Mechanical Engineering Program
2015-1016 Assessment Report

INTRODUCTION

This report documents the assessment done within the Bachelor of Science in Mechanical Engineering (BSME) program at Oregon Institute of Technology during the 2015-16 academic year, with the program being delivered both on the main campus in Klamath Falls and at our Seattle campus. Note that the Manufacturing and Mechanical Engineering and Technology (MMET) Department is located on a third Oregon Tech campus, located in Wilsonville, Oregon. Undergraduate MMET programs at the Wilsonville campus consist of the Bachelors of Science Degree in Manufacturing Engineering Technology and the Bachelors of Science Degree in Mechanical Engineering Technology (both of which are also offered at the Klamath Falls and Seattle campuses; and are accredited through ABET ETAC); and they have a number of courses that are common with the BSME program. Thus faculty input from the Wilsonville campus is also considered when assessing the effectiveness of a number of our departmental courses. Finally, note that the BSME program is just starting to be offered at the Wilsonville campus, with the planned hiring of 3 new faculty members taking place this academic year.

Besides reviewing several of the BSME learning outcomes, the MMET Department reviewed the BSME Program Educational Outcomes during the 2015 – 2016 academic year.

The BSME program is using a three year assessment cycle; and this assessment cycle is the same for both the Klamath Falls and Seattle campuses. This cycle is set up so that each outcome is assessed at least once every three years. The outcomes being assessed within the 2015-1016 school year are summarized here, both the assessment being done and results of these assessments.

PROGRAM MISSION STATEMENT AND EDUCATIONAL OBJECTIVES

The mission statement of the ME Program is in line with and built upon the mission statements of 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. Its mission is to provide graduates the skills and knowledge for successful careers in mechanical engineering.

Current Mechanical Engineering Program Educational Objectives

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 regionally and nationally.
- pursued continued professional development, including professional registration if desired.
- successfully pursued engineering graduate studies and research, if desired.

Review of the BSME Program Educational Objectives (PEOs):

The MMET Department is currently reviewing the BSME Program Educational Objectives (PEO). The MMET Department has a review process that is being modified to meet ABET criteria. The process being used this year is as follows:

- The MMET Department faculty reviews/revises the PEOs at a Department meeting during the academic year.
- The MMET Department next reviews/revises the PEOs with their Industry Advisory Council during one of their two annual meetings.
- The PEOs are then sent out to our other constituents for review:
    - The Department Chairs for Mechanical Engineering at Oregon State University and Portland State University (since one of our current PEOs involves our students being prepared for graduate school).
    - Our alumni are surveyed, since they are also one of our main constituents.
    - We currently do not survey industry/employers of our graduates since we feel that our current IAC members are a good representative of this faction.
- Using this feedback the department then makes the final revisions to our BSME PEOs and posts them to the Oregon Tech webpage.

Using this review process we have slightly modified our BSME PEOs for the 2015 – 2016 academic year to read as follows:

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.

EDUCATIONAL OUTCOMES

The ME program's Student Learning Outcomes are aligned with ABET EAC outcomes. These are stated as:
(a) an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design and realize a physical system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(m1) Graduates will be able to work professionally in the area of thermal systems
(m2) Graduates will be able to work professionally in the area of mechanical systems.

These outcomes mirror those of the EAC of ABET. Outcomes (a) and (c) have been slightly modified to better represent ABET's Mechanical Engineering program specific criteria. Also, outcomes (m1) and (m2) have been added also to address ABET's Mechanical Engineering program specific criteria.

Three-Year Cycle for Assessment of Student Learning Outcomes
The faculty planned a three-year assessment cycle for the program's student learning outcomes as shown in Table 1.

Student Learning Outcome	2015-16	2016-17	2017-18	ETAC
(a) an ability to apply knowledge of mathematics, science, and engineering			x	b
(b) an ability to design and conduct experiments, as well as to analyze and interpret data		x		c
(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			x	d
(d) an ability to function on multidisciplinary teams	x			e
(e) an ability to identify, formulate, and solve engineering problems			x	f
(f) an understanding of professional and ethical responsibility	x			i
(g) an ability to communicate effectively		x		g
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	x			j
(i) a recognition of the need for, and an ability to engage in life-long learning		x		h
(j) a knowledge of contemporary issues		x		j
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice		x		a
(m1) Graduates will be able to work professionally in the area of thermal systems			x	
(m2) Graduates will be able to work professionally in the area of mechanical systems.			x	

Table 1. Assessment Cycle

Summary of 2015-16 Assessment Activities

The Mechanical Engineering faculty conducted formal assessment of three student learning outcomes during 2015-16. The outcomes assessed this year are: SLO d. *Graduates will be able to function on multi-disciplinary teams;* SLO f. *Graduates will have an understanding of professional and ethical responsibility;* and SLO h. *Graduates will have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.* These outcomes have been mapped to the curriculum as shown in Appendix I.

At each campus where a degree program is offered the normal assessment for each outcome consists of two direct assessments, and one indirect assessment. The direct assessments are evaluated using an outcome-specific Rubric developed by the Oregon Tech MMET Department and/or the faculty at Oregon Tech. The faculty and Program Directors at each campus determine which courses are used to assess each outcome; they do not have to be the same courses at both campus. The rubrics used for this year's assessment activities are included in Appendix II of this report.

The indirect assessment used for both campuses is a "senior survey", which is given spring term to all of the BSME students enrolled in our year-long senior projects sequence. The survey is common for all campuses, but can be sorted to give results for individual campuses.

