Oregon TECH

2022-2023
Program Assessment Report
Computer Engineering Technology

Section 1 – Program Mission and Educational Objectives

Oregon Tech Mission:

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.

Core Theme 1: Applied Degree Programs

Oregon Tech offers innovative and rigorous applied degree programs. The teaching and learning model at Oregon Tech prepares students to apply the knowledge gained in the classroom to the workplace.

Core Theme 2: Student and Graduate Success

Oregon Tech fosters student and graduate success by providing an intimate, hands-on learning environment, which focuses on application of theory to practice. The teaching and support services facilitate students' personal and academic development.

Core Theme 3: Statewide Educational Opportunities

Oregon Tech offers statewide educational opportunities for the emerging needs of Oregon's citizens. To accomplish this, Oregon Tech provides innovative and rigorous applied degree programs to students across the state of Oregon, including high-school programs, online degree programs, and partnership agreements with community colleges and universities.

Core Theme 4: Public Service

Oregon Tech will share information and technical expertise to state, national, and international constituents.

Computer Engineering Technology Program Mission: The mission of the Computer Engineering Technology (CET) bachelor's degree program in the Computer Systems Engineering Technology (CSET) Department at Oregon Institute of Technology is to provide an excellent education incorporating industry-relevant, applied laboratory based design and analysis for our students. The program is to serve a constituency consisting of its alumni, and employers in industry and government. Major components of the CET program's mission in the CSET Department are to:

- educate computer engineering technology students to meet current and future industrial challenges,
- promote a sense of scholarship, leadership, and professional service among our graduates,
- enable our students to create, develop, and disseminate knowledge for the applied engineering environment,
- expose our students to cross-disciplinary educational programs, and
- provide high tech industry employers with graduates in the computer engineering technology profession

Mission Alignment:

Our program is very hands-on and thus aligns with Core Theme 1. The program features two years of project-based learning environment with both a team-based junior project and an individual senior project. Our graduates are in high demand by the industries we support many of which are in Oregon and the West coast. This is evidence that we are aligned with Core Themes 2 and 3.

Section 2 – Program Student Learning Outcomes

Graduates of the Computer Engineering Technology (CET) bachelor degree program may be employed in a wide range of high tech industries from industrial manufacturing to consumer electronics where they will be involved in solving problems through the development of hardware, software and embedded applications. Graduates may be involved in product design, testing and qualification, application engineering, customer support, sales, or public relations.

Program Educational Objectives

The Program Educational Objectives reflect those attributes a student of the CET program will practice in professional endeavors.

- Demonstrate technical competency through success in computer engineering technology positions and/or pursuit of engineering or engineering technology graduate studies if desired.
- Demonstrate competencies in communication and teamwork skills by assuming increasing levels of responsibility and leadership or managerial roles.
- Develop professionally, pursue continued learning, and practice computer engineering technology in a responsible and ethical manner.

Program Student Learning Outcomes

(1) an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline.

(2) an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

(3) an ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.

(4) an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.

(5) an ability to function effectively as a member as well as a leader on technical teams.

Program Student Learning Outcomes Update

On Nov 01, 2023 the ESET and CET faculty met to review the mission statement, and program student learning outcomes. No changes were made as a result of these discussions. Faculty also met to discuss PSLO responsibilities for the 2022-2023 cycle, and assessment results for the 2021-2022 cycle.

External validation

External validation of PSLOs are achieved through the following:

1) Industry Advisory Board discussions

2) Graduate job placement and continuing education rates
3) ABET ETAC accreditation process

On Oct 25, 2023 the mission statements and program student learning outcomes were presented to and approved by the department's Industrial Advisory Board.

