

OREGON INSTITUTE OF TECHNOLOGY
Mechanical Engineering Program

Mechanical Engineering
Assessment Report
2011-12

June 8, 2012

INTRODUCTION

This report documents the assessment done within the Mechanical Engineering (ME) program at Oregon Institute of Technology during the 2011-12 school year.

The ME program is using a three year assessment cycle. In this, each outcome is assessed at least once every three years. The document “Mechanical Engineering Program Assessment Plan” documents this plan over the three year cycle. The outcomes being assessed within the 2011-12 school year are summarized here, both the assessment being done and results of these assessments. For the overall three year cycle the reader is referred to the program’s assessment plan.

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.

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.*

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.

ASSESSMENT CYCLE

Assessment within the MMET Department is done on a three-year cycle. Each outcome is assessed at least once every three years. The schedule for assessment activities for the ME Program is shown in Table 1.

Table 1: Assessment Cycle

<i>Educational Outcome</i>	<i>2011-12</i>	<i>2012-13</i>	<i>2013-14</i>	<i>TAC</i>
Review Program Mission and Educational Objectives	x			
Assess Program Educational Objectives		x		
a) Graduates will have the 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.	x			b
b) Graduates will have the ability to design and conduct experiments, as well as to analyze and interpret data.			x	c
c) Graduates will be able 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.	x			d
d) Graduates will be able to function on multi-disciplinary teams.		x		e
e) Graduates will be able to identify, formulate, and solve engineering problems. Graduates will be able to analyze and model physical systems or components using principles of engineering, basic science and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems or components.	x			f
f) Graduates will have an understanding of professional and ethical responsibility.		x		i
g) Graduates will have the ability to communicate effectively.			x	g
h) Graduates will have the broad education necessary to		x		j

<i>Educational Outcome</i>	<i>2011-12</i>	<i>2012-13</i>	<i>2013-14</i>	<i>TAC</i>
understand the impact of engineering solutions in a global, economic, environmental, and societal context.				
i) Graduates will recognize the need for, and have the ability to engage in life-long learning.			x	h
j) Graduates will have a knowledge of contemporary issues.			x	j
k) Graduates will be able 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			

Note that ME Program Mission and Program Educational Objectives are to be assessed along with program Student Learning Outcomes.

The MMET Department consists of both engineering and engineering technology programs. The ABET outcomes for engineering and engineering technology are quite similar. The engineering technology outcomes (a-k) are listed in Table I for reference.

MISSION STATEMENT AND PROGRAM EDUCATIONAL OBJECTIVES REVIEW

The ME Program Mission Statement and Program Educational Objectives are reviewed and updated through the assessment process. At the beginning of each assessment cycle the faculty and select constituents will review and, as necessary, revise them. If revised, the revisions will be reviewed by a broader constituency.

The ME program underwent its second ABET review during fall 2010. ABET expressed concern about our Educational Objectives. During this assessment cycle the Educational Objectives were revised to better match ABET's definition. The faculty and Advisory Council were involved in edited these objectives. The resulting changes were minor and felt not to change the thrust of those objectives. Thus, it was decided not to seek wider constituent input.

The ME program Educational Objectives were thus changed from:

Mechanical Engineering Program Educational Objectives

- *are able to analyze, design and improve practical thermal and mechanical systems.*
- *communicate effectively and work well on team-based engineering projects.*
- *succeed in entry-level mechanical engineering positions regionally and nationally.*
- *pursue continued professional development, including professional registration if desired.*
- *have the skills and knowledge to pursue engineering graduate studies and research, if desired.*

to:

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.

SUMMARY OF 2011-12 ASSESSMENT ACTIVITIES

As seen in the above assessment cycle, outcomes a, c, e, m1 and m2 were assessed during the 2011-12 school year. This being the first year of the three year cycle, the program's Mission Statement and Program Educational Objectives were also reviewed. Each Student Learning Outcome is broken down into several Performance Criteria to be assessed individually.

Following are the assessment results for the SLOs addressed during 2011-12.

OUTCOME (a): Mathematics, Science & Core Engineering

Graduates will have the 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.

The Performance Criteria to consider in assessing this outcome are:

1. Apply math principles to obtain analytical or numerical solution(s) to an engineering problem
2. Apply scientific principles that govern the performance of a given process or system in engineering problem(s)
3. Apply engineering principles that govern the performance of a given process or system in engineering problem(s)
4. Apply appropriate technology tools (software, equipment, CAD, CNC, instrumentation, etc.) for a given process or system to an engineering problem

Assessment Method: Pre-Exams

Faculty of the ME program administer "Pre-Exams" in selected junior level mechanical engineering courses. These pre-exams evaluate a cross section of the prerequisite mathematics, science and core engineering knowledge needed in the ME program. They will indicate to the instructor and students what prerequisite material, if any, needs review and in general indicate how effective the mathematic, science and core engineering courses are. These entry exams were given in the following courses.