SLO d. *Graduates will be able to function on multi-disciplinary teams.*

The Performance Criteria to consider in assessing this outcome are:

- Identify and achieve goal/purpose.
- Assume roles and responsibilities as appropriate.
- Communicate effectively.
- Recognize and help reconcile disagreements among team/group members.
- Share appropriately in work of team/group.
- Develop strategies for effective action.
- Recognize and adapt to cultural differences.

Klamath Falls Campus Assessment:

Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 437 Winter term 2016, using an assignment scored with a rubric. There were 21 mechanical engineering students involved in the assessment; the results are shown in Table 2.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify and achieve goal/purpose	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%

Assume roles and responsibilities as appropriate	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%
Interact appropriately with team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%
Recognize and help reconcile differences among team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%
Share appropriately in work of team/group.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%
Develop strategies for effective action.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%
Cultural Adaptation.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%

Table 2. ME Assessment Results for SLO d, Winter 2016, Klamath Campus

Strengths: All of the groups showed excellent teamwork skills! They attributed this to the fact that they knew each other from many common courses.

Weaknesses: No weaknesses were identified. Most of the students said that in this group size (nominally 4 students) that they had excellent teamwork. Some students did comment that for groups of 6+ students that teamwork becomes more challenging.

Actions: None for this course; but there is a recommendation that we should also assess this outcome in larger groups such as senior projects.

Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MECH 492 Senior Project III Spring term 2016, using an evaluation of the group teamwork based upon the group-members input; scored with a rubric (the Oregon Tech Teamwork Rubric). There were three instructors involved in this assessment; Professors Moravec, Stuart, and Lee. This assessment was administered to MMET students enrolled in the third term of their senior project sequence, and included input from mechanical engineering students, MET students, and MFG students in the MMET Department. For Professor Lee's section of Senior Project there were 8 mechanical engineering students involved in the assessment, the results are shown in Table 3.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify and achieve goal/purpose	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	75%
Assume roles and responsibilities as appropriate	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	100%

Interact appropriately with team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	75%
Recognize and help reconcile differences among team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	62.5%
Share appropriately in work of team/group.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	75%
Develop strategies for effective action.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	87.5%
Cultural Adaptation.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	87.5%

Table 3. ME Assessment Results for SLO d, Spring 2016, Klamath Campus; Prof Lee

Strengths: All of the groups showed excellent teamwork skills! They attributed this to the fact that they knew each other from many common courses. Students know well what his/her roles or responsibilities are and also develop actions as well as strategies to move to the next step towards getting the goals. These qualities show they showed great teamwork and they all equipped with some high-level of engineering knowledge, skills and techniques.

Weaknesses: I did not identify any weaknesses. Most of the students said that in this group size (nominally 4 students) that they had excellent teamwork. Some students did comment that for groups of 6+ students that teamwork becomes more challenging. A few students showed they are not very much interactive with team members in terms of sharing, co-working, or helping each other.

Actions: None for this course; but we should also assess this outcome in larger groups such as senior projects: I'd like to execute this teamwork evaluation at every term.

For Professor Moravec's section of Senior Project there were 14 mechanical engineering students involved in the assessment, the results are shown in Table 4.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify and achieve goal/purpose	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	85%
Assume roles and responsibilities as appropriate	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	54%
Interact appropriately with team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	54%
Recognize and help reconcile differences among team/group members	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	64%
Share appropriately in work of	Rubric-scored	1-4	80% score 3	

team/group.	student interviews	proficiency scale	or 4	43%
Develop strategies for effective action.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	57%
Cultural Adaptation.	Rubric-scored student interviews	1-4 proficiency scale	80% score 3 or 4	86%

Table 4. ME Assessment Results for SLO d, Spring 2016, Klamath Campus; Prof Moravec

Strengths: The only categories that the group scored at the 80% goal or above were Identifies and Achieves goal/purpose, and Cultural Adaptation.

Weaknesses: All of the other categories scored below the 80% goal; with shares work appropriately scoring the lowest at 43%.

Actions: More emphasis needs to be put on teamwork, especially sharing work appropriately. Also, the MMET Department should look at creating a second Rubric that would evaluate individual team contributions, and clearly define the student's roles.

Seattle Campus Assessment:

No assessments were turned in for Seattle.

Indirect Assessment #1 MMET Undergraduate Exit Survey (Both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. 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. There were a total of 29 responses from Klamath Falls seniors and only 1 response from Seattle seniors; for a total of 30 responses (note that not all students answered all questions). Student responses from the Klamath Falls campus indicate that 92.9% of all BSME students felt prepared in this outcome; see Table 5 below.

	Highly Prepared	Prepared	Inadequately Prepared
Outcome d KF	15	11	2
Outcome d Seattle	1	0	0

Table 5. ME Indirect Assessment for SLO d, Senior Exit Surveys 2015-16

Summary Recommendations for Outcome (d):

The results shown above indicate that the Klamath Falls students are effectively able to function on smaller multidisciplinary of 4-6 students, but they may have trouble performing on larger teams. It is recommended that a new rubric be created to give along with the current OIT Teamwork Rubric; the new rubric would be created to allow for individual contributions to teams to be determined.

It is recommended that this outcome be assessed at both campuses with two direct, and one indirect assessment.

SLO f. an understanding of professional and ethical responsibilities.

