Bachelor of Science in Mechanical Engineering (BSME)
2018/19 Program Assessment Report

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1. Introduction

This report documents the assessment activities undertaken within the Bachelor of Science in Mechanical Engineering (BSME) program at the Oregon Institute of Technology during the 2018-19 academic year. The BSME program is delivered at three campuses within the University – Klamath Falls, Portland-Metro (in Wilsonville) and Seattle. The MMET Department's other two degree programs (the Bachelor of Science in Mechanical Engineering Technology, BSMET and the Bachelor of Science in Manufacturing Engineering Technology, BSMFG) share a number of common courses with the BSME and thus faculty input from the staff on these programs is also considered when assessing the effectiveness of several Departmental courses.

The 2018/19 academic year was challenging for the MMET Department. In July 2018, Prof. Jeffery Hayen stepped down as Department Chair after serving in the role for four years. The Department was then led by a series of acting Chairs during the Summer of 2018. In Fall 2018, Prof. Steve Adison became the interim Chair for the Department for the 2018/19 academic year. Prof. Adison immediately set about implementing a more-efficient revised management structure leading to a reshuffling of staff into different roles at short notice. At the Klamath-Falls campus, Prof. Joe Stuart became the Site Director and Prof Steve Edgeman retained his role as the Program Director for the BSMET and BSMFG degrees. At the Portland-Metro campus, Prof. Wangping Sun became the Site Director and Prof. Robert Paxton became the Program Director for the BSME. At the Seattle campus, Prof. Addison retained his role as Site Director and Program Director for the MSMFG (as well as holding the interim Chair position).

Ultimately, this meant that the Department's data collection activities for program assessment were not as highly organized or coordinated as normal. Some data was collected from the Portland-Metro campus and is presented in this report. This report will primarily serve however, as a "planning" document to allow the Department to move forward and execute a more rigorous assessment plan in the 2019/20 academic year. Details of the revised assessment plan, rubrics and curricular alignment will be discussed in the relevant sections of this report.

2. Program Mission and Educational Objectives

The mission statement of the Mechanical Engineering (ME) Program is in-line with and built upon the mission statements of both the Institution and the Department. The ME program's Mission Statement and Program Educational Objectives are stated as:

Mechanical Engineering Program Mission Statement

The Mechanical Engineering Program at Oregon Institute of Technology is an applied engineering program with a focus on hands-on, project-based learning. Its mission is to provide graduates the skills and knowledge for successful careers in mechanical engineering.

Program Educational Objectives (PEO)

The program expects graduates to achieve, within several years of graduation, the following objectives. Mechanical Engineering graduates will have:

- Demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems.
- Shown the ability to communicate effectively and work well on team-based engineering projects.
- Succeeded in entry-level mechanical engineering positions.
- Pursued continued professional development, including professional registration if desired.
- Successfully pursued engineering graduate studies and research if desired.

These PEO's were last reviewed during the 2015/16 academic year and will be reviewed again in the 2019/20 academic year to ensure their relevance.

3. Program Student Learning Outcomes (SLO)

Towards the end of 2017, ABET's Engineering Area Delegation (EAD) approved changes to criterion 3 Student Learning Outcomes (SLOs), applicable beginning the 2019/20 cycle. This remapped and consolidated the "old" 11 SLOs (a-k) into 7 "new" SLOs. Details of this remapping are included in Appendix I.

In Fall 2018, it was decided by the Chair (Prof. Addison) and the BSME Program Director (Prof. Paxton) that it would be more pragmatic and beneficial if the MMET Department began using the updated SLOs as soon as possible. This would provide the greatest amount of useful assessment data for the next accreditation visit (during the 2021/22 academic year). Unfortunately, due to a lack of communication the implementation of the new SLOs was not as successful as hoped. This led to a mix of "old" and "new" SLOs being used for assessment.

The ME program's SLOs are aligned with "new" ABET EAC SLOs. These are stated as:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. An ability to communicate effectively with a range of audiences.
4. 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. 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. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

4. Three-Year Cycle for Assessment of Student Learning Outcomes

The BSME program is using a three-year assessment cycle for its SLOs, with the assessment cycle being the same for all three campuses. This cycle is set up so that each outcome is assessed at least once every three years.

One of the first tasks designated to the current Program Director (Prof. Paxton) was to remap the "old" SLOs into the "new" SLOs (discussed in Section 3). Once this was completed, the three-year assessment cycle was updated to reflect these new outcomes.

The outcomes being assessed in the 2018/19, 2019/20 and 2020/21 assessment cycles are shown in Table 1.

Table 1: Three-year assessment cycle timetable

Assessment Criteria	18/19	19/20	20/21
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.			✓
2. 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. an ability to communicate effectively with a range of audiences.		✓	
4. 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. 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. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.		✓	
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.		✓	

5. Assessment Activities Undertaken 2018/19

The Mechanical Engineering faculty conducted formal assessment of two SLOs (#4, #5) during the 2018/19 academic year, as detailed in Table 1. As discussed in the introduction, assessment activities were limited during the year and only the Portland-Metro campus participated in data collection and assessment process.

The outcomes assessed during the 2018/19 academic year were:

- SLO 4: Graduates will have 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.
- SLO 5: Graduates will have 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.

Typically, these outcomes would be mapped to the curriculum, however this has yet to be completed for the updated SLOs (and PEOs, as discussed in Section 2). At each campus the normal assessment activities for each SLO consists of two direct assessments, and one indirect assessment. However, during the 2018/19 academic year, only one direct and one indirect measure were used.

Direct assessments are evaluated using an outcome-specific rubric developed by OIT MMET Department and/or other faculty. As two different sets of SLOs were used for assessment, this necessitated the use of two sets of rubrics. During the 2019/20 academic year, the Department is hoping to establish a working committee to work on re-writing the rubrics used for assessment.

The indirect assessment used is a “senior survey”, which all BSME students enrolled in the senior project sequence (ENGR491/492/493) are invited to participate in. The survey is sent out during the Spring term to each graduating senior. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. The survey is common for all campuses but can be sorted to give results for individual campuses, if required. In this survey, students are asked two types of questions: 1) how proficient they believe they are in a particular SLO, and 2) How much did Oregon Tech contribute to this proficiency?