<i>Course</i>	<i>Performance Criteria</i>
MECH 315 Machine Design I	1, 3
MECH 318 Fluid Mechanics I	1, 2
MECH 480 Vibrations	4

Each set of pre-exams were reviewed by the faculty member giving that exam using an analytic rubric. There was a proficiency scale from 1 to 4 and the “minimum acceptable performance” was determined to be 80% of the students scoring 3 or 4.

Table 2 shows the results from pre-exams in MECH 315, MECH 318 and MECH 480. Results from the last assessment, 2009, are given along with the current assessment. The number of students represented in the data is given below the course numbering in parenthesis.

Table 2: Assessment Results for SLO A

Performance Criteria	2009 Assessment			2012 Assessment		
	MECH 315 (7)	MECH 318 (23)	MECH 480 (11)	MECH 315 (24)	MECH 318 (9)	MECH 480 (19)
Apply math principles to an engineering problem	86%	100%	73%	92%	89%	74%
Apply scientific principles in engineering problem(s)	71%	100%	27%	88%	78%	95%
Apply engineering principles in engineering problem(s)	86%	74%	55%	83%	78%	84%
Apply appropriate engineering tools to an engineering problem	100%	100%	N/A	N/A	89%	N/A

The graded Pre-Exams and faculty rubric evaluations have been retained in electronic form. They are kept on a shared drive at OIT and available to OIT faculty and staff.

Assessments from 2012 are much more consistent than from 2009. It is hoped this is due to faculty becoming more familiar with the assessment process and forming more consistent expectations. The data is not extensive enough to show this however.

Some refinement regarding the assessment tools may be indicated. The last SLO is noted as being inapplicable for both MECH 315 and MECH 480. The faculty member assessing these interpreted the SLO to involve engineering tools, primarily computer usage. He felt these could not be assessed in the Pre-Exams used here.

Three evaluations fell below our 80% criteria. However, there is no consistency to where these occurred and they fell close to 80%. Overall the results are considered good.

Assessment Method: MMET Senior Survey

As part of the ME capstone course students were asked to complete a senior survey. The data represents assessment done during spring term 2011 and was accomplished using Survey Monkey. Ten ME students responded to the survey,. 70% graduating this spring term 2011, 10% in fall 2011, and 20% graduating winter 2012. 80% reported a GPA above 3.0 with 40% reporting GPA above 3.5. 50% are planning to obtain a mathematics minor. Only 10% participated in a MECOP internship. 90% felt their education prepared them to take the FE Exam, however the survey did not attempt to break this down further. Each respondent was asked to judge how well their education prepared them in each SLO.

30% of the responding students transferred in 9 or less credits. 50% started mathematics at algebra or trigonometry while 50% started in differential calculus or above. For this particular SLO, “mathematics, science, and core engineering”, 60% felt highly prepared and 40% felt prepared. No respondents reported feeling inadequately prepared.

Assessment Method: Fundamentals of Engineering Exam

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. Thus results from the prior year’s exam, spring 2011, are used here. The data represents eight students who took the exam in spring 2011. The prior year’s results, spring 2010 are also represented for the eight students taking that exam. Results from the previous assessment, 2009, are included for reference. Note that only three students are represented by the 2008 data.

Results from the FE Exam are broken down into disciplines. Those relevant to math, science and core engineering are tabulated in Table 3. This data represents eight students who took this exam.

FE Exam results in mathematics, science and core engineering are, in general, slightly below the national average. 2011 shows results very similar to the prior year's. Three students sat for the exam in 2008, two in 2010 and 8 in 2011. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam.

Table 3: FE Math, Science & Core Engineering Results

Discipline	Spring 2008 Exam		Spring 2010 Exam		Spring 2011 Exam	
	OIT ME (3)	National Avg.	OIT ME (2)	National Avg.	OIT ME (8)	National Avg.
Mathematics	74%	75%	51%	65%	62%	74%
Prob. & Statistics	79%	68%	52%	63%	50%	64%
Chemistry	73%	71%	74%	78%	57%	66%
Computers	83%	85%	75%	78%	70%	77%
Ethics & Bus.			80%	77%	81%	75%
Statics	87%	73%	81%	81%	56%	60%
Dynamics			70%	78%	68%	74%
Strength of Materials	75%	65%	59%	60%	48%	60%
Material Properties	71%	77%	68%	68%	63%	62%
Fluid Mechanics	75%	73%	70%	72%	44%	60%
Electricity & Mag.	76%	69%	59%	59%	49%	58%
Thermodynamics	62%	63%	38%	48%	53%	56%

OUTCOME (c): Design a System, Component or Process within Realistic Constraints

Graduates will be able 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.