The performance criteria for this learning outcome are

- Demonstrates knowledge of the professional code of ethics
- Using code of ethics, describes ethical issue(s)
- Describes parties involved and discusses their points of view
- Describes and analyzes possible/alternative approaches
- Chooses an approach and explains the benefits and risks

Klamath Falls Campus Assessment:

Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 491 Senior Projects II during winter 2016, using an assigned paper that was scored with a rubric. The assignment was a combination of reading and then providing details on the Code of Ethics for Engineers; and then reading an assigned ethics senior and using their knowledge to guide the reader through a solution. This assignment was assessed in the 3 section of Senior Project II taught by Lee (8 students), Moravec (17 students), and Stuart (8 students). The results are shown in Table 6 for all three sections of senior projects II. The comments below are from the 3 faculty members involved.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results Lee	Results Moravec	Results Stuart
Demonstrates knowledge of the professional code of ethics	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%	100%	100%
Using code of ethics, describes ethical issue(s)	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%	86.7%	100%
Describes parties involved and discusses their points of view	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%	86.7%	100%
Describes and analyzes possible/alternative approaches	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%	80%	100%
Chooses an approach and explains the benefits and risks	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%	80%	100%

Table 6. ME Assessment Results for SLO f, Fall 2014, Klamath Campus

Strengths: Good research done by students and an understanding of ethics! The students all did a good job in showing their knowledge of the Code of Ethics.

Weaknesses: Written skills need some improvement.

Actions: Provide more written assignments.

Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in ENGR 111 MMET Orientation during fall 2015, using an assigned paper that was scored with a rubric. This exercise involved applying a structured methodology to a hypothetical ethical dilemma in order to evaluate and resolve the dilemma. There were 49 BSME students involved in this assessment assignment; the results are shown in Table 7.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Demonstrates knowledge of the professional code of ethics	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	95.9
Using code of ethics, describes ethical issue(s)	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	95.9
Describes parties involved and discusses their points of view	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	85.7
Describes and analyzes possible/alternative approaches	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	83.7
Chooses an approach and explains the benefits and risks	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	93.9

Table 7. ME Assessment Results for SLO f, Fall 2014, Klamath Campus

Strengths: Successful identification of stakeholders, alternative resolution scenarios, ethical/moral principles; and assessment via an evaluation/decision matrix.

Weaknesses: Failure to read/understand instructions and follow directions specified in exercise documentation.

Actions: Reiterate importance of reading/understanding instructions and following directions provided.

Seattle Campus Assessment:

No assessments were turned in for Seattle.

Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. 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. There were a total of 29 responses from Klamath Falls seniors and 1 response from Seattle seniors; for a total of 30 responses (note that not all students answered all questions). Student responses from the Klamath Falls campus indicate that 100% of all BSME students felt prepared in this outcome; see Table 8 below.

	Highly Prepared	Prepared	Inadequately Prepared
Outcome f KF	12	16	0
Outcome f Seattle	1	0	0

Table 8. BSME Indirect Assessment for SLO f, Senior Exit Surveys 2015-16

Summary Recommendations for Outcome (f):

The results shown above indicate that the Klamath Falls students are effectively able to understand professional and ethical responsibilities. It is recommended that this outcome be assessed with at least 2 direct assessments and one indirect assessment at each campus.

SLO h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

The performance criteria for this learning outcome are

1. Understands the global impact of engineering decisions.
2. Understands the macro-economic impact of engineering solutions.
3. Understands the environmental and the social impact of engineering decisions.

Klamath Falls Campus Assessment:

Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 491 Senior Projects I during Fall term 2016, using an assigned paper scored with a rubric. There were 22 mechanical engineering students involved in the assessment, and 3 MMET faculty members; Lee (1 student), Moravec (18 students) and Stuart (3 students). The results are shown in Table 9 for the combined 22 students; and the comments below are from Moravec.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Understands the global impact of engineering decisions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	90.9%
Understands the macro-economic impact of engineering solutions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%
Understands the environmental and the social impact of engineering decisions	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%

Table 9. ME Assessment Results for SLO h, Fall 2015, Klamath Campus

Strengths: 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..

Weaknesses: There were no weaknesses observed

Actions: none.

Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MECH 313 Thermodynamics II Spring term 2016, using a report scored with a rubric. There were 26 mechanical engineering students involved in the assessment. The results are shown in Table 10.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Understands the global impact of engineering decisions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	96.2%
Understands the macro-economic impact of engineering solutions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	92.3%
Understands the environmental and the social impact of engineering decisions	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	92.3%

Table 10. ME Assessment Results for SLO h, Spring 2016, Klamath Campus

Strengths: They knew about Climate change well. Many good critiques with factual support and calculations

Weaknesses: Students were weaker on identifying the need to act as an international body and commit to agreements.

Actions: I should have given them more than 4 days to complete, 7 days seems ideal.

Seattle Campus Assessment:

Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 313 Thermodynamics II Winter term 2016, writing a paper scored with a rubric. The students were assigned to write a short paper on the impact of ChloroFluoroCarbons (CFCs); they were also given the Rubric that the paper would be scored with. There were14 mechanical engineering students involved in the assessment. The results are shown in Table 11.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Understands the global impact of engineering decisions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	92.9%
Understands the macro-economic impact of engineering solutions.	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	100%
Understands the environmental and the social impact of engineering decisions	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	92.9%

Table 11. BSME Assessment Results for SLO h, Winter 2016, Seattle campus

Strengths: Almost all students demonstrated a good understanding of the global, economic and environmental/societal impact of CFCs

Weaknesses: There were no real weaknesses identified of any of the Programs.

Actions: No proposed action. Making sure that the students understood the rubric that was going to be used to evaluate their paper helped this assessment.

Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. 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. There were a total of 29 responses from Klamath Falls seniors and 1 response from Seattle seniors; for a total of 30 responses (note that not all students answered all questions). Student responses from the Klamath Falls campus indicate that 96.4% of all BSME students felt prepared in this outcome; see Table 12 below.