Assessment Procedures

The procedure for determining which courses are to be used for assessment activities is listed below:

1) During summer, the BSME Program Director notifies the Site Directors (at all three campuses) of the SLOs that will be evaluated in the upcoming year. The BSME Program Director also consults with the Program Directors for the BSMET and BSMFG to determine whether any overlap in assessment activities is possible (preferred option)
2) The Site Directors, using their site-specific knowledge (eg. knowledge of timetabling, course offerings, adjunct availability etc.) consult with their local faculty and determine which courses and assessment type (homework/lab report/exam etc.) are to be used for each SLO. While campuses do not have to use the same course for a particular assessment, this can sometimes be advantageous and allows the Department to look at intra-campus differences in course offerings. As "local experts", Site Directors are given significant leeway in determining which courses would be most appropriate for their particular campus, although this can be overruled by the Program Director or Chair if necessary.
3) Before the start of Fall term, the Site Directors notify the Program Director and Chair of the courses (and types of assessment) that will be undertaken by their site.
4) The Program Director (in conjunction with the Chair and Site Directors) then manages the data collection process and assessment activities throughout the academic year.
5) During summer, the Program Director collates and analyzes the assessment data and authors the Program Assessment Report (ie. this document)

6. Assessment of SLO 4: Ethical and Professional Responsibilities

As described in Section 3, SLO 4 is stated as graduates "will have 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".

Coincidentally, in the 2018/19 academic year, this SLO was also chosen as one of the University's Essential Student Learning Outcomes (ESLO). The performance criteria for the two SLOs are compared in Table 2.

Table 2: Comparison of MMET SLO and OIT ESLO

MMET Department	Oregon Tech
SLO 4: Graduates will have 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. 1. Demonstrates knowledge of the professional code of ethics and can use it to describe ethical issues. Demonstrates knowledge and understanding of "ethical diversity". 2. Understands the global impact of engineering decisions 3. Understands the macro-economic impact of engineering solutions 4. Understands major socio-economic and political issues of engineering solutions 5. Understands the environmental and the social impact of engineering decisions 6. Describes and analyzes possible/alternative approaches and can explain the benefits and risks	ESLO 3: Oregon Tech Students will make and defend reasonable ethical judgements. 1. Theory: Student demonstrates knowledge of different ethical theories and codes. 2. Recognition: Student can recognize decisions requiring ethical judgments. 3. Logic: Student demonstrates knowledge of the logic of ethical reasoning. 4. Judgment: Student can make and support plausible ethical decisions.

Although the two assessment criteria are similar, the University ESLO is significantly vaguer. This is not surprising given that it is used to assess students from all majors and not just mechanical engineering. The SLO for the BSME expands on the University ESLO to evaluate whether students can recognize and apply ethical behavior in terms of economic, social and environmental aspects as well as the concept of ethical diversity.

SLO 4 is a combination of the "old" EAC SLOs f, h & j:

- EAC-f: An understanding of professional and ethical responsibility
- EAC-h: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- EAC-j: a knowledge of contemporary issues). As described earlier, Faculty used a mix of both rubrics encompassing both "old" and "new criteria" leading to a convoluted overall result.

Direct Assessment Activities

For the 2018/19 academic year, faculty assessed SLO 4 using two separate exercises:

- Prof. Stover assessed "new" SLO 4 ("an understanding of professional and ethical responsibility") in MECH 316 Machine Design II in Spring term 2019, using a homework design project. There were 8 BSME, 4 BSMET and 5 BSMFGT students in this course, but only the BSME students are considered for the purposes of this report and the results are shown in Table 3 (details of each SLO can be found in column 1 of Table 2).
- Prof. Sun assessed "old" SLO h ("the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context") in ENGR 493 in Spring 2019, using the Final project report. There were 4 BSME, 1 BSMET and 1 BSMFGT students in this course, but only 3 of the 4 BSME students are considered for the purposes of this report (1 student did not submit any work, so was not counted). The results are shown in Table 4 (details of each SLO can be found in column 1 of Table 2).
- No assessment was made of "old" SLO j ("a knowledge of contemporary issues").

Table 3: Assessment Results for SLO 4 using MECH 316:
Prof. Stover, Spring 2019, Portland-Metro campus, n = 8 students

Assessment Criteria	1. Limited or No Proficiency (%)	2. Some Proficiency (%)	3. Proficiency (%)	4. High Proficiency (%)
3. Understands the macro-economic impact of engineering solutions	0	0	12.5	87.5
5. Understands the environmental and the social impact of engineering decisions	0	0	25	75
6. Describes and analyzes possible/alternative approaches and can explain the benefits and risks	0	12	12.5	75

**NOTE: For this assessment item, the instructor reported criterion 1,2 and 4 as "not-applicable" and so these are not reported in Table 3.*

Table 4: Assessment Results for SLO h using ENGR 493:
Prof. Sun, Spring 2019, Portland-Metro campus, n = 3 students

Assessment Criteria	1. Limited or No Proficiency (%)	2. Some Proficiency (%)	3. Proficiency (%)	4. High Proficiency (%)
Understands the global impact of engineering decisions	0	0	0	100
Understands the macro-economic impact of engineering solutions	0	0	0	100
Understands the environmental and the social impact of engineering decisions	0	0	0	100

It should be noted that the sample size for both Tables 3 & 4 is extremely small (8 and 3 students). Thus, caution should be used when trying to draw conclusions from this data.

Indirect Assessment Activities

For the 2018/19 academic year (as with past years), the student exit survey was used as the indirect assessment activity. The questions used on the survey are determined during the Fall term preceding the Spring term that the survey is sent out. For the 2018/19 academic year, the "old" SLOs were used on the student exit survey.

Prompt question: Please rate your proficiency in the following areas.

Table 5: Assessment Results for SLOs f, h and j using Student Exit Survey, Spring 2019

Question	Very much	Quite a bit	Some	Very little	Total
f. An understanding of professional and ethical responsibility.	50.00%	46.15%	3.85%	0.00%	26
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	38.46%	53.85%	3.85%	3.85%	26
j. A knowledge of contemporary issues.	42.31%	42.31%	11.54%	3.85%	26

Prompt question: How much has your experience at Oregon Tech contributed to your knowledge, skills, and personal development in these areas?

Table 6: Assessment Results for SLOs f, h and j using Student Exit Survey, Spring 2019

Question	Very much	Quite a bit	Some	Very little	Total
f. An understanding of professional and ethical responsibility.	42.31%	38.46%	11.54%	7.69%	26
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	44.00%	40.00%	12.00%	4.00%	25
j. A knowledge of contemporary issues.	26.92%	46.15%	15.38%	11.54%	26

As discussed in Table 2, SLO f and ESLO 3 are similar in scope, so it is interesting to compare the results from Tables 5 and 6 to these results (Tables 7 and 8).

Prompt question: Please rate your proficiency in the following areas.