The Performance Criteria to consider in assessing this outcome are:

1. Identify an appropriate set of realistic constraints and performance criteria.
2. Generate one or more creative solutions to meet the criteria and constraints.
3. Create a detailed design to meet the criteria within the realistic constraints.
4. Plan and manage a small technical project.

Assessment Method: Review Project Reports

Project Final Reports were reviewed by the faculty member(s) giving the assignment. Project reports in Orientation and Senior Projects were assessed. An analytic rubric was used in each case to assess the students' ability to meet the Performance Criteria. There was a proficiency scale from 1 to 4 and the "minimum acceptable performance" was determined to be 80% of the students scoring 3 or 4.

Table 4 shows the results from project report review in Orientation and Senior Projects. The last assessment, in 2009, assessed project reports in MECH 316, MECH 318 and Senior Projects. These assessments are included for comparison.

Both assessments used final project reports. Faculty overseeing the projects assessed each report using a rubric. All projects included a mix of ME, MET and MFG students. The Orientation class was made up of 38 students with 28 ME students enrolled. However, it is anticipated that some of these freshman will change majors before graduation.

Assessment results from MECH 492, Senior Projects taught spring term of 2011, are shown. The assignment assessed was the final report developed for this three term sequence. As the project teams are a mix of Mechanical Engineering, Mechanical Engineering Technology and Manufacturing Technology the results are not purely ME related but the information is none the less useful. There were 5 senior projects in 2010-11 and all were assessed.

Table 4: Assessment Results for ISLO C

Performance Criteria	2009 Assessment			2012 Assessment	
	MECH 316 (17)	MECH 318 (11)	MECH 492 (8)	MECH 111/112 (28)	MECH 492 (5)
Identify an appropriate set of realistic constraints and performance criteria.	80%	100%	88%	82%	100%
Generate one or more creative solutions.	73%	100%	100%	68%	100%
Create a detailed design within realistic constraints.	40%	73%	100%	79%	100%
Plan and manage a small technical project.	60%	100%	88%	71%	100%

Assessments of the Orientation (MET 111/112) projects were below the desired 80%. However, this seems appropriate for freshmen who have had little or no introduction to engineering projects. It is encouraging to see they improved through their education.

Of the five senior projects none were judged to be unacceptable. Even though assessments were quite high, improvements can always be made.

Assessment Method: MMET Senior Survey

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, “Design a System, Component or Process within Realistic Constraints”, 40% felt they were highly prepared and 60% felt prepared. No respondents reported feeling inadequately prepared.

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

Graduates will be able to identify, formulate, and solve engineering problems. Graduates will be able to analyze and model physical systems or components using principles of engineering, basic science and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems or components.

The Performance Criteria to consider in assessing this outcome are:

1. Identify an engineering problem.
2. Make appropriate assumptions.
3. Formulate a plan which will lead to a solution.
4. Apply engineering principles to analyze the problem.
5. Document results in an appropriate format.

These performance criteria are taught throughout the ME curriculum including all MECH courses. A review of lab reports was used for assessment. In addition, a survey of graduating seniors was used.

Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) giving the assignment. Reports from Finite Element Analysis (MECH 351), Fluid Mechanics II (MECH 417), Heat Transfer II (MECH 437) and Vibrations (MECH 480) were assessed. The number of students in each assessment is listed in parenthesis under the course number. An analytic rubric was used to assess the students' ability to meet the Performance Criteria. The rubric had a measurements scale of 1 to 4. The data indicates the percentage of students performing at a level of 3 or 4, proficient or highly proficient.

Results from the last assessment, in 2009, are included for comparison. MECH 351 was not assessed in 2009.

Table 5 shows the results of this assessment.