	Highly Prepared	Prepared	Inadequately Prepared
Outcome h KF	12	15	1
Outcome h Seattle	1	0	0

Table 12. ME Indirect Assessment for SLO h, Senior Exit Surveys 2015-16

Summary Recommendations for Outcome (h):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to understand the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. It is

recommended that this outcome be assessed with at least 2 direct assessments and one indirect assessment at each campus.

SLO j. a knowledge of contemporary issues.

The performance criteria for this learning outcome are

1. Address major socio-economic issues.
2. Address US political issues.

Klamath Falls Campus Assessment:

Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 491 Senior Projects II Winter term 2016, using a rubric-scored discussion session. There were 32 mechanical engineering students involved in the assessment, and three MMET faculty members; Professors Lee, Moravec, and Stuart. The results are shown in Table 13 for all three professors.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results Lee	Results Moravec	Results Stuart
Address major socio-economic issues	Rubric-scored discussion	1-4 proficiency scale	80% score 3 or 4	93.3	96.8%	100%
Address US political issues	Rubric-scored discussion	1-4 proficiency scale	80% score 3 or 4	90.3	96.9%	93.8%

Table 13. ME Assessment Results for SLO j, Winter 2016, Klamath Campus

Strengths: Comments from the three instructors included: The students as a group performed very well; almost all of them were well-spoken and knowledgeable. They seemed well read on most issues and had quite strong opinions.

Weaknesses: No weaknesses were identified. Sometimes they were given to opinion rather than stating fact.

Actions: In the future, if a similar assessment is conducted, I would suggest bring along someone to time each student so that one of the faculty members that is scoring this assessment can concentrate more on scoring. I would also suggest running this assessment over 2 days (Tuesday/Thursday; or consecutive weeks on Tuesday) maybe during the beginning of the quarter instead of during finals week.

Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MET 160 Winter term 2016, using a paper scored with a rubric. There were 14 mechanical engineering students involved in the assessment. The results are shown in Table 14.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Address major socio-economic issues	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	35.7%
Address US political issues	Rubric-scored paper	1-4 proficiency scale	80% score 3 or 4	21.4%

Table 14. ME Assessment Results for SLO j, Winter 2016, Klamath Campus

Strengths: No strengths were readily identified.

Weaknesses: Due to the timing of the request for the assignment, the Contemporary Issues outcome was difficult to implement into a 100 level course. Though the assignment was structured to be very open ended, students did not take the assignment seriously enough to show understanding. Several students had issues identifying the Contemporary Issues that needed to be addressed. Though this was an open ended assignment, students failed at being able to take a position and defend it accordingly.

Actions: It may be necessary to restructure the assignment such that it is more directed and focuses the students more. The most concerning issue is how assignments like this are perceived by students at this academic level.

This assessment was given in a Freshman course; in the future we should look at assessing this outcome in an upper-division course.

Seattle Campus Assessment:

No assessments were turned in for Seattle.

Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. 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. There were a total of 29 responses from Klamath Falls seniors and 1 response from Seattle seniors; for a total of 30 responses (note that not all students answered all questions). Student responses from the Klamath Falls campus indicate that 89.3% of all BSME students felt prepared in this outcome; see Table 15 below.

	Highly Prepared	Prepared	Inadequately Prepared
Outcome j KF	12	13	3
Outcome j Seattle	1	0	0

Table 15. ME Indirect Assessment for SLO j, Senior Exit Surveys 2015-16

Summary Recommendations for Outcome (j):

The results shown above indicate that the Klamath Falls senior students have knowledge of contemporary issues. It is recommended that this outcome be carefully assessed again in a lower-division course to see if there is a problem with this outcome for freshman students.

It is recommended that this outcome be assessed with at least 2 direct assessments and 1 indirect assessment at each campus.

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

This year the BSME Program at both Klamath Falls and Seattle assessed outcomes d, f, and h; plus the MMET Department reviewed the BSME Program Educational Objectives. In addition, the BSME Program assessed outcome j, which was not done during its scheduled time in the 2013 2014 academic year.

For Outcome d (teamwork), the KF students performed well in smaller, short-term groups (3-5 members in a course project); there larger the group (such as the Baja SAE team with 12 members) the poorer they performed. It is recommended that a new rubric be created for teamwork that will evaluate individual student performance; the current Oregon Tech Teamwork Rubric is geared towards team evaluations.

For Outcome f (ethics), the KF students performed well in both the freshman orientation course, and in the senior project assignment. No action is recommended at this time.

For Outcome h (impact of Engineering solutions) both the KF and Seattle students performed well, and no action is recommended at this time.

For Outcome j (contemporary issues) the Klamath Falls seniors performed well. However, freshman students taking MET 160 scored very poorly, with less than 40% of the students performing at the targeted performance level. It is recommended that this outcome be reevaluated this coming year.

The MMET Department held a “closing the loop” assessment meeting on June 9, 2016 to discuss the results of this academic year’s activities. In the next 2-3 years there may be significant changes required for the BSME assessment plan, with the new General Education Requirements, and the planned changed changes in the ABET EAC student learning outcomes.

Finally, note that for several outcomes the MMET Department did not give the students two direct assessments at each campus; and the indirect assessment at the Seattle campus only had one response.

FUTURE ACTION ITEMS – to be completed before next assessment cycle, fall 2016

1) Organize the material on the T-drive to make it easier to find our assessment material.

2) Assess each outcome with two direct methods and one indirect method; and do this at both the main campus in Klamath Falls and the Seattle campus.