Table 7: Comparison of ESLO 3 and SLO f using Student Exit Survey, Spring 2019

Question	High proficiency	Proficiency	Some proficiency	Limited proficiency	Total
ESLO 3. Ethical Reasoning: Making ethical judgements	56.67%	40.00%	3.33%	0.00%	30
SLO f. An understanding of professional and ethical responsibility.	50.00%	46.15%	3.85%	0.00%	26

Prompt question: How much has your experience at Oregon Tech contributed to your knowledge, skills, and personal development in these areas?

Table 8: Comparison of ESLO 3 and SLO f using Student Exit Survey, Spring 2019

Question	High proficiency	Proficiency	Some proficiency	Limited proficiency	Total
ESLO 3. Ethical Reasoning: Making ethical judgements	32.26%	25.81%	29.03%	12.90%	31
SLO f. An understanding of professional and ethical responsibility.	26.92%	46.15%	15.38%	11.54%	26

Analysis and Recommended Actions

Strengths:

All students demonstrated proficiency or high proficiency in their understanding of the economic, environmental and social impacts of engineering solutions (rubric criteria 3 and 5). Although 12.5% of students only show limited proficiency for criteria 6 ("describes and analyzes possible/alternative approaches and can explain the benefits and risks"), this is fact only accounts for a single student! This demonstrates the students in the BSME program are exposed and aware of the different aspects of engineering decisions.

Weaknesses:

Beginning with Table 3 (Stover, SLO 4), the primary weakness is that rubric criteria 1,2 and 4 were not evaluated! Given that the ethical aspects of SLO 4 were evaluated in criteria 1, this is a significant piece of missing information. This demonstrates that the assessment activity was not well-matched to the rubric criteria.

In Table 7, 96.15% of BSME students feel that they have a "proficient" or "highly proficient" understanding of the professional and ethical responsibilities of an engineer. However, only 73.07% of students feel that Oregon Tech contributed to this understanding. Adding the 15.38% of student who feel that Oregon Tech contributed "some proficiency" to their knowledge, and the total is still less than 96.15% This indicates that while students believe they ultimately end up with the requisite knowledge, they do not believe that the MMET Department completely gives them this knowledge.

Interestingly, when these same students are asked about ethics from a University's perspective (ESLO 3), the results are similar with 96.67% believing they have a "proficient" or "highly proficient" understanding of ethical reasoning. Similarly, only 58.07% feel that Oregon Tech contributed to this understanding.

Comparisons to previous data:

SLOs f, h and j were last assessed at the Klamath Falls and Seattle campuses during the 2015/16 academic year. SLO f was assessed using ENGR 111 (Fall 2015) and MECH 491 Senior Projects II (Fall 2015), and a summary of these results is shown in Tables 4 & 5. SLO h was assessed using MECH 491 (Fall 2015) and MECH 313 (Winter 2016 & Spring 2016), and a summary of these results is shown in Tables 6 - 8. SLO j was assessed using MECH 491 (Fall 2015) and MET 160 (Winter 2016) and a summary of these results is shown in Tables 9 & 10.

Table 9: Abridged summary of assessment results for SLO f using ENGR 111 (Fall 2015), Klamath Falls campus

Assessment Criteria	Average score
Demonstrates knowledge of the professional code of ethics	96%
Using code of ethics, describes ethical issue(s)	96%
Describes parties involved and discusses their points of view	86%
Describes and analyzes possible/alternative approaches	84%
Chooses an approach and explains the benefits and risks	94%

Table 10: Abridged summary of assessment results for SLO f using MECH 491 (Fall 2015), Klamath Falls campus

Assessment Criteria	Average score
Demonstrates knowledge of the professional code of ethics	100%
Using code of ethics, describes ethical issue(s)	96%
Describes parties involved and discusses their points of view	96%
Describes and analyzes possible/alternative approaches	93%
Chooses an approach and explains the benefits and risks	93%

Comments from this assessment activity include mention of the fact that students successfully identified stakeholders, alternative resolution scenarios, ethical/moral principles and assessment via an evaluation/decision matrix. As with the 2018/19 assessment, it appears that students continue to struggle with describing and analyzing possible and alternative approaches and being able to explain the benefits and risks of those approaches.

Table 11: Abridged summary of assessment results for SLO h using MECH 491 (Fall 2015), Klamath Falls campus

Assessment Criteria	Average score
Understands the global impact of engineering decisions.	91%
Understands the macro- economic impact of engineering solutions.	100%
Understands the environmental and the social impact of engineering decisions	100%

Table 12: Abridged summary of assessment results for SLO h using MECH 313 (Spring 2016), Klamath Falls campus

Assessment Criteria	Average score
Understands the global impact of engineering decisions.	96%
Understands the macro- economic impact of engineering solutions.	92%
Understands the environmental and the social impact of engineering decisions	92%

Table 13: Abridged summary of assessment results for SLO h using MECH 313 (Winter 2016), Seattle campus

Assessment Criteria	Average score
Understands the global impact of engineering decisions.	93%
Understands the macro- economic impact of engineering solutions.	100%
Understands the environmental and the social impact of engineering decisions	93%

Comments from this assessment activity include mention of the fact that almost all of the students had a good understanding of the global impact of portable energy, and they all had a good understanding of both the economic and environmental/social impacts. This has remained unchanged in the 2018/19 assessment and Oregon Tech students remain very aware of the world around them.

Table 14: Abridged summary of assessment results for SLO j using MECH 491 (Fall 2015), Klamath Falls campus

Assessment Criteria	Average score
Address major socio- economic issues	97%
Address US political issues	94%

Table 15: Abridged summary of assessment results for SLO j using MET 160 (Winter 2016), Klamath Falls campus

Assessment Criteria	Average score
Address major socio- economic issues	36%
Address US political issues	21%

Comments from this assessment activity state the students seemed well read on most issues. No major weaknesses were identified aside from the fact that sometimes students were given to opinion rather than stating fact.

Recommended actions:

Three recommendations are made:

1. Firstly, in future assessments care should be taken to choose an assessment item that will allow students to demonstrate their knowledge and understanding of ethical issues.
2. Secondly, a larger sample be used in order to garner more useful statistical information. Potentially, BSMET and BSMFG students could be included in the statistical analysis, since these programs have many common courses to the BSME.
3. Lastly, the MMET Department needs to investigate methods to better assist students to identify, critically evaluate and justify alternative approaches as they develop various engineering solutions.

7. Assessment of SLO 5: Teamwork

As described in Section 3, SLO 5 is stated as graduates "will have 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".

SLO 5 is a rephrasing of the "old" EAC SLO d:

- EAC-d: An ability to function on multidisciplinary teams.