Section 3 – Curriculum Map

Program Student Learning Outcome Coverage by Course

Course	Major	Title	PSLO				
			1	2	3	4	5
CST 162		Digital Logic I	X				
CST 130		Computer Organization	X				
CST 120		Embedded C	X				
CST 131		Computer Architecture	X				
CST 133		Digital Logic II	X	x			
CST 134		Instrumentation	X			X	
CST 250		Computer Assembly Language	X	x			
CST 204		Introduction to Microcontrollers	X	x	x		
CST 231		Digital Systems Design I	X		X		
CST 337		Embedded System Architecture	X	X	x	X	
CST 315		Embedded Sensor Interfacing & I/O	X			X	
CST 374		Embedded Project Proposal	X		X		
CST 371		Embedded Systems Development 1 (Junior Project)	X		X	X	X
CST 372		Embedded Systems Development 2 (Junior Project)	X		X		X
CST 373		Embedded Systems Development 3 (Junior Project)	X		X		X
CST 471		Embedded Senior Project 1	X		X		
CST 472		Embedded Senior Project 2	X		X		
CST 473		Embedded Senior Project 3	X		X		
CST 331	CpE	Microprocessor Peripheral Interfacing	X	X	x	X	
CST 418	CpE	Data Comm & Networks	X				
CST 351	CpE	Digital System Design II	X		x		
CST 344	CpE	Intermediate Computer Architecture	X				
CST 442	CpE	Advanced Computer Architecture	X				
CST 455	ES	System on a Chip Design	X				
CST 456	ES	Embedded System Testing	X				
CST 466	ES	Embedded System Security	X		X	x	
CST 417	ES	Embedded Networking	X				
CST 347	ES	Real Time Embedded Operating Systems	X				

X = Major component, x = minor component

The curriculum map was last updated and approved on October 4, 2019. No core curriculum or course content changes have been made since that time.

Assessment Level Key:

Foundation – introduction of the learning outcome, typically at the lower-division level,
Practicing – reinforcement and elaboration of the learning outcome, or
Capstone – demonstration of the learning outcome at the target level for the degree

Section 4 – Assessment Cycle

The table below is the updated assessment cycle for 2022-2023. ISLOs and PSLOs are assessed in a three year Our goal is that each PSLO will have two direct measurements (two classes) with one indirect measurement, and each ISLO will have one direct measurement.

PSLO	ESLO	2022-2023	2023-2024	2024-2025
(1) an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline; (ESLO Inquiry and Analysis)	Inquiry and Analysis			**CET/ESET: CST 162 (Phong)** **CET: CST 334, 442, 418 (Doug)** **ESET: CST 456 (Stephen)**
(2) an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.		**CST 315 (George)** **CST 473 (Troy Phong)**		
(3) an ability to apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature; (ESLO Communication)	Communication		**CST 371/2 (Phong and Troy)** **CST 472 (Phong, Ganghee)**	
(4) an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; (ESLO Quantitative Literacy)	Quantitative Literacy			**ESLO** **CET/ESET: CST 337 (Doug)** **CET/ESET: CST 134 (George)** **CET/ESET: CST 473 (Phong)**
(5) an ability to function effectively as a member as well as al leader on technical teams. (ESLO Teamwork)	Teamwork		**CST 373 (Troy, Phong)**	

	Diverse Perspectives	**CST 471 (or2) (Troy, Phong) ESLO Only** **CST 371 (Mike, Phong)**		
	Ethical Reasoning		**CST 472 (Phong, Ganghee)** **CST 372 (Phong and Troy)**	

Section 5 – Assessment Data Results Summary

This year's assessment activities focused on the learning outcomes below.
Reference the following table and the section 6 page numbers for detail on each assessment.

PSLO and ISLO Assessment Activities	Assessment Methods	Performance Target	Results	Status
(PSLO 2): an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.	**CST 315 (A: George KF pg 8)**	**70% at Highly Proficient or Proficient**	**80%**	**Ok**
	CST 473 (B: Phong WL pg 9,	"	**80%**	**Ok**
	C:Troy KF pg 10)	"	**100%**	**Ok**
	D: Exit Survey pg 11	"	**100%**	**Ok**
(ISLO Diverse Perspectives)	**CST 373 E: Phong WL pg 12**	**70% demonstrate Some Proficiency**	**100%**	**Ok**
	F: Exit Survey pg 13	**70% at Highly Proficient or Proficient**	**100%**	**Ok**
Graduation Rate	**University Dashboard**	**6-year rate > 50%**	**36.4%**	**No**
Departmental Retention	**University Dashboard**	**1-year rate > 50%**	**52.6%**	**Ok**

- Interpretation of results: The assessment results for the PSLO and the ISLO indicate that performance targets were met. Faculty will need to consider what factors may be driving the low 6-year CET graduation rate and high number of stop-outs.
- History of results: This year's results for the PSLO assessments were consistent with the results obtained for these assessments the last time they were done (2018-19).
- Evaluation of past actions: The last time the PSLO was evaluated there were no suggested changes to courses or evaluations.

- Action plans: There are no action plans arising out of PSLO assessment this year. Faculty should meet to look at the data to see if there are specific reasons behind the large number of stop-outs leading to the low 6-year graduation rate in CET.