3) With the BSME program starting at the Wilsonville campus, we need to make sure that the BSME learning outcomes are also assessed at this campus.

4) Revise our Assessment Rubrics to reflect that our student learning outcomes are slightly modified from the standard ABET a-k outcomes; several of the BSME Oregon Tech MMET outcomes contain additional criteria from that given in the a-k outcomes.

APPENDIX I
Student Learning Outcomes - Curriculum Maps

The curriculum maps below show the courses in which each SLO is introduced, emphasized or reinforced. This is a continuum as most SLOs are considered in all courses. However, the maps presented indicate the courses most instrumental in obtaining each SLO. Since this year is the ABET Self-Study year, the SLO Curriculum Maps are shown below for all of the BSME SLO's.

OUTCOME (a): Mathematics, Science & Core Engineering

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04	E	MATH 252	E	MATH 341	E	MECH 323	R
	ENGR 111	I	MET 242	E	MECH 318	R	MECH 351	R
	WRI 121		PHY 221	E	MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375	E	WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05	E	ENGR 211	E	ENGR 212	E	MECH 437	R
	MFG 103		MATH 254N	E	ENGR 355	E	MECH 480	R
	WRI 122		Statistics	E	MECH 315	R	MECH 491	R
	Hum/Soc Sci		PHY 222	E	MECH 360	R	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251	E	ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236	E	MATH 451	E	MECH 436	R
	MET 160	E	ENGR 266	E	MECH 313		MECH 492	R
	MET 241	E	MATH 321	E	MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223	E	MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (b): Experiments

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04	I	MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	
	WRI 121		PHY 221	R	MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05	I	ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics	R	MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222	R	MECH 360	R	PHIL 331	
					MET 326	R	Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	R	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	R
	MET 160	I	ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223	R	MECH Elec		MECH Elec	

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OUTCOME (c): Design of System, Components, or Processes

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	R
	ENGR 111	I	MET 242	R	MECH 318	R	MECH 351	R
	WRI 121		PHY 221		MECH 363	R	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375	R	WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212	R	MECH 437	R
	MFG 103		MATH 254N		ENGR 355	R	MECH 480	R
	WRI 122		Statistics		MECH 315	R	MECH 491	E
	Hum/Soc Sci		PHY 222		MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	R	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	R
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241	R	MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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OUTCOME (d): Multidisciplinary Teams

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	R	MECH 351	
	WRI 121		PHY 221	I	MECH 363	R	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	R
	WRI 122		Statistics		MECH 315		MECH 491	E
	Hum/Soc Sci		PHY 222	R	MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321	R	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	R
	MET 160	I	ENGR 266		MECH 313		MECH 492	E
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	
	SPE 111		PHY 223	R	MECH Elec		MECH Elec	

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OUTCOME (e): Identify, Formulate, and Solve Engineering Problems

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	E
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	E
	WRI 121		PHY 221		MECH 363	E	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	E
							MECH Elec	E
Winter	CHE 202/05		ENGR 211		ENGR 212	E	MECH 437	E
	MFG 103		MATH 254N		ENGR 355	E	MECH 480	E
	WRI 122		Statistics		MECH 315	E	MECH 491	E
	Hum/Soc Sci		PHY 222		MECH 360	E	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	E
Spring	MATH 251		ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236	E	MATH 451	E	MECH 436	E
	MET 160	I	ENGR 266	E	MECH 313	E	MECH 492	E
	MET 241		MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec	E	MECH Elec	E

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OUTCOME (f): Professional and Ethical Responsibility

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	E
	Hum/Soc Sci	R	WRI 227		MET 375		WRI 327	
			Econ Elec	R	MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	E
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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OUTCOME (g): Communications

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	
	WRI 121	E	PHY 221	R	MECH 363	E	MECH 490	R
	Hum/Soc Sci	R	WRI 227	E	MET 375		WRI 327	E
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122	E	Statistics		MECH 315		MECH 491	
	Hum/Soc Sci	R	PHY 222	R	MECH 360	R	PHIL 331	R
					MET 326		Hum/Soc Sci	R
					SPE 321	E	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	R	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	R
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	R
	SPE 111	E	PHY 223	R	MECH Elec		MECH Elec	

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OUTCOME (h): Impact of Engineering Solutions

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	E
	Hum/Soc Sci	R	WRI 227	R	MET 375		WRI 327	R
			Econ Elec	R	MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122	I	Statistics		MECH 315	R	MECH 491	E
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321	R	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	R
	SPE 111	R	PHY 223		MECH Elec		MECH Elec	

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OUTCOME (i): Life-Long Learning

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	R
	Hum/Soc Sci	R	WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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E = Emphasized

OUTCOME (j): Contemporary Issues

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121	I	PHY 221		MECH 363		MECH 490	R
	Hum/Soc Sci	R	WRI 227	R	MET 375		WRI 327	R
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122	I	Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111	R	PHY 223		MECH Elec		MECH Elec	

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OUTCOME (k): Techniques, Skills, and Modern Tools

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242	E	MECH 318	E	MECH 351	E
	WRI 121		PHY 221		MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375	E	WRI 327	
			Econ Elec		MFG 314	R	MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222		MECH 360	E	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	E
	MET 160	E	ENGR 266	E	MECH 313		MECH 492	R
	MET 241	E	MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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OUTCOME (m1): Thermal Systems Professional Work

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	E
	ENGR 111		MET 242		MECH 318	E	MECH 351	
	WRI 121		PHY 221		MECH 363	R	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	E
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355	E	MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222	I	MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	E	MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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E = Emphasized