Direct Assessment Activities

For the 2018/19 academic year, faculty assessed SLO 5 using three separate exercises:

- Prof. Paxton assessed "new" SLO 5 ("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") in MECH 318 Fluid Mechanics in Winter term 2019 using three laboratory reports. These reports were assessed at the beginning, middle and end of the course to observe how students' abilities changed during the term. Students worked in groups composed of BSREE BSME and BSMET students, and thus it is not possible to discern the individual contributions of BSME students in this type of assessment. Additionally, the group composition changed during the term, this comparisons between assessments was not possible except in very general terms. The relative number of students were: 11 BSREE (58%), 5 BSME (26%) and 3 BSMET (16%). The results of this assessment are shown in Tables 11 – 13.

Table 16: Assessment Results for SLO 5 using MECH 318 Lab 1: Prof. Paxton, Winter 2019, Portland-Metro campus, n = 6 groups

Assessment Criteria	1. Limited or No Proficiency (%)	2. Some Proficiency (%)	3. Proficiency (%)	4. High Proficiency (%)
1. Identifies and achieves goal/purpose	33	50	0	17
2. Assumes and fulfills roles and responsibilities as appropriate. Leadership strives to create a collaborative and inclusive environment.	0	0	100	0
3. Interacts and communicates effectively with team/group members.	0	0	100	0
5. Share appropriately	0	17	33	50
7. Documentation and record keeping	0	17	66	17

**NOTE: For this assessment item, the instructor reported criterion 4, 6 and 8 as "not-applicable" and so these are not reported in Table 3.*

Table 17: Assessment Results for SLO 5 using MECH 318 Lab 3:
Prof. Paxton, Winter 2019, Portland-Metro campus, n = 6 groups

Assessment Criteria	1. Limited or No Proficiency (%)	2. Some Proficiency (%)	3. Proficiency (%)	4. High Proficiency (%)
1. Identifies and achieves goal/purpose	0	33	33	33
2. Assumes and fulfills roles and responsibilities as appropriate. Leadership strives to create a collaborative and inclusive environment.	0	0	100	0
3. Interacts and communicates effectively with team/group members.	0	0	100	0
5. Share appropriately	0	17	50	33
7. Documentation and record keeping	0	0	50	50

**NOTE: For this assessment item, the instructor reported criterion 4, 6 and 8 as "not-applicable" and so these are not reported in Table 3.*

Table 18: Assessment Results for SLO 5 using MECH 318 Lab 5:
Prof. Paxton, Winter 2019, Portland-Metro campus, n = 5 groups

Assessment Criteria	1. Limited or No Proficiency (%)	2. Some Proficiency (%)	3. Proficiency (%)	4. High Proficiency (%)
1. Identifies and achieves goal/purpose	20	20	40	20
2. Assumes and fulfills roles and responsibilities as appropriate. Leadership strives to create a collaborative and inclusive environment.	0	0	100	0
3. Interacts and communicates effectively with team/group members.	0	0	100	0
5. Share appropriately	0	0	100	0
7. Documentation and record keeping	0	0	100	0

**NOTE: For this assessment item, the instructor reported criterion 4, 6 and 8 as "not-applicable" and so these are not reported in Table 3.*

Indirect Assessment Activities

For the 2018/19 academic year (as with past years), the student exit survey was used as the indirect assessment activity. The questions used on the survey are determined during the Fall term preceding the Spring term that the survey is sent out. For the 2018/19 academic year, the "old" SLOs were used on the student exit survey.

Prompt question: Please rate your proficiency in the following areas.

Table 19: Assessment Results for SLO d using Student Exit Survey, Spring 2019

Question	Very much	Quite a bit	Some	Very little	Total
d. An ability to function on multidisciplinary teams	38.46%	57.69%	3.85%	0.00%	26

Prompt question: How much has your experience at Oregon Tech contributed to your knowledge, skills, and personal development in these areas?

Table 20: Assessment Results for SLO d using Student Exit Survey, Spring 2019

Question	Very much	Quite a bit	Some	Very little	Total
d. An ability to function on multidisciplinary teams	26.92%	30.77%	30.77%	11.54%	26

Similar to the previous discussion, there is some similarity to SLO d and University ESLO 4 (Teamwork: Work effectively with groups and teams). Thus, it can be informative to compare the results of both the SLO 5/d and ESLO 4).

Prompt question: Please rate your proficiency in the following areas.

Table 21: Comparison of ESLO 3 and SLO d using Student Exit Survey, Spring 2019

Question	High proficiency	Proficiency	Some proficiency	Limited proficiency	Total
ESLO 4. Teamwork: Work effectively with groups and teams	53.33%	43.33%	3.33%	0.00%	30
SLO d. An ability to function on multidisciplinary teams	38.46%	57.69%	3.85%	0.00%	26

Prompt question: How much has your experience at Oregon Tech contributed to your knowledge, skills, and personal development in these areas?

Table 22: Comparison of ESLO 3 and SLO d using Student Exit Survey, Spring 2019

Question	High proficiency	Proficiency	Some proficiency	Limited proficiency	Total
ESLO 4. Teamwork: Work effectively with groups and teams	29.03%	38.71%	29.03%	3.23%	31
SLO d. An ability to function on multidisciplinary teams	26.92%	30.77%	30.77%	11.54%	26

Analysis and Recommended Actions

Strengths

Students clearly benefit from the feedback received – in the final assessment, all groups achieved proficient or higher in the final lab report for most of the performance criteria, a noticeable increase from the first assessment item.

Weaknesses

An unusually high number of students showed "low" or "some" proficiency for the final assessment, after most groups showed "proficiency" or "high proficiency" for the mid assessment. This is attributed to the fact that the final assessment was due in Finals week, and students were likely preoccupied with their other final exams.

Comparing the data for ESLO 3 and SLO d (Table 21), it is interesting that the number of students who rank themselves as "proficient" or "highly proficient" is almost identical (96.66% and 96.15%). However, when asked whether Oregon Tech contributed to this proficiency, 67.74% felt it had when considering the University ESLO and only 57.69% when considering the EAC SLO.

In Table 7, 96.15% of BSME students feel that they have a understanding of the professional and ethical responsibilities of an engineer. However, only 73.07% of students feel that Oregon Tech contributed to this understanding. Adding the 15.38% of student who feel that Oregon Tech contributed "some proficiency" to their knowledge, and the total is still less than 96.15% This indicates that while students believe they ultimately end up with the requisite knowledge, they do not believe that the MMET Department completely gives them this knowledge. Thus, one could conclude that most students end up with proficiency in teamwork, but at least some of this proficiency is being gained through non-ME courses or activities.