Section 6 – Assessment Data Collection and Analysis Activity

Assessment A – KF – 315

Learning Outcome (2): an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

Course/Event: CST 315 -- Embedded Sensor Interfacing and I/O, Direct Assessment

Level: Practicing

Assessor & Campus: George Drouant, Klamath Falls

Activity: A laboratory exercise requiring student to build a microcontroller based water level control system using system components and techniques developed in previous labs. (Actual assignment is found in Appendix A, and the rubric is in Appendix B.)

Sample and Reliability: 15 artifacts were collected. Scoring was performed by George Drouant (instructor of record).

Performance Target: 70% of students should achieve a grade of 75%) or better (i.e. rank at proficient (3) or highly proficient (4 on each performance criteria in the assessment.

Performance Level:

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	% at Proficiency or Highly Proficiency
Demonstrate Understanding of the technical problem		3	8	4	12/15 (80.0%)
Design a solution to the problem		3	8	4	12/15 (80.0%)
Correct use of Tools to assess results			3	12	15/15 (100%)

History of Results: This assessment was last performed Fall 2019, At that time 92% of students met the performance criterion.

Faculty Discussion: (1 Nov 2023) 80% of students scored at Proficient or Highly Proficient on all criteria in this assessment, meeting the overall performance target.

Interpretation: No improvement needed. The drop in performance from historical results can be attributed to the fact that labs in the Portland section of the class was run remotely due to lack of staff which would not normally be the case.

Assessment B – WL - 472

Learning Outcome (2): an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

Course/Event: CST 472 -- Embedded Senior Project II, Direct Assessment

Level: Capstone

Assessor & Campus: Phong Ngyuen at Wilsonville

Activity: Student beta prototype was assessed using a grading rubric (see Appendix B).

Sample and Reliability: Five student artifacts assessed. Limited sample size may skew results. Scoring was performed by Phong Nguyen (instructor of record).

Performance Target: 70% of students rank at Proficient or Highly Proficient.

Performance Level:

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	% at Proficiency or Highly Proficiency
Demonstrate Understanding of the technical problem			1	4	5/5 (100.0%)
Design a solution to the problem	1			4	4/5 (80.0%)
Correct use of Tools to assess results	1			4	4/5 (80.0%)

History of Results: This assessment was last performed Winter 2019, At that time 2/2 (100%) students met the performance criterion though at that time both only ranked as proficient.

Faculty Discussion: (1 Nov 2021) In this assessment 80% of students met the performance target In all criteria meeting the overall performance target.

Interpretation: No improvement needed at this time.

Assessment C – Troy

Learning Outcome (2): an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

Course/Event: CST 473 -- Embedded Senior Project III, Direct Assessment

Level: Capstone

Assessor & Campus: Troy Scevers at Klamath Falls

Activity: Students in Senior project presented their projects at Idea fest. Student presentations were rated using the rubric in Appendix B.

Sample and Reliability: Five student artifacts assessed. Limited sample size may skew results. Scoring was performed by Troy Scevers (instructor of record).

Performance Target: 70% of students rank at Proficient or Highly Proficient.

Performance Level:

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	% at Proficiency or Highly Proficiency
Demonstrate Understanding of the technical problem				5	5/5 (100%)
Design a solution to the problem			3	2	5/5 (100%)
Correct use of Tools to assess results			1	4	5/5 (100%)

History of Results: The last time this outcome was assessed (2019/20) it was done with a different instructor and a different assessment vehicle, but at that time 100% of students met the performance target in all criteria.

Faculty Discussion: (1 Nov 2023) In this assessment 100% of students met the performance target In all criteria meeting the overall performance target.

Interpretation: No improvement needed at this time.

Assessment D – Exit Survey

Learning Outcome (2): an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

Course/Event: 2022-23 Senior Exit Survey Indirect Assessment

Level: Capstone

Assessor & Campus: Barb Meng at Klamath Falls

Activity: Questions related to this outcome asked on the Senior Exit survey were:
Q BEMB 1 - Program Student Learning Outcomes for Computer Engineering Technology B.S. Please rate your proficiency in the following areas.

> b. An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline.

Sample and Reliability: Only 2 BCMP student responded to this question on the Senior exit survey, so the results aren't statistically reliable.

