– Electronics Engineering Technology –
2019-20 Assessment Report

Aaron Scher

Electrical Engineering & Renewable Energy Department

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1 Introduction

1.1 Program Location

The Bachelor of Science in Electronics Engineering Technology (BSEET) is offered at the Oregon Tech Portland-Metro campus in Wilsonville 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. The campus is only about a 30 minute drive from high-tech companies in the Hillsboro and Beaverton area such as Intel, Tektronix, MAXIM, Credence, Lattice, Synopsis, Qorvo 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, Qorvo, Tektronix, MSEI, and Intel.

The BSEET degree at the Oregon Tech Portland-Metro (Wilsonville) campus 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. The next accreditation visit will be in Fall 2020.

The 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 Portland-Metro (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 Portland-Metro (Wilsonville) campus, and continue to accommodate professionals working in high-tech industry in the Portland-Metro 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 support continuing partnerships with industry leaders to ensure that our program and classes are at the top of the board with adapting to new technology and preparing students for workforce demands.

1.4 Program Enrollment and Salary Data

Table 1 below present program enrollment data from Fall 2015 to Fall 2019. Table 2 shows the number of BSEET degrees awarded over the same time span. These tables reveal a trend towards lower enrollment in the BSEET program over the past five years. A cause of this lower enrollment is the attractiveness of our BSEE program, as we have found that many students are choosing to pursue the BSEE over the BSEET degree. However, since 2017 the enrollment in our BSEET program has improved due to a renewed effort towards recruitment and advertising the BSEET program's attractive features like hands-on instruction, transferability and graduate success.

Table 1: BSEET Program Enrollment

Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Five year difference	Five year change
37	32	14	18	20	17	-46 %

Table 2: Number of BSEET Degrees Awarded

AY2015-2016	AY 2016-2017	AY 2017-2018	AY 2018-2019	AY 2019-2020
13	4	6	1	N/A

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 ("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.

2.4 Program Outcomes

On November 2, 2018 the ABET Board of Delegates - Engineering Technology Area Delegation approved a major revision of outcomes effective for reviews during the 2019-2020 accreditation cycle. The new outcomes were communicated through an Accreditation Alert and are published in the 2019-2020 Criteria for Accrediting Engineering Technology Programs. To comply with these changes, this year (AY2019-2020) the BSEET program replaced the old ABET $a-n$ outcomes with the new ABET (1)-(5) 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; and

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

A mapping between the ABET ETAC (1) - (5) outcomes and the courses in the BSEET program are presented in Appendix A. We note that the outcomes are attained and reinforced throughout the curriculum.

A mapping between the old ABET ETAC $a-k$ outcomes and the new $(1)-(5)$ outcomes are presented in the Table 3 . This mapping is partly based on the document ETAC: Side-by-side comparison posted in an Accreditation Alert from ABET.

Table 3: Mapping between old ABET ETAC $a-k$ outcomes and the new $(1)-(5)$ outcomes.

Outcome	(1)	(2)	(3)	(4)	(5)	Notes
a. Fundamentals	√	–	–	–	–	–
b. Application	√	–	–	–	–	And under Criterion 5
c. Experimentation	–	–	–	√	–	–
d. Design	–	√	–	–	–	–
e. Teamwork	–	–	–	√	–	
f. Problem Solving	√	–	–	–	–	–
g. Communication	–	–	√	–	–	–
h. Lifelong Learning	–	–	–	–	–	Omitted
i. Ethics	–	√	–	–	–	And under Criterion 5
j. Impact	–	√	–	–	–	And under Criterion 5
k. Continuous Improvement	–	–	–	–	–	Moved to Criterion 5
l. Electronic Systems	–	–	–	–	–	Program criteria (curriculum)
m. Project Management	–	–	–	–	–	Program criteria (curriculum)
n. Advanced Mathematics	√	–	–	–	–	–

3 Plan and Methodology for Assessing Program Outcomes

Outcomes are to be assessed each year according to the assessment plan presented in Table 4. Outcomes $(1)-(4)$ are 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 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. Outcome (5) is assessed in ENGR 465 - Capstone Project when applicable, as not all capstone projects are team based. To ensure this outcome (5) is assessed, this outcomes is also assessed in EE 335 - Advanced Microcontrollers using a team project that target this particular outcome. A systematic, rubric-based process is then used to assess student attainment of the outcome based on a set of performance criteria. The results of all the assessment activities are then summarized in an annual assessment report. At the end of each academic year, the program faculty meet to review the assessment data at the annual Closing-The-Loop meeting.