Comparisons to previous data:

SLO d ("graduates will be able to function on multi-disciplinary teams") was last assessed at the Klamath Falls campus during the 2015/16 academic year using MECH 437 (Winter 2016) and MECH 492 (Spring 2016). A summary of these results is shown in Tables 14 & 15.

Table 23: Abridged summary of assessment results for SLO d using MECH 437 (Winter 2016), Klamath Falls campus

Assessment Criteria	Average score
Identify and achieve goal/purpose	100%
Assume roles and responsibilities as appropriate	100%
Interact appropriately with team/group members	100%
Recognize and help reconcile differences among team/group members	100%
Share appropriately in work of team/group.	100%
Develop strategies for effective action.	100%
Cultural Adaptation.	100%

Table 24: Abridged summary of assessment results for SLO d using MECH 492 (Spring 2016), Klamath Falls campus

Assessment Criteria	Average score
Identify and achieve goal/purpose	80.0%
Assume roles and responsibilities as appropriate	77.0%
Interact appropriately with team/group members	64.5%
Recognize and help reconcile differences among team/group members	63.5%
Share appropriately in work of team/group.	59.0%
Develop strategies for effective action.	72.5%
Cultural Adaptation.	87.0%

Comments from this assessment activity indicated that the instructors felt that the students showed excellent teamwork skills. This is replicated in the 2018/19 assessment, where students continue to form good working relationships with their peers. One observation that students made in 2015/16 was group work became challenging when the group size exceeded 6 students. This was corrected in the 2018/19 assessment by only allowing groups of 2-4 students.

Recommended actions

A method needs to be found to discriminate the contributions of BSME, BSMET, BSMFG and BSREE students. At present, groups form organically and consist of students from multiple programs. Additionally, a method should be found to assess the individual contributions of each student.

8. Summary of Student Learning Outcomes & Actions Taken

As mentioned in the introduction to this report, the assessment activities for the 2018/19 academic year were limited to one direct and one indirect assessment activity. Additionally, assessment was only conducted by one of the three campuses. However, from this limited amount of data the following conclusions can be drawn:

- SLO 4: Students appear to continue to struggle with identifying, critically evaluating and justifying alternative approaches/solutions to engineering problems.
  ACTION: The Program Director will write to all staff, asking them to try and ensure that their students think of the "bigger picture" when undertaking assessment items. In the 2022/23 academic year (when SLO 4 is next evaluated), this point will be further emphasized to staff.
- SLO 5: Students continue to work very collaboratively with each other. It appears that the fact that these students are in enrolled in different degrees (or majors) has little to no bearing on their ability to work together to achieve a good result. This is extremely encouraging and suggests that Oregon Tech graduates should easily be able to work in multidisciplinary teams.

Additional actions suggested for the 2019/20 academic year

- In the 2015/16 report, it is stated that Program Educational Objectives (PEO) were currently under review. However, it is unclear what the outcomes of this review were. This needs to be clarified.
- The curriculum map needs to be updated to reflect changes in the program SLOs.
- The rubrics used for assessment need to be re-written to reflect the updated ABET SLOs being assessed. Draft rubrics are shown in Appendix II.
- Two direct and one indirect assessment activity needs to be completed for each SLO at each campus for the 2019/20 academic year.
- Overall communication between the three campuses needs to be improved to ensure consistency between assessment activities.

APPENDIX I: EAC SLOs Comparing "Old" And "New" Language

Current Language EAC Criteria effective 2017-18 and 2018-19 Cycles	New Language Approved by the EAD October 20, 2017 Applicable beginning in the 2019-20 cycle
Criterion 3. Student Outcomes The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.	Criterion 3. Student Outcomes The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.
(a) an ability to apply knowledge of mathematics, science, and engineering (e) an ability to identify, formulate, and solve engineering problems	1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	2. 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
(d) an ability to function on multidisciplinary teams	5. 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
(f) an understanding of professional and ethical responsibility (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (j) a knowledge of contemporary issues	4. 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
(g) an ability to communicate effectively	3. an ability to communicate effectively with a range of audiences
(i) a recognition of the need for, and an ability to engage in life-long learning	7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Implied in 1, 2, and 6

APPENDIX II: Rubrics Used For Assessment

Draft versions of the rubrics to be used for assessment activities are listed below. Some faculty used these rubrics in 2018/19 in order to evaluate their effectiveness. These rubrics will be reviewed during the 2019/20 academic year. Listed in the rubrics is "old" EAC language (a-k) and "new" EAC language (1-7) to allow comparisons to be made. Refer to Appendix I for details of how the "old" SLOs have been remapped to the "new" SLOs.

"NEW" EAC SLO 01: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and
mathematics

"OLD" EAC SLO a: Graduates will have the ability to apply mathematics, science and engineering.
"OLD" EAC SLO e: Graduates will be able to identify, formulate, and solve engineering problems.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
1a) Identifies an engineering problem.	Does not identify the problem clearly.	Defines problem but has missing elements or does not include important information.	Adequately defines problem, including sufficient basic information.	Clearly identifies problem or reiterates given problem, including underlying principals and scope. Demonstrates depth of understanding.
1b) Formulate a plan which will lead to a solution, including making appropriate assumptions.	Unable to develop a coherent plan to solve the problem. Does not identify assumptions or constraints, or makes errors in attempting to do so.	Develops a marginal plan with some important elements missing. Identifies some assumptions and constraints but important elements are missing.	Develops an adequate plan that leads to a plausible solution. Identifies basic assumptions and constraints.	Develops a coherent and concise plan to solve the problem with alternative strategies and a clear path to solution. Plan smoothly flows from problem statement and assumptions. Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.

1c) Identify the engineering principles that govern the performance of a given process or system, and use these to analyze the problem (utilizing appropriate hardware and software technology tools).	Unable to apply prerequisite engineering concepts to new problems. Makes significant errors in computation and/or logic. Does not use appropriate principals for analysis. Unable to select and apply appropriate technology tools or does not demonstrate understanding of tools selected.	With extensive guidance, applies prerequisite engineering concepts to new problems. Computations may not include all important elements or steps. Order may not be logical and analysis incomplete with some elements missing. With extensive guidance, selects and properly applies appropriate technology tools. Demonstrates some understanding of tools selected.	Applies prerequisite engineering concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order. Performs basic analysis using appropriate principles to solve problems. Selects and properly applies appropriate technology tools, but may need guidance. Demonstrates basic understanding of tools selected	Independently applies prerequisite engineering concepts to new problems. Selects correct engineering principles. Performs computations in a logical order. Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem. Independently selects and properly applies appropriate technology tools. Demonstrates thorough understanding of tools selected.
1d) Apply scientific principles that govern the performance of a given process or system in engineering problem(s).	Unable to apply prerequisite scientific concepts to new problems. Makes significant errors in computation and/or logic.	With extensive guidance, applies prerequisite scientific concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite scientific concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies prerequisite scientific concepts to new problems. Selects correct scientific principles. Performs computations in a logical order.
1e) Apply math principles to obtain analytical or numerical solution(s) to an engineering problem.	Unable to apply prerequisite math concepts to new problems. Make significant errors in computation and or logic.	With extensive guidance, applies prerequisite math concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite math concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies perquisite math concepts to new problems. Selects correct math principles. Performs correct, thorough, clear computations in logical order.