OUTCOME (m2): Mechanical Systems Professional Work

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111		MET 242		MECH 318		MECH 351	E
	WRI 121		PHY 221	I	MECH 363		MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211	R	ENGR 212	E	MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics		MECH 315	E	MECH 491	R
	Hum/Soc Sci		PHY 222		MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	E
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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APENDIX II
RUBRICS

Since this is the ABET Self-Study year, all of the rubrics used for the BSME Program assessments are shown below. The proficiency scale for all of the rubrics is as follows:

Proficiency Scale (see rubric)

4 High proficiency

3 Proficiency

2 Some proficiency

1 Limited or no proficiency

Rubric for Math, Science, Engineering & Technology

ETAC SLO b: An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
EAC SLO a: Graduates will have the ability to apply mathematics, science and engineering.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Apply math principles to obtain analytical or numerical solution(s) to an engineering problem.	Unable to apply prerequisite math concepts to new problems. Makes 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 prerequisite math concepts to new problems. Selects correct math principles. Performs correct, thorough, clear computations in a logical order.	
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.	
Apply engineering principles that govern the performance of a given process or system in engineering problem(s).	Unable to apply prerequisite engineering concepts to new problems. Makes significant errors in computation and/or logic.	With extensive guidance, applies prerequisite engineering concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite engineering concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies prerequisite engineering concepts to new problems. Selects correct engineering principles. Performs computations in a logical order.	
Apply appropriate technology tools (software, equipment, CAD, CNC, instrumentation, etc.) for a given process or system to an engineering problem.	Unable to select and apply appropriate technology tools or does not demonstrate understanding of tools selected.	With extensive guidance, selects and properly applies appropriate technology tools. Demonstrates some understanding of tools selected.	Selects and properly applies appropriate technology tools, but may need guidance. Demonstrates basic understanding of tools selected.	Independently selects and properly applies appropriate technology tools. Demonstrates thorough understanding of tools selected.	

Rubric for Experiments

ETAC-c: ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
EAC-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	Score
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.	
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.	Shows ability to analyze experimental data independently extracting and presenting insightful results.	
Ability to use experimental results to improve processes	Has trouble applying experimental results to improve processes.	Able to use results to improve processes with significant guidance.	Can use results to improve processes with guidance.	Has ability to apply experimental results to improve processes.	

Rubric for Designing a System, Component or Process

ETAC SLO d: An ability to apply creativity in the design of systems, components or processes within realistic constraints.
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	Score
Identify an appropriate set of realistic constraints and performance criteria.	A large number of codes, standards or performance criteria are missing or unclear.	Is able to identify some codes & standards, but important elements are missing. Identifies & documents some performance criteria, but important elements are missing or unclear.	Presents basic relevant codes & standards. Identifies and documents performance criteria in a basic manner.	Thoroughly presents most important, relevant codes & standards applying to project. Clearly identifies & documents in-depth performance criteria.	
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, usable 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.	
Create a detailed design within realistic constraints.	Is unable to create a design with sufficient detail or documentation. Does not address constraints.	Design has some, but inadequate detail or documentation or does not address constraints.	Creates design with adequate detail and documentation. Incorporates and addresses constraints.	Applies engineering principles. Creates design with high level of detail and appropriate documentation. Thoroughly addresses constraints.	
Plan and manage a small technical project.	Does not develop a task/timeline, does not implement project with success, or does not provide documentation. Does not meet deadline.	Defines task and timeline with some elements missing or unrealistic. Implements project but misses important elements. Documentation is provided but needs more detail. May not meet deadline.	Defines basic tasks and timelines, implements project, including testing and basic documentation, meets deadline.	Defines realistic and detailed tasks and timelines, implements project in exemplary fashion, performs thorough testing, documents important procedures or processes in detail, completes plan on time.	

Rubric for Multidisciplinary Teamwork

ETAC e: An ability to function effectively as a member or leader on a technical team.
EAC d: an ability to function on multidisciplinary teams

OIT Team and Group Work Rubric, p. 1 of 2					
Performance Criteria	**No/Limited Proficiency (1)**	**Some Proficiency (2)**	**Proficiency (3)**	**High Proficiency (4)**	**Score:**
1. Identifies and Achieves goal/purpose	Clear goals are not formulated or documented; thus all 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.	
2. Assumes and fulfills roles and responsibilities as appropriate	Members do not fulfill roles and responsibilities. Leadership roles are not defined and/or shared. Members are not self-motivated and 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 fulfill 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 toward the 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.	
3. 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.	

OIT Team and Group Work Rubric, p. 2 of 2					
Performance Criteria	**No/Limited Proficiency (1)**	**Some Proficiency (2)**	**Proficiency (3)**	**High Proficiency (4)**	**Score:**
4. Reconcile Disagreement	Members do not welcome disagreement. Difference often results in voting. Subgroups are present.	Few members welcome disagreement. Difference often results in voting. Some members respect and accept disagreement and work to account for differences. Subgroups may be present.	Many members welcome disagreement and use difference to improve decisions. Most members respect and accept disagreement and work to account for differences. Subgroups rarely present.	All members welcome disagreement and use difference to improve decisions. All members respect and accept disagreement and employ effective conflict resolution skills. Subgroups absent.	
5. Share Appropriately	Contributions are unequal. Certain members dominate discussions, decision making, and work. Some members may not contribute at all. Individuals work on separate sections of the work product, but have no coordinating effort to tie parts together.	Contributions are unequal although all members contribute something to discussions, decision making and work. Coordination is sporadic so that the final work product is of uneven quality.	Many members contribute to discussions, decision-making and work. Individuals focus on 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)	All members contribute significantly to discussions, decision making and work. The work product is a collective effort; team members have both individual and mutual accountability for the successful completion of the work product.	
6. 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 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 reach 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 decisions 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.	
7. 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.	