Additionally, all graduating students are asked to fill out an anonymous exit survey. As part of the survey, students are asked to rate their level of attainment of the program

Table 4: BSEET Outcome Assessment Plan for the ABET (1) – (5) Outcomes

Outcome	Course	Assignment type
(1) Problem solving	ENGR 465	Capstone project
(2) Design	ENGR 465	Capstone project
(3) Communication	ENGR 465	Capstone project
(4) Experimentation	ENGR 465	Capstone project
(5) Teamwork	ENGR 465/EE 335[a]	Capstone/Team project

[a]Other upper-division EE courses may be used for assessing Outcome (5).

outcomes. This provides an indirect assessment measure. The results of this indirect assessment are also included in the assessment report, and evaluated at the Closing-The-Loop meeting.

The Closing-The-Loop meetings provide an opportunity to evaluate and compare assessment results, and discuss whether any changes are needed to the curriculum or to the assessment methodology in order to improve attainment of the outcomes or to improve effectiveness, objectivity, and consistency in the assessment methodology. By comparing assessment results over multiple years, faculty can also ascertain the effect of previous changes to curriculum or assessment methodology on outcome attainment or assessment results.

4 Summary of Assessment Activities for AY2019-2020

This section summarizes the performance of students for each of the assessed program outcomes. reports the number of students performing at a 1-developing, 2-accomplished, and 3-exemplary level for each performance criteria. The table also indicates the course instructors who performed the assessments. The rubrics used in this assessment are presented in Appendix B.

4.0.1 2018-2019 Indirect Assessment

In addition to direct assessment measures, the student outcomes (1) - (5) were indirectly assessed through a senior exit survey.

The number of BSEET graduates was very low and no exit survey responses were received with respect to the student outcomes. The BSEET Program Director has brought this issue to the attention of the Office of Academic Excellence and Assessment.

Table 5: Summary of BSEET direct assessment for AY2019-20.

	1-Developing	2-Accomplished	3-Exemplary
(1) Problem solving - Scher, Prahl			
1 - Apply mathematics	0	2	0
2 - Apply science, engineering, tech	0	1	1
2 - Apply modern tools	0	0	2
(2) - Design - Scher, Prahl			
1 - Define	0	0	2
2 - Design and implement	0	1	1
3 - Characterize and evaluate	0	1	1
(3) - Communication - Scher, Prahl			
1 - Written	0	0	2
2 - Oral	0	1	1
3 - Graphical	0	2	0
4 - Technical literature	0	2	0
5 - Audience	0	1	1
(4) - Experimentation - Scher, Prahl			
1 - Conduct experiments	0	0	2
2 - Analyze and interpret	0	1	1
3 - Apply to improve processes	0	1	1
(5) - Teamwork - Douglas			
1 - Participation	0	1	0
2 - Communication	0	0	1
3 - Decision making	0	1	0
4 - Management	0	1	0

5 Evaluation and Continuous Improvement

The BSEET faculty met in September 2020 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 Closing-the-Loop meeting provides faculty a chance to reflect and assess data and trends with regards to continuous improvement. This year marks the beginning of the new (1) – (5) ABET outcomes, and faculty decided to consider only assessment data based on these new outcomes going forward. For historical context, Figure 1 presents a summary of all assessment results collected between AY 2012-13 to AY 2018-19 based on the old (a) - (n) outcomes.