"NEW" EAC SLO 02: 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

"OLD" EAC SLO c: Graduates will be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
2a) Identify an appropriate set of realistic constraints and performance criteria with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	No consideration of public health, safety or welfare. No consideration of any global, cultural, social, environmental or economic factors. A large number of codes, standards or performance criteria are missing or unclear.	Some consideration of public health, safety or welfare and/or global, cultural, social, environmental or economic factors. Is able to identify some codes & standards, but important elements are missing. Identifies & documents some performance criteria, but important elements are missing or unclear	Considers public health, safety or welfare and/or global, cultural, social, environmental or economic factors, but these considerations are limited or very basic. Presents basic relevant codes & standards. Identifies and documents performance criteria in a basic manner.	Prevents a multifaceted approach that fully considers the public health, safety and welfare as well as the global, cultural, social, environmental or economic factors. Thoroughly presents most important, relevant codes & standards applying to project. Clearly identifies & documents in-depth performance criteria.
2b) Create a detailed design/solution within realistic constraints.	Is unable to create a design or solution with sufficient detail or documentation. Does not address constraints.	Design or solution has some, but inadequate detail or documentation or does not address constraints.	Creates design or solution with adequate detail and documentation. Incorporates and addresses constraints.	Applies engineering principles to solution. Creates design with high level of detail and appropriate documentation. Thoroughly addresses constraints.
2c) Generate one or more creative solutions to meet the criteria and constraints.	Is unable to generate a creative, workable, usable, or realistic solution. Does not recognize constraints or identify criteria.	Generates a solution but does not demonstrate creativity or the ability to think through alternatives. Design may not be workable, useable or realistic. Misses important constraints or criteria.	Generates a basic solution demonstrating creativity in the design. Recognizes basic criteria and constraints.	Generates one or more workable, usable, or creative solutions. Demonstrates ability to see unique alternatives. Recognizes and addresses constraints thoroughly.
2d) Plan and	Does not develop a	Defines task and	Defines basic tasks	Defines realistic and

manage a small technical project.	task/timeline, does not implement project with success, or does not provide documentation. Does not meet deadline.	timeline with some elements missing or unrealistic. Implements project but misses important elements. Documentation is provided but needs more detail. May not meet deadline.	and timelines, implements project, including testing and basic documentation, meets deadline.	detailed tasks and timelines, implements project in exemplary fashion, performs thorough testing, documents important procedures or processes in detail, completes plan on time.

"NEW" EAC SLO 03 An ability to communicate effectively with a range of audiences

"OLD" EAC SLO g: An ability to communicate effectively

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
3a) Purpose and Audience	• Purpose is unclear or requires substantial inference from the audience. • Intended audience is unclear or overly broad. • The work would not be meaningful or useful to the intended audience. • The work omits or dismisses key audience concerns.	• Purpose may be inferred, but is not clearly stated • Minor changes in approach or medium would make the work more meaningful or useful to the intended audience. • Some content is too advanced/basic for the intended audience.		• Content serves a specific, identifiable purpose (e.g., inform, persuade, analyze). • Purpose and content are appropriate to the needs of a specific, identifiable, and appropriate audience. • Content is tailored to the level of expertise, authority, and values of the audience. • Communication medium (essay, memo, report, speech, etc.) matches purpose and audience.
3b) Focus and Organization	• Organizing element is underdeveloped, inconsistent, or missing. • Order and structure are	• Organizing element is present, but needs development (it is too broad, narrow, or trivial). • Minor gaps in organization detract from the effectiveness of the work. • Minor changes in organization would clarify the hierarchy of claims and		• Content is focused on a specific and appropriate organizing element: a thesis statement,

	unclear. • Digressions compromise or obscure the work's purpose. • Transitional elements are underdeveloped, inconsistent, or missing.	information. • Minor changes in transition language would improve the work (transitions between key ideas are choppy or abrupt).	purpose statement, or theme. • Content is organized so that ideas relate clearly to each other and to the organizing element. • Distinctions between major and minor claims are clear, providing consistent focus in content. • Transition language (and other organizing elements, such as headings or lists) throughout organizes ideas and guides audience understanding.
3c) Support and Documentation	• The work includes frequent instances of unsupported claims or key missing details. • The work relies on evidence that lacks rigor, based on the audience's or discipline's standards. • The work relies on demonstrably biased evidence (without providing appropriate context or qualification of that evidence). • The work treats sources with bias, or demonstrates incomplete understanding of source material.	• The work includes few instances of claims unsupported by appropriate evidence. • Additional or more carefully chosen details would improve the work. • The work includes (but does not rely on) evidence that lacks rigor, based on the audience's or discipline's standards. • Additional context or discussion of credentials for sources of evidence would add value to the work. • The work contains few, minor documentation errors (according to academic citation style or disciplinary approach).	• Claims are consistently supported with appropriate, relevant, and specific evidence, whether drawn from disciplinary knowledge, careful reasoning, or credible research. • Evidence derived from sources supports and develops original content. • Source material is credible; it is introduced and interpreted to provide context. • Source material is documented accurately according to the