Rubric for Solving Engineering Problems

ETAC SLO f: An ability to identify, formulate, analyze and solve engineering problems.
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	Score
Identify 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 principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan which will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing.	Develops an adequate plan that leads to a plausible solution.	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.	
Apply engineering principles to analyze the problem.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in an appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	

Rubric for an Understanding of professional and Ethical Responsibility

ETAC-i: an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
EAC f: An understanding of professional and ethical responsibility

OIT Ethics Rubric

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Demonstrates knowledge of the professional code of ethics	Identifies provisions in the professional code of ethics, but is unable to demonstrate importance or relevance to the profession.	Describes the importance of provisions, but some examples do not apply or fail to illustrate importance of the specified provision.	Describes the importance of provisions in the professional code of ethics. Examples are applicable to the specified provisions and illustrate importance.	Describes in detail 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.	
Using code of ethics, describes ethical issue(s)	Has a vague idea of what the issue is and is uncertain how the code of ethics applies.	Describes the issue(s) using concepts from code of ethics, but important elements may be missing or misunderstood.	Describes the issue(s) using basic concepts from code of ethics.	Describes the issue(s) in detail, demonstrating full understanding of relevant code of ethics provisions and how they relate to the issue(s).	
Describes parties involved and discusses their points of view	Is unsure who should be involved in the issue and/or does not reflect on their viewpoints.	Describes some of the parties and their viewpoints, but important elements are missing or misunderstood.	Describes who should be involved in the issue(s) and discusses the viewpoints of the parties at a basic level.	Describes who should be involved in the issue(s) and thoroughly discusses their viewpoints.	
Describes and analyzes possible/ alternative approaches	Is unable to describe or analyze alternatives or consider the effect on parties involved.	Describes and analyzes only one alternative and its effect on parties involved, but important elements are missing or misunderstood.	Describes and analyzes at least two alternatives and their effects on parties involved.	Describes and analyzes a number of alternative approaches and thoroughly considers the interests and concerns of all parties involved.	
Chooses an approach and explains the benefits and risks	Has difficulty choosing an approach or stating benefits and risks.	Chooses an approach and explains benefits and risks, but important elements are missing or misunderstood.	Chooses an approach and explains basic benefits and risks.	Chooses an approach and thoughtfully and thoroughly explains benefits and risks.	

Demonstrates knowledge and understanding of "ethical diversity"	Demonstrates none or minimal understanding of ethical diversity. Does not recognize biases.	Demonstrates a partial understanding of ethical diversity and recognition of biases.	Demonstrates adequate understanding of ethical diversity and recognition of biases.	Demonstrates a complete understanding of ethical diversity and the recognition of biases.	

OIT Public Speaking Rubric

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)
Content	Few or no attributed sources. Supporting materials lack credibility and/or don't relate to thesis. Limited or no attempt to inform or persuade.	Some attributed sources used. Supporting materials are somewhat credible and/or don't clearly relate to thesis. Attempt to inform or persuade.	Adequate number of credible and appropriately attributed sources used. Supporting materials relate to thesis. Informs or persuades.	A variety of credible and appropriate sources used. Supporting materials relate in an exceptional way to a focused thesis. Informs or persuades.
Organization	Lacks organizational structure. Introduction and/or conclusion missing. No transitions used.	Organizational structure present but unclear with underdeveloped introduction and conclusion. Transitions are awkward.	Appropriate organizational pattern used and easy to follow with developed introduction and satisfying conclusion. Main points are smoothly connected with transitions.	Organizational pattern is compelling and moves audience through speech with ease. Introduction draws in the audience and conclusion is satisfying. Main points are smoothly connected with transitions.
Style	No understanding of audience regarding topic or purpose of speech. Little enthusiasm and passion for topic. No regard for time constraints.	Some understanding of audience regarding topic or purpose of speech. Some enthusiasm and passion for topic. Some regard for time constraints.	Competent understanding of audience regarding topic and purpose. Enthusiasm and passion for topic. Speech given within time constraints.	Thorough understanding of audience regarding topic and purpose. Clear enthusiasm and passion for topic. Speech given within time constraints.
Delivery	No gestures or eye contact. Monotone voice or insufficient volume. Little poise. Reading of notes only. Abundant oral fillers and nonverbal distractions.	Some gestures and eye contact. Ineffective use of language and voice. Little poise. Heavy reliance on notes. Multiple oral fillers and nonverbal distractions.	Adequate use of gestures, eye contact, language, and voice. Poised with minor reliance on notes. Limited oral fillers and nonverbal distractions.	Effective use of gestures, eye contact, vivid language, and voice to add interest to speech. Poised with use of notes for reference only. No oral fillers and nonverbal distractions.
Visuals	No visuals or poorly-designed and documented visuals that distract from speech or do not create interest. Limited reference to visuals or so much reference delivery is hindered.	Visuals present, but simply designed with limited use of documentation. Visuals are referred to but do not create interest. Visuals may interfere with delivery.	Well-designed and documented visuals that clarify speech and create interest. Visuals are referred to and sufficiently discussed, while not interfering with delivery.	Well-designed and documented visuals that clarify speech, create interest, and hold attention of the audience. Visuals are sufficiently discussed and effectively integrated into speech.