The objective set by the BSEET faculty is to have at least 80% of the students perform at the level of accomplished or exemplary in all performance criteria of the assessed outcomes. Because of the low sample size, the statistical power of the present results are limited. To generate a larger sample size, the faculty intend to combine together data collected over a number of years to provide a more accurate view and better allows for general inferences and conclusions. At this point, our data obtained through direct assessment (see Table 5) shows evidence of the attainment of student outcomes (1) - (5), and suggest that no major programatic changes are necessary. The faculty have been informed of the results and our intent to continue collecting data to form a larger sample size. In addition, with respect to assessment methodology, we decided at the Closing-the-Loop meeting to start assessing all outcomes (1) - (5) in both EE 335 Microcontrollers II and ENGR 465 to capture data at both junior and senior levels. This change will be implemented starting AY 2020-2021.

Outcome	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Entire cycle 2012 - 2019
a Fundamentals	21				14			35
b Application			17			3		20
c Experimentation		18		12			4	34
d Design			18				3	21
e Teamwork	14		18			3		35
f Problem solving		11			8			19
g Communicaiton		18			8	3		29
h Lifelong Learning		15			10			25
i. Ethics	18			4	5			27
j. Impact	14			4		1	1	20
k. Cont. Improvement		14	19				3	36
l Electronic Systems	18			5	4		3	30
m Project mgmt		18			8			26
n Advanced math			7		5	3		15

Numbers indicated are sample size (N)

Legend:

- Performance>80%
- 70%<Performance<80%
- Performance<70%
- Sample size N <10

Figure 1: Summary of assessment results from AY 2012-13 to AY 2018-19 based on the old (a) - (n) outcomes.

A Mapping between the ABET ETAC (1) - (5) outcomes and the courses in the BSEET program

	Outcome				
	(1)	(2)	(3)	(4)	(5)
Communication					
SPE 111: Fundamentals of Speech			X		X
SPE 321: Small Group & Team Comm.			X		X
WRI 121: English Composition			X		
WRI 122: English Composition			X		
WRI 227: Technical Report Writing			X		
WRI 3xx/4xx: Adv. Writing Elective			X		X
Math/Science					
MATH 111: College Algebra	X				
MATH 112: Trigonometry	X				
MATH 251: Differential Calculus	X				
MATH 252: Integral Calculus	X				
MATH 254N: Vector Calculus I	X				
MATH 321: Applied Differential Eq. I	X				
MATH 361: Statistical Methods I	X				
PHY 221: General Physics w/ Calculus	X		X	X	
PHY 222: General Physics w/ Calculus	X		X	X	
PHY 223: General Physics w/ Calculus	X		X	X	
General Eng. & Programming					
CST 116: C++ Programming I	X				
ENGR 267: Engineering Programming	X				
Electrical and Electronics Engineering					
EE 131: Digital Electronics I	X			X	X
EE 133: Digital Electronics II	X			X	X
EE 121: Circuits I	X			X	X
EE 123: Circuits II	X			X	X
EE 219: Semiconductors and Ampl.	X				
Lower divison EET Electives (varies)	X			X	X
EE 320: Adv. Circuit System Analysis	X	X	X	X	X
EE 321: Electronics I	X	X	X	X	X
EE 323: Electronics II	X	X	X	X	X
EE 325: Electronics III	X	X	X	X	X
EE 331: Digital Sys. Design w/ HDL	X	X			X
EE 333: Microcontroller Engineering	X	X		X	X
EE 335: Adv. Microcontroller Eng.	X	X		X	X
EE 401: Communication Systems	X				X
EE430: Linear Systems & DSP	X				X
Engineering Electives (varies)	X	X	X	X	X
ENGR465: Capstone Project	X	X	X	X	X
Business and General Education					
MGT 345: Engineering Economy					
Humanities Electives (varies)					
Social Science Electives (varies)					

B Rubrics for direct assessment

ETAC RUBRIC: OUTCOME 1 – APPLICATION

Outcome (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.