	• The work does not meet academic citation or disciplinary standards.		appropriate conventions (academic citation style or disciplinary approach).
3d) Style and Conventions	• (Where students have a choice in form or medium) the choice or form or medium is inappropriate to audience, purpose, or context. • Terminology, word choice, sentence structure, or tone are not in keeping with professional or academic expectations for the work. • **Written**: prevalent or distracting spelling, grammar, syntax, usage, and/or mechanics errors compromise the work's impact, credibility, or coherence. • **Oral:** prevalent or distracting verbal and/or non-verbal delivery issues compromise the work's impact, credibility, or coherence.	• (Where students have a choice in form or medium) a minor change in form or medium would make the work more accessible or engaging to the audience. • Minor changes in terminology, word choice, sentence structure, or tone would improve the work. • **Written:** the work contains minor, isolated errors in spelling, grammar, syntax, usage, and/or mechanics; an editing pass would improve the work. • **Oral:** the work contains minor, isolated issues in verbal and/or non-verbal delivery; additional preparation or practice would improve the work.	• Students deliver content in spoken, written, or visual forms and media, as appropriate to context. • Use of language (terminology and word choice, sentence structure, etc.) is clear and professional, demonstrating mastery of content and form. • **Written:** students demonstrate correct grammar, spelling, syntax, usage, and mechanics. • **Oral:** both verbal and nonverbal delivery demonstrate poise, preparation, mastery of material and audience awareness/ engagement.
3e) Visual Communication (where appropriate)	• The work includes any visuals that are inappropriate to audience or context. • Necessary visuals are missing	• Minor changes in content, organization, or appearance would enhance the visuals in the work. • Additional or more carefully-chosen visuals would improve the work. • Some (but a minority of) visuals in the work serve a purely aesthetic purpose, and relate only tangentially to the	• High quality visuals are employed to illustrate, contribute to, or develop content, and not for purely aesthetic appeal.

	from the work. • Most (or all) visuals in the work serve a purely aesthetic purpose, and relate only tangentially to the work's purpose and content. • The work presents most (or all) visuals without context or interpretation. • The work presents most (or all) visuals without documentation (according to academic citation style or disciplinary approach).	work's purpose and content. • Additional context and interpretation of visuals would improve the work. • The work contains few, minor documentation errors of visuals, or the information presented in visual format (according to academic citation style or disciplinary approach).	• All visuals are appropriately introduced and interpreted. • All visuals are documented according to the appropriate conventions (academic citation style or disciplinary approach).
3f) Justification (Self- Assessment)	• Student omits discussion of multiple ESLO criteria. • Student's self-evaluation is cursory, facile, or is compromised by lack of insight (student overlooks obvious deficiencies in the work). • Student demonstrates an inability or unwillingness to elicit or use feedback to improve the work.	• Student omits evaluation of one ESLO criterion. • Student's self-evaluation would be improved by a more rigorous analysis. • Student's self-evaluation addresses only process, or only product, but does not address both. • A more rigorous approach to eliciting and using feedback would improve the work.	• Articulate a clear rationale for communication choices (purpose and audience, focus and organization, support and documentation, style and conventions, and visual communication). • Self-assess the quality of their work (including process and product). • Elicit and effectively use feedback to improve their work.

Communication rubric based on the OIT ESLO Communication rubric developed by the ESLO Communication Committee (approved by the Assessment Executive Committee, November 2016)

"NEW" EAC SLO 04: 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

"OLD" EAC SLO f: An understanding of professional and ethical responsibility.
"OLD" EAC SLO h: The broad education necessary to understand the impact of engineering in a global, economic, environmental, and societal context.
"OLD" EAC SLO j: Graduates will have knowledge of contemporary issues.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
4a) Demonstrates knowledge of the professional code of ethics and can use it to describe ethical issues. Demonstrates knowledge and understanding of "ethical diversity".	Identifies provisions in the professional code of ethics, but is unable to demonstrate importance or relevance to the profession. Has a vague idea of what the issues are but is uncertain how the code of ethics applies. Demonstrates none or minimal understanding of ethical diversity. Does not recognize biases.	Describes the importance of provisions, but some examples do not apply or fail to illustrate importance of the specified provision. Describes the issue(s) using concepts from code of ethics, but important elements may be missing or misunderstood. Demonstrates a partial understanding of ethical diversity and recognition of biases.	Describes the importance of the provisions in the professional code of ethics. Examples are applicable to the specified provisions and illustrate importance. Describes the issue(s) using basic concepts from the code of ethics. Demonstrates adequate understanding of ethical diversity and recognition of biases.	Describes in details the importance of provisions in the professional code of ethics and relevance to the profession. Examples are applicable to the specified provisions and illustrate importance. Describes the issue(s) in detail, demonstrating full understanding of relevant code of ethics provisions and how they relate to the issues(s). Demonstrates a complete understanding of ethical diversity and the recognition of biases.
4b) Understands the global impact of engineering decisions	Does not understand that engineering solutions have a global impact.	Realizes that engineering solutions have a global impact but had difficulty giving examples.	Understands engineering decisions have a global impact and can explain several examples.	Understands engineering decisions have a global impact, can analyze examples, and can reflect on impact of proposed engineering solutions.

4c) Understands the macro-economic impact of engineering solutions	Has little or no understanding of macro-economics.	Has little understanding of macro-economics and the effects of engineering solutions. Cannot give examples of such impacts.	Has some understanding of macro-economics and impacts on it from engineering solutions. Can give examples.	Has an understanding of macro-economics and the impact of engineering solution on it. Can explain examples and reflect on the impact new solutions may have.
4d) Understands major socio-economic and political issues of engineering solutions	Little or no understanding (or interest). Unable to put forth more than one side to an issue.	Moderate understanding of national and international issues. Can follow but has trouble expressing more than one side of an issue.	Good understanding of many issues. Understands and can express more than one side of an issue.	Deep understanding of the immediate and long-term implications. Articulate and expressive arguments from several viewpoints including the historical perspective.
4e) Understands the environmental and the social impact of engineering decisions	Does not believe that engineering decisions have a social or environmental impact.	Believe engineering solutions have a social and/or environmental impact but can't relate this to a particular situation.	Understands engineering decisions have social and/or environmental impacts. Can describe examples.	Understands engineering decisions have social and/or environmental impacts. Can relate this knowledge to a current situation.
4f) Describes and analyzes possible/alternative approaches and can explain the benefits and risks	Is unable to describe or analyze alternatives or consider the effect on parties involved. Has difficulty choosing an approach or stating benefits and risks.	Describes and analyzes only one alternative and its effect on parties involved, but important elements are missing or misunderstood. Chooses an approach and explains benefits and risks, but important elements are missing or misunderstood.	Describes and analyzes at least two alternatives and their effects on parties involved. Chooses an approach and explains basic benefits and risks.	Describes and analyze a number of alternative approaches and thoroughly considers the interests and concerns of all parties involved. Chooses an approach and thoughtfully and thoroughly explains benefits and risks.

"NEW" EAC SLO 05: 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

"OLD" EAC SLO d: An ability to function on multidisciplinary teams.

