to engage different audiences (e.g., technical vs non-technical).

Table 9: Results of direct assessment for student outcome (3) Communication

Performance Criteria	**1 Developing**	**2 Accomplished**	**3 Exemplary**	**Students ≥2**
Klamath Falls, ENGR 465, N=9				
3.1 Written	0	3	6	100%
3.2 Oral	0	3	6	100%
3.3 Graphical	0	3	6	100%
3.4 Audience	0	3	6	100%
Portland Metro, ENGR 465, N=4				
3.1 Written	0	4	0	100%
3.2 Oral	0	4	0	100%
3.3 Graphical	0	4	0	100%
3.4 Audience	0	4	0	100%

4.1.3 Direct Assessment of Outcome (4) Ethics

An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

A total of 14 BSEE students were assessed across the Klamath Falls and Portland Metro campuses (KF: N = 8; PM: N = 6). The results are presented in Table 10.

Klamath Falls, EE 401 – Winter 2022, Aaron Scher

This outcome was assessed in EE 401 - Communication Systems. Students were asked to read two case studies and respond to each case study with an essay that answers a set of questions. The first case study considers the waste disposal practice of a small company from the perspective of a newly hired engineer, and students were asked to identify the ethical dilemma and issues based on the IEEE Code of Ethics, analyzed possible approaches to the issues, and select one of the approaches and explain the benefits and risks. The second case study involves the ethics behind the supply and extraction of rare-earth materials necessary to the production of EV batteries. ENGR 465 students were also asked to write an additional essay analyzing the ethical issues of their capstone projects, based on series of questions and prompts.

Portland Metro, ENGR 465 – Spring 2022, Aaron Scher

This outcome was assessed in ENGR 465 - Capstone Project, using the same assignment as the Klamath Falls campus, detailed above.

Table 10: Results of direct assessment for student outcome (4) Ethics

Performance Criteria	**1 Developing**	**2 Accomplished**	**3 Exemplary**	**Students ≥2**
Klamath Falls, EE 401, N=8				
4.1 Recognize	0	0	8	100%
4.2 Identify	0	1	7	100%
4.3 Judge	0	3	5	100%
Portland Metro, ENGR 465, N=6				
4.1 Recognize	0	5	1	100%
4.2 Identify	1	5	0	83%
4.3 Judge	2	4	0	67%