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
AN ABILITY TO APPLY MATHEMATICS TO BROADLY-DEFINED ENGINEERING PROBLEMS	Inadequate ability to apply mathematic principles from algebra, trigonometry, calculus, differential equations, and/or statistics to the solution of engineering broadly-defined problems appropriate to electronics technology.	Adequate ability to apply mathematic principles from algebra, trigonometry, calculus, differential equations, and/or statistics to the solution of engineering broadly-defined problems appropriate to electronics technology.	Exceptional ability to apply mathematic principles from algebra, trigonometry, calculus, differential equations, and/or statistics to the solution of broadly-defined engineering problems appropriate to electronics technology.	
AN ABILITY TO APPLY SCIENCE, ENGINEERING, AND TECHNOLOGY TO BROADLY-DEFINED ENGINEERING PROBLEMS	Inadequate ability to apply science, engineering, and technology principles to the solution of engineering problems broadly-defined appropriate to electronics technology.	Adequate ability to apply science, engineering, and technology principles to the solution of engineering broadly-defined problems appropriate to electronics technology.	Exceptional ability to apply science, engineering, and technology principles to the solution of broadly-defined engineering problems appropriate to electronics technology.	
AN ABILITY TO APPLY MODERN TOOLS TO BROADLY-DEFINED ENGINEERING TECHNOLOGY PROBLEMS	Inadequate ability to apply modern tools such as circuit layout and simulation CAD tools and/or standard electronic test equipment for test and validation to the solution of broadly-defined engineering problems.	Adequate ability to apply modern tools such as circuit layout and simulation CAD tools and/or standard electronic test equipment for test and validation to the solution of broadly-defined engineering problems.	Exceptional ability to apply modern tools such as circuit layout and simulation CAD tools and/or standard electronic test equipment for test and validation to the solution of broadly-defined engineering problems.	

*As defined by ABET, broadly-defined activities or problems are practical, broad in scope, relatively complex, and involve a variety of resources; use new processes, materials, or techniques in innovative ways; and may require extension of standard operating procedures.

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

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
AN ABILITY TO DEFINE AND CONTEXTUALIZE THE PROJECT	Demonstrates inadequate ability to define the project. Does not properly identify the problem to be solved, its relevance and context. Weak problem definition. Criteria are vague, subjective, or not relevant. Specifications and constraints are insufficient or unclear.	Demonstrates adequate ability to define the project. Properly identifies the problem to be solved, its relevance and context. Problem is adequately defined in engineering terms. Appropriate objective criteria are used. Specifications and constraints are clear and sufficient.	Demonstrates exceptional ability to define the project. Clearly identifies problem to be solved, and explains its relevance and context thoroughly and effectively. Problem is clearly defined in engineering terms. Criteria are objective, relevant and adequately prioritized based on context. Specifications and constraints are clear and allow to thoroughly evaluate the effectiveness of the proposed solution in solving the problem.	
AN ABILITY TO DESIGN AND IMPLEMENT ENGINEERING SYSTEMS, COMPONENTS, OR PROCESSES	Demonstrates inadequate ability for engineering design: • Selects preliminary design based on criteria that are not well aligned with design specifications and constraints. • Describes design solution without articulated scientific or engineering principles. • Does not use iterative modifications in a systematic way to improve design. • Rudimentary use of engineering tools and methods in the design process. • Design meets some but not all specs/constraints.	Demonstrates adequate ability for engineering design: • Provides subjective justification for preliminary design which aligns with design specifications and constraints. • Describes design solution using scientific or engineering concepts and principles. • Uses iterative modifications in a systematic way to improve design. • Uses engineering tools and methods effectively in the design process. • Design meets most or all specs/constraints.	Demonstrates exceptional ability for engineering design: • Provides objective justification for preliminary design which aligns with design specifications and constraints. • Describes design solution using scientific or engineering concepts and principles with great precision. • Uses iterative modifications in a systematic and effective way to improve design. • Shows mastery of engineering tools and methods in the design process. • Design meets or exceeds all specs/constraints.	
AN ABILITY TO CHARACTERIZE AND EVALUATE DESIGN SOLUTIONS	Demonstrates inadequate ability to evaluate the performance of the design solution. Limited design characterization. Insufficient discussion of design tradeoffs/limitations. No or vague suggestions for further improvement.	Demonstrates adequate ability to evaluate the performance of the design solution. Adequate design characterization. Sufficient discussion of design tradeoffs/limitations. Reasonable suggestions for further improvement provided at a high level of generality.	Demonstrates exceptional ability to evaluate the performance of the design solution. Thorough design characterization. Detailed discussion of design tradeoffs/limitations. Good specific and detailed suggestions provided for further improvement of design.	