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Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
5a) Identifies and achieves goal/purpose	Clear goals are not formulated or documented. Members don't accept or understand the purpose/task of the group. Group does not achieve goal.	Individuals share some goals but a common purpose may be lacking. Priorities may be unrealistic and documentation may be incomplete. Group may not achieve goal.	Group shares common goals and purpose. Some priorities may be unrealistic or undocumented. Group achieves goal.	When appropriate, realistic, prioritized and measurable goals are agreed upon and documented and all team members share the common objectives/purpose. Team achieves goal.
5b) Assumes and fulfills roles and responsibilities as appropriate. Leadership strives to create a collaborative and inclusive environment.	Members do not fulfill roles and responsibilities. Leadership roles are not defined and/or shared. Members are not self-motivated and feel isolated. Assignments are not completed on time. Many members miss meetings.	Some members may not fulfill roles and responsibilities. Leadership roles are not clearly defined and/or effectively shared. Some members are not motivated and some assignments are not completed in a timely manner. Meetings rarely include most members.	Members often fulfil roles and responsibilities. Leadership roles are generally defined and/or shared. Generally, members are motivated and complete assignments in a timely manner. Many members attend most meetings.	Members consistently and effectively fulfill roles and responsibilities. Leadership roles are clearly defined and/or shared. Members move team goal by giving and seeking information or opinions and assessing ideas and arguments critically. Members are all self-motivated and complete assignments on time. Most members attend all meetings.
5c) Interacts and communicates effectively with team/group members.	Members do not communicate openly and respectfully. Members do not listen to each other. Communication patterns undermine teamwork.	Members may not consistently communicate openly and respectfully. Members may not listen to each other.	Members usually communicate openly and respectfully. Members often listen to most ideas. Members usually support and encourage each other.	Members always communicate openly and respectfully. Members listen to each other's ideas. Members support and encourage each other. Communication patterns foster a positive climate that motivates the team and builds cohesion and trust.
5e) Share appropriately	Contributions are unequal. Certain members dominate discussions, decision making, and work. Some	Contributions are unequal although all members contribute something to discussions,	Many members contribute to discussions, decision-making and work. Individuals focus on	All members contribute significantly to discussions, decision making and work. The work product is a collective effort: team

	members may not contribute at all. Individuals work on separate sections of the work product, but have no coordinating effort to tie parts together.	decision making and work. Coordination is sporadic so that the final work of product is uneven quality.	separate sections of the work product, but have a coordinator who ties the disparate parts together (they rely on the sum of each individual's work).	members have both individual and mutual accountability for the completion of the work product.
5f) Develop strategies for effective action	Members seldom use decision making processes to decide on action. Individuals often make decisions for the group. The group does not share common norms and expectations for the outcomes. Group fails to reach consensus on most decisions. Group does not produce plans for action.	Members sometimes use decision making processes to decide on action. Some of the members of the group do not share norms and expectations for outcomes. Group sometimes fails to each consensus. Plans for action are informal and often arbitrarily assigned.	Members usually use effective decision making processes to decide on action. Most of the group shares norms and expectations for outcomes. Group reaches consensus on most decision and produces plans for action.	Members use effective decision making processes to decide on action. Group shares a clear set of norms and expectations for outcomes. Group reaches consensus on decisions and produces detailed plans for action.
5g) Documentation and record keeping	No formal method or process for recording group decisions. Information is scattered and not accessible to group members.	An attempt has been made to keep records, but the format has missing elements and the documentation is incomplete or unclear.	A method or process exists for recording group decisions and results in understandable and usable documentation.	A method or process exists for recording group decisions which are shared and understood by all group members. Information about decisions is readily accessible and the final documentation is polished and organized.
5h) Cultural adaptation	Members do not recognize differences in background or communication style.	Members may recognize, but do not adapt to differences in background and communication style.	Members usually recognize and adapt to differences in background and communication style.	Members always recognize and adapt to differences in background and communication style.

"NEW" EAC SLO 6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

"OLD" EAC SLO b: Graduates will have the ability to design and conduct experiments, as well as to analyze and interpret data.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
6a) Ability to develop experiments	Has trouble identifying what parameters or physical phenomenon need to be measured	Can identify what physical parameters or phenomenon needs to be measured with some direction, but understanding of the reasons behind the choice are limited	Can identify what physical parameters or phenomenon that needs to be measured, but does not understand why.	Can identify what physical parameters or phenomenon needs to be measured. Understand the reasons behind the choices and can troubleshoot and provide alternative approaches as required.
6b) Ability to conduct experiments	Has trouble carrying out pre-defined experiments.	Able to conduct experiments with some direction.	Able to set up and carry through pre-defined experiments obtaining useful data.	Able to conduct experiments obtaining solid data appropriate to the investigation at hand.
6c) Ability to analyze and interpret data	Has difficulty analyzing experimental data. Presentation and reporting of results is confusing and hard to follow.	Able to analyze experimental data with general direction and guidance.	Ability to analyze experimental data. Can present and report results in an orderly and understandable manner.	Show ability to analyze experimental data independently extracting and presenting insightful results.
6d) Ability to use experimental judgement to draw conclusions	Has trouble applying experimental results as a basis for conclusions.	Able to use results as a basis for conclusions with significant guidance.	Can use results to support conclusions, but these conclusions are simplistic and limited.	Can use results to support detailed and insightful conclusions. Counter-arguments are examined and alternative hypotheses proposed.

"NEW" EAC SLO 07: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

"OLD" EAC SLO i: a recognition of the need for, and an ability to engage in life-long learning

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency
7a) Lifelong learning	Fails to identify the need for "lifelong learning" and/or omits discussion of their own learning and relevant examples.	Misses important elements ins discussing "lifelong learning" applying concepts to their own learning or providing a relevant example.	Defines the concept of "lifelong learning". Demonstrates self-awareness by accurately identifying strengths/weaknesses in their own ability to learn independently. Gives a relevant example.	Defines the concept of "lifelong learning" and its importance. Demonstrates self-awareness by accurately discussing strengths/weaknesses in their own ability to learn independently. Gives relevant example(s).
7b) Learning strategies	Is not aware of any learning strategies. Learning is random and haphazard	Is aware of different learning strategies, but fails to apply these in a meaningful or purposeful way.	Is aware of different learning strategies and is able to utilize them.	Is aware of different learning strategies and actively works to utilize them to gain additional knowledge. Maintains currency of different learning methods and/or systems.
7c) Professional development	Fails to identify professional development opportunities.	Discusses professional development opportunities that are either inappropriate or irrelevant.	Identifies appropriate professional development opportunities.	Identifies and thoroughly discusses appropriate professional development opportunities.
7d) Short and long term career plans	Vaguely describes career goals and/or does not include a plan to meet them.	Career goals after graduation do not include both long and short term plans and/or the plan is unrealistic.	Describes short and long term career goals after graduation. Includes realistic plan to meet these goals.	Describes short and long term career goals after graduation. Includes realistic, thorough, and thoughtful plan to meet these goals.