Performance Target: 70% of students rate their performance as Highly proficient or Proficient

Assessment Method:

Performance Criteria	High Proficiency	Proficiency	Some Proficiency	Low Proficiency
Q BCMP 1b	1/2 (50.0%)	1/2 (50.0%)		

History of Results: Data from surveys completed in previous years also show that students consistently rate themselves as Highly Proficient or Proficient on this outcome.

Faculty Discussion (1 Nov 2023): 100% of students rated their performance as Highly proficient or Proficient exceeding the performance target.

Interpretation: No improvement needed.

Assessment E – CST 373 WL

ISLO (6) Diverse Perspectives: Oregon Tech students will explore diverse perspectives.

Course/Event: CST 373 – Embedded Systems Development III (Junior Project Sequence) Direct/Indirect Assessment

Level: Developing

Assessor & Campus: Phong Nguyen, Wilsonville

Activity: Students in CST 373 (Junior Project sequence) were assigned a paper on Diverse perspectives. The instructor evaluated each student using the diverse perspectives rubric (see Appendix C).

Sample and Reliability: Four students were assessed. Limited sample size may skew results. Scoring of the student papers was performed by Phong Nguyen (instructor of record).

Performance Target: 70% of students demonstrate at least Some Proficiency on the rubric.

Assessment Method:

	High Proficiency	Proficiency	Some Proficiency	Limited or no Proficiency	% at Some Profciency or Above
Recognize	2	1	1		4/4 (100%)
Know	1	3			4/4 (100%)
Understand		3	1		4/4 (100%)
Apply		2	2		4/4 (100%)

History of Results: Not available

Faculty Discussion (1 Nov 2023): Students met the performance goal in all criteria.

Interpretation: No improvement is required as a result of this assessment.

Assessment F – Exit Survey

ISLO (6) Diverse Perspectives: Oregon Tech students will explore diverse perspectives.

Course/Event: 2022-23 Senior Exit Survey Indirect Assessment

Level: Capstone

Assessor & Campus: Barb Meng at Klamath Falls

Activity: Questions related to this outcome asked on the Senior Exit survey were:
ISLO 1 - Oregon Tech Institutional Student Learning Outcomes
Please rate your proficiency in the following areas.

7. ISLO 6. Diverse Perspectives: Understanding of diverse perspectives to improve interactions with others

Sample and Reliability: Only 2 BCMP student responded to this question on the Senior exit survey, so the results aren't statistically reliable.

Performance Target: 70% of students rate their performance as Highly proficient or Proficient

Assessment Method:

Performance Criteria	High Proficiency	Proficiency	Some Proficiency	Low Proficiency
Q BCMP 1-7	2/2 (100%)			

History of Results: Data from surveys completed in previous years also show that students consistently rate themselves as Highly Proficient or Proficient on this outcome.

Faculty Discussion (1 Nov 2023): 100% of students rated their performance as Highly proficient or Proficient, exceeding the performance target.

Interpretation: No improvement needed.

Appendix A

OREGON INSTITUTE OF TECHNOLOGY

Computer Systems Engineering Technology Department

CST 315 – Embedded Sensor Interfacing I/O

Project Portion of Final Exam (50% of Final Exam Grade)

Requirements Document for Acceptance Test

Systems will be demonstrated to the instructor by the designer/builder. Wilsonville students will provide a short video demonstrating the operation of their systems. Klamath Falls students will demonstrate their systems to the instructor in person.

1) Starting Conditions:
   Bucket A is filled to 4 inches of water.
   Bucket B is filled to 2 inches of water.
   Use a ruler to show that the water levels meet the specifications. Record water levels below.

   Water Level Bucket A: _____ Water Level Bucket B:_____

   Send start signal to microcontroller to begin test.

2) First, pump water from Bucket A to Bucket B under microcontroller supervision. Stop pumping water from Bucket A to Bucket B when the water level in Bucket B reaches 4 inches. Pump motor must remain off for at least 10 seconds before water level is recorded. Record actual water level in Bucket B. _____

3) Remove water from Bucket B with a plastic cup until the water level drops enough for the pump to start pumping. Stop removing water from Bucket B and wait for the pump to stop. Measure and record the water level in Bucket B after the pump has been off for at least 10 seconds.

   Record water level in Bucket B._____

4) This is the end of the acceptance test.