* As defined by ABET, broadly defined activities or problems are practical, broad in scope, relatively complex, and involve a variety of resources; use new processes, materials, or techniques in innovative ways; and may require extension of standard operating procedures.

ETAC RUBRIC: OUTCOME 3 – COMMUNICATION

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

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
AN ABILITY TO APPLY WRITTEN COMMUNICATION	Presentation and format rough or inconsistent throughout the document. Content is disorganized. Ideas are not clearly presented. Frequent grammar/spelling errors, writing style is rough or imprecise.	Presentation and format is adequate and consistent throughout the document. Content is well organized and ideas are clearly presented. Grammar/spelling mostly correct, readable style.	Work is professionally presented and very well formatted. Content is very well organized and easy to follow. Ideas are clearly presented. All grammar/spelling correct, very well written.	
AN ABILITY TO APPLY ORAL COMMUNICATION	Low volume or monotonous tone makes it hard for audience to engage. Speaker mispronounces important terms. Speaker does not transmit any interest or enthusiasm about the topic. Presentation length not appropriate.	Speaker talks in a firm, clear, expressive voice. Adequate volume and dynamic tone engage audience. Speaker pronounces important terms correctly. Speaker occasionally transmits interest and enthusiasm about the topic. Adequate presentation length.	Speaker is an excellent communicator. Speaker is eloquent and dynamic, talks in a loud, clear voice, does not mispronounce important terms. Speaker displays and transmits a strong interest and enthusiasm for the topic. Adequate presentation length.	
AN ABILITY TO APPLY GRAPHICAL COMMUNICATION	Inadequate use of figures, charts, and tables to display data. Many figures, charts, and tables missing key formatting elements, such as titles, labels, units, captions, etc. Figures are not well placed, scales are not fitted to the dataset, titles/captions are incorrect or missing.	Adequate use of figures, charts, and tables to display data. A few figures, charts, and tables missing key formatting elements, such as titles, labels, units, captions, etc. Figures are well placed, scales are fitted to the dataset. Some titles/captions may be too general or unclear.	Excellent use of figures, charts, and tables to display data. All figures, charts, and tables properly labeled and formatted, easy to read and interpret, with proper titles and captions. In some instances, results offer additional information above that required.	
AN ABILITY TO IDENTIFY AND USE APPROPRIATE TECHNICAL LITERATURE	Performs an inadequate review of published material and literature to place work in context. Obvious omissions in literature search. Does not use proper format citation for references. Does not give proper credit to authors and researchers. May show instances of plagiarism. Sources are of low quality.	Performs a satisfactory review of published material and literature to place work in context. Mostly uses proper format citation for all references. Source documentation gives proper credit to authors and researchers - no instances of plagiarism. Sources are of satisfactory quality.	Performs a systematic and thorough review of published material and literature to determine what is already known, what has already been done, and to learn about the skills, techniques, and any instrumentation that are needed to accomplish project objectives. Literature review fully demonstrates understanding of topic, and places work in context. Uses proper format citation for all references. Source documentation gives proper credit to authors and researchers - no instances of plagiarism. Sources are of high quality and exceed those found in a simple web search.	