OIT Essay Rubric				
Performance Criteria	**Limited Proficiency (1)**	**Some Proficiency (2)**	**Proficiency (3)**	**High Proficiency (4)**
Purpose and Ideas	Writing has limited or no focus. Purpose and main ideas are unclear and require inference from reader.	Reader can discern the purpose and main ideas although they may be overly broad or simplistic.	Writing is clear and focused. Reader can easily understand the purpose and main ideas.	Purpose and main ideas are exceptionally focused, clear, and interesting.
Organization	Order and structure are unclear. Introduction and conclusion are underdeveloped or missing.	Order and structure are overly formulaic. Introduction and conclusion may be underdeveloped or too obvious.	Order and structure are clear and easy to follow. Introduction draws in the reader and conclusion brings satisfying closure.	Order and structure are compelling and move the reader through the text easily. Introduction draws in the reader and conclusion brings satisfying closure.
Support	Development is minimal. Some supporting details may be irrelevant or repetitious.	Supporting details are relevant, but are limited or rather general. Support may be based on clichés, stereotypes, or questionable sources or evidence.	The main ideas are well developed by supporting details. When appropriate, use of outside sources provides credible support.	Main ideas are well developed by strong support and rich details. When appropriate, use of outside sources provides strong, credible support.
Style	Voice is inappropriate for topic, purpose, or audience. Wording is incorrect or monotonous, detracting from impact. Sentences tend to be choppy, rambling, and awkward.	Voice is inconsistent for topic, purpose, and audience. Wording is quite ordinary, lacking interest, precision, and variety, and may rely on clichés. Sentences tend to be mechanical rather than fluid with an overuse of simple sentence structures.	Voice is generally appropriate for topic, purpose, and audience. Generally, wording conveys message in an interesting, precise, and natural way. Sentences are carefully crafted with variations in structure.	Voice is appropriate for topic, purpose, and audience. Wording is fresh and specific, with a striking and varied vocabulary. Sentences are highly crafted, with varied structure that makes reading easy and enjoyable.
Conventions	Numerous errors in usage, spelling, punctuation, and/or grammar. Errors sometime impede readability. Substantial editing needed.	Writing contains punctuation, spelling, and/or grammar errors, but they do not impede readability and are not extensive. Moderate need for editing.	Writing demonstrates control of standard writing conventions and uses them effectively to enhance communication. Few errors.	Writing demonstrates strong control of standard writing conventions and uses them well to enhance communication. Very few or no errors.
Documentation	Documentation has major errors or is not present.	Documentation has frequent errors.	Documentation is correct except for a few errors.	Documentation is meticulous.

IMPACT of ENGINEERING ASSESSMENT RUBRIC

ETAC (j): a knowledge of the impact of engineering technology solutions in a societal and global contex
EAC (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
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 has 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.	
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. Can not give examples of such impacts.	Has some understanding of macro-economics and the 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.	
Understands the environmental and the social impact of engineering decisions	Does not believe that engineering decisions have a social or environmental impact.	Believes 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.	

OIT Lifelong Learning Rubric

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
1. Lifelong learning	Fails to identify the need for "lifelong learning" and/or omits discussion of their own learning and relevant examples.	Misses important elements in 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).	
2. 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.	
3. 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 a realistic plan to meet these goals.	Describes short- and long-term career goals after graduation. Includes a realistic, thorough, and thoughtful plan to meet these goals.	

Rubric for Contemporary Issues

EAC SLO j: Graduates will have knowledge of contemporary issues.

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Address major socio-economic issues	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. Articulately expresses arguments from several viewpoints including the historical perspective.	
Address US political issues	Little or no understanding (or interest). Unable to put forth more than one side to an issue.	Moderate understanding. Rudimentary understanding of current political issues.	Good understanding. Can express and explain different sides of political issues.	Deep understanding. Can knowledgeably explain current political issues, the underlying problems, and historical perspective.	

Rubric for Use of Techniques, Skills, and Modern Engineering Tools

TAC SLO a: An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines

EAC SLO k: Graduates will be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Use computers and a wide range of programs effectively	Marginal ability with word processor and spreadsheet use. Struggles with other programs and programming	Able to use word processors and spreadsheets to produce reports. Has difficulty with other programs	Able to use word processors and spreadsheets to produce well formatted reports. Able to use other programs and write computer programs	Skilled at word processing and spreadsheet use. Skilled with other programs and able to write longer intricate programs	
Appropriate mastery of modern engineering tools.	Able to use modern engineering tools with close supervision. Marginal understanding of modern engineering tools.	Able to use modern engineering tools with supervision.	Skilled at using modern engineering tools.	Able to direct others in the use of modern engineering tools. Skilled at using modern engineering tools.	
Use the techniques and skills necessary for engineering practice	Has little or no understanding of engineering methods.	Some understanding of engineering methods, but has trouble selecting appropriate techniques and designing parts.	Understands basic engineering methods and can, with assistance, design parts.	Has a broad understanding of engineering methods. Able to design parts using engineering techniques and skills.	

Rubric for Work Professionally in Thermal Systems

EAC SLO m1: An ability to work professionally in the area of thermal systems

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an engineering problem	Does not identify the problem.	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 principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan with will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing.	Develops an adequate plan that leads to a plausible solution.	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.	
Apply engineering principles to analyze the problem.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in a appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	

Rubric for Work Professionally in Mechanical Systems

EAC SLO m2: An ability to work professionally in the area of mechanical systems

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an engineering problem	Does not identify the problem.	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 principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan with will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing.	Develops an adequate plan that leads to a plausible solution.	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.	
Apply engineering principles to analyze the problem.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in a appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	