Additional information

Grading will be as follows:

A. Requirement #2 – Water Level Bucket B should equal 4 inches.
   - 100 points for water level 4 inches +/- (1/16) of an inch
   - 85 points for water level 4 inches +/- (1/8) of an inch
   - 75 points for water level 4 inches +/- (1/4) inch
   - 65 points for water level 4 inches +/- (1/2) inch
   - 50 points for water level more than +/- (1/2) inch from 4 inches

B. Requirement #3 – Water Level Bucket B should equal 2 inches.
   - 100 points for water level 2 inches +/- (1/16) of an inch
   - 85 points for water level 2 inches +/- (1/8) of an inch
   - 75 points for water level 2 inches +/- (1/4) inch
   - 65 points for water level 2 inches +/- (1/2) inch

- 50 points for water level more than +/- (1/2) inch from 2 inches

C. How was the current out of the microcontroller's GPIO pin (connected to either a transistor or MOSFET) limited to 20 mA or less. Be quantitative. (100 points)

D. How was the signal from the oscillator's output limited in order not to damage the input pin of the microcontroller. (100 points)

E. Provide a sketch of your circuit (electronic format or photo of sketch on paper) and explain how the circuit worked.(100 points)

Appendix B

PSLO 2, Designing Solutions for Well Defined Technical Problems Rubric:

	High Proficiency	**Proficiency**	**Some Proficiency**	**Limited or no Proficiency**
Understanding of Technical Problem	Clearly defines the problem and outlines necessary objectives in an efficient manner.	Problem statement has some ambiguity or misses some important issues	Problem is defined incorrectly or too narrowly. Key information is missing or incorrect.	Problem not defined at all
Design of system to solve problem	Can describe planned experiments and how they relate to the problem; relate hypotheses to previous knowledge;	Description of planned experiments, relation of hypotheses, identification of steps and timeline, can be accomplished	Fails to formulate hypotheses to test. Does not express possible outcomes.	No clue on how to solve problem
Procedures and Tools	Consistently uses new procedures and tools successfully, and can describe rationale for them. Runs appropriate control and replicate experiments	Uses new methods and tools, but may not always be successful. May not accurately explain rationale. Control and replicate experiments run	Errors made in analytical methods, but sources of error aren't found. Appropriate control or replicate experiments not run.	Unfamiliar with rudimentary electrical measurement tools

Appendix C: ISLO 6 Diverse Perspectives

Oregon Tech students will explore diverse perspectives.

Recognition of diverse perspectives requires the self-awareness, intellectual flexibility, and broad knowledge that enables perception of the world through the eyes of others.[1] This includes but is not limited to the awareness and understanding of the customs, practices, methodologies, and viewpoints of varied cultures, individuals, and identities.

Performance Criteria	High Proficiency (4) The work *meets listed requirements* for this criterion; little to no development needed.	Proficiency (3) The work *meets most requirements*; minor development would improve the work.	Some Proficiency (2) The work needs moderate development in *multiple requirements.*	Limited Proficiency (1) The work does not meet this criterion: it needs substantial development in *most requirements.*
Recognize: Shows awareness of one's own perspective.	The student demonstrates a **refined** self-awareness in relation to other perspectives.	The student demonstrates an **evolving** self-awareness in relation to other perspectives.	The student demonstrates an **emerging** self-awareness in relation to other perspectives.	The student does **not** demonstrate self-awareness in relation to other perspectives.
Know: Demonstrates factual knowledge of the foundations of others' perspectives.	The student **applies** factual knowledge of diverse cultures, personalities, places, histories, and/or technologies to their students/work/community.	The student acquires a **developed** body of factual knowledge regarding diverse cultures, personalities, places, histories, and/or technologies.	The student acquires a **basic** level of factual knowledge regarding diverse cultures, personalities, places, histories, and/or technologies.	The student has **no** factual knowledge of diverse cultures, personalities, places, histories, and/or technologies.
Understand: Displays understanding of others' perspectives through practice.	The student is able to **apply** their understanding of a diversity of perspectives to their studies/work/community.	The student is able to **understand** a diversity of perspectives.	The student is able to **recognize** diverse perspectives.	The student is **unable** to recognize diverse perspectives.
Apply: Applies factual knowledge and understanding of diverse perspectives to their interactions with others.	The student applies their knowledge and understanding of diverse perspectives to their **studies/work/community.** *	The student **applies** their knowledge and understanding of diverse perspectives to their studies.	The student may **understand how** to apply knowledge and understanding of diverse perspectives to their studies, but **does not do so**.	The student is **unable** to apply knowledge and understanding of diverse perspectives to their studies.