ABET ETAC RUBRIC: OUTCOME 4 – EXPERIMENTATION

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

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
AN ABILITY TO CONDUCT EXPERIMENTS	Demonstrates inadequate knowledge and abilities for conducting experiments with standard equipment to collect experimental data. May not obverse lab safety and procedures.	Demonstrates adequate knowledge and abilities for conducting experiments. Able to use standard equipment to collect experimental data. May require supervision and steering in the right direction. Overall, observes lab safety plan and procedures.	Demonstrates comprehensive knowledge, exceptional abilities, and resourcefulness for conducting experiments. Selects appropriate equipment/measuring devices and methodology for conducting experiments. Demonstrates an ability to predict and overcome difficulties associated with data collection. Arrives well-prepared to conduct experiments. Observes established lab safety plan and procedures. Proposes improvements as necessary.	
AN ABILITY TO ANALYZE AND INTERPRET EXPERIMENTAL RESULTS	Demonstrates inadequate knowledge and abilities for analyzing and interpreting experimental results. Reporting methods are unsatisfactory.	Demonstrates adequate abilities for experimental data analysis, interpretation, and visualization. Able to draw some reasonable conclusions based on experimental results. Demonstrates an awareness for measurement error. Reporting methods are satisfactorily organized, logical, and complete.	Demonstrates exceptional ability for experimental data analysis, interpretation, and visualization. Able to draw insightful conclusions based on experimental results. Analyzes and interprets data using appropriate theory, accounts for measurement error into analysis and interpretation, reporting methods are well-organized, logical, and complete.	
AN ABILITY TO APPLY EXPERIMENTAL RESULTS TO IMPROVE PROCESSES.	Demonstrates inadequate knowledge and abilities for applying quantitative experimental results for decision making.	Demonstrates adequate abilities for applying experimental results to adjust a process (or propose adjustments to a process) to optimize some specified set of parameters without violating some constraint. This may include demonstrating an adequate ability to learn from and apply quantitative experimental results for decision making.	Demonstrates exceptional ability to apply experimental results to adjust a process (or propose adjustments to a process) to optimize some specified set of parameters without violating some constraint. Independently seeks additional reference material and properly references sources to substantiate analysis, learns from mistakes, errors, and wrong assumptions and formulates innovative and resourceful solutions. Demonstrates exceptional ability to learn from and apply quantitative experimental results for decision making.	

ABET ETAC RUBRIC: OUTCOME 5 – TEAMWORK

Outcome 5 – an ability to function effectively as a member as well as a leader on technical teams.				
CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
TEAM PARTICIPATION	Is sometimes absent from group meetings. Routinely comes unprepared for meetings. Rarely shares credit for success with others and accountability for team results	Rarely absent without inconveniencing the group. Contributes a fair share to the project workload. Prepares somewhat for group meetings. Occasionally shares credit for success with others and accountability for team results.	Routinely present at team meetings or work sessions Exceeds expectations in work contribution. Is prepared for the group meeting with clearly formulated ideas. Shares credit for success with others and accountability for team results.	
TEAM COMMUNICATION	Rarely uses respectful language or shows cooperative communication skills. Does not demonstrate ability and willingness to communicate with the rest of the group members regarding status updates, results, ideas.	Generally uses respectful language and shows cooperative communication skills. Demonstrates adequate ability and willingness to communicate with the rest of the group members regarding status updates, results, ideas, as well as providing some constructive critique of others' ideas and proposals.	Uses respectful language and shows advanced cooperative communication skills. Demonstrates exceptional ability and willingness to communicate with the rest of the group members regarding status updates, results, ideas, as well as providing constructive critique of others' ideas and proposals.	
TEAM DECISION MAKING	Rarely contributes to promoting group dialog. Not effective at facilitating group decisions.	Occassionally contributes to promoting group dialog. Occasionally uses conflict resolution skills.	Regularly contributes to promoting group dialog. Uses conflict resolution skills effectively. Involves all members in decision making and incorporates divergent ideas.	
TEAM MANAGEMENT	Rarely uses processes and tools for organizing and coordinating the team while working towards a common goal. Provides inadequate management of meetings with regards to time, discussion, etc. Does not provide a clear definition of tasks to be accomplished.	Adequately uses processes and tools for organizing and coordinating the team while working towards a common goal. Adequate management of meetings with regards to time, discussion, etc. Provides a clear definition of tasks to be accomplished.	Highly effective at using processes and tools for organizing and coordinating the team while working towards a common goal. Manages a meeting well with regards to time, discussions etc. Supports a clear definition of tasks to be accomplished, anticipating future needs.	