Table 5: Assessment for SLO E

Performance Criteria	2009 Assessment			2012 Assessment			
	MECH 417 (17)	MECH 437 (11)	MECH 480 (17)	MECH 351 (11)	MECH 417 (7)	MECH 437 (20)	MECH 480 (24)
Identify an Engineering Problem	100%	100%	100%	100%	100%	100%	92%
Make appropriate assumptions	100%	100%	94%	100%	100%	80%	88%
Formulate a plan which will lead to a solution	100%	100%	88%	100%	100%	95%	83%
Apply engineering principles to analyze the problem	N/A	100%	94%	91%	100%	90%	79%
Document results in an appropriate format	100%	72%	100%	100%	100%	95%	83%

Students are meeting, or nearly meeting, our desired 80% proficient or highly proficient criteria. The results are very similar to the last assessment evaluations done in 2009.

Assessment Method: MMET Undergraduate Exit Survey

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, “Identify, Formulate and Solve Engineering Problem,” 60% felt they were highly prepared and 40% felt prepared. No respondents reported feeling inadequately prepared.

OUTCOME (me1): Thermal Systems

Graduates will be able to work professionally in the area of thermal systems.

The Performance Criteria, and assessment tools, used in Outcome E will be used here to assess student abilities related to thermal systems. Those performance criteria are then:

1. Identify an engineering problem.
2. Make appropriate assumptions.
3. Formulate a plan which will lead to a solution.
4. Apply engineering principles to analyze the problem.
5. Document results in an appropriate format.

Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) assigning those labs. Reports from Fluid Mechanics II (417 MECH) and Heat Transfer II (MECH 437) were assessed. An analytic rubric was used to assess the students’ ability to meet these Performance Criteria. This was the same rubric and scoring used in SLO E above. The number of students involved in each is given in parenthesis below the course number.

Table 6 shows the results from this assessment. Results from the last assessment, in 2009, are included for reference.

Table 6: Assessment Results for SLO me1

Performance Criteria	2009 Assessment		2012 Assessment	
	MECH 417 (17)	MECH 437 (11)	MECH 417 (7)	MECH 437 (20)
Identify an Engineering Problem	100%	100%	100%	100%
Make appropriate assumptions	100%	100%	100%	80%
Formulate a plan which will lead to a solution	100%	100%	100%	95%
Apply engineering principles to analyze the problem	N/A	100%	100%	90%
Document results in an appropriate format	100%	72%	100%	95%

Students are easily meeting our desired 80% proficient or highly proficient criteria.

Assessment Method: Fundamentals of Engineering Exam

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. Thus results from the prior year's exam, spring 2011, is used here.

Results from the FE Exam are broken down into disciplines. Those relevant to thermal sciences are tabulated in Table 7. Three students took the exam in 2008 and eight in 2011.

Table 7: FE Exam Results from spring 2011

<i>Discipline</i>	<i>2008 Results</i>		<i>2011 Results</i>	
	<i>OIT ME (3)</i>	<i>National Avg.</i>	<i>OIT ME (8)</i>	<i>National Avg.</i>
Thermo. & Energy Conversion	44%	44%	42%	61%
Fluid Mechanics & Fluid Machinery	52%	58%	47%	62%
Heat Transfer	67%	47%	65%	71%
Refrigeration & HVAC	56%	48%	31%	54%

FE Exam results in thermal sciences are, in general, slightly below the national average. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam. Another concern is the low number of students sitting for the exam.

Assessment Method: MMET Senior Survey

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, “thermal systems”, 50% felt they were highly prepared and 50% felt prepared. None of the reporting students feeling inadequately prepared.

OUTCOME (me2): Mechanical Systems

Graduates will be able to work professionally in the area of mechanical systems.

The Performance Criteria, and assessment tools, used in Outcome E will be used here to assess student abilities related to mechanical systems. Those performance criteria are then:

1. Identify an engineering problem.
2. Make appropriate assumptions.
3. Formulate a plan which will lead to a solution.
4. Apply engineering principles to analyze the problem.
5. Document results in an appropriate format.

Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) assigning those labs. Lab reports from Finite Element Analysis and Vibrations were assessed. An analytic rubric was used to assess the students’ ability to meet the Performance Criteria. This was the same rubric used in SLO E above. The number of students is listed in parenthesis below the course number. Results from the last assessment, in 2009, is included for comparison. Note that MECH 351 was not assessed in 2009.

Table 8 shows the results for this assessment.

Table 8: Assessment Results from SLO me2

Performance Criteria	2009 Assessment	2012 Assessment	
	MECH 480 (17)	MECH 351 (11)	MECH 480 (24)
Identify an Engineering Problem	100%	100%	92%
Make appropriate assumptions	94%	100%	88%
Formulate a plan which will lead to a solution	88%	100%	83%
Apply engineering principles to analyze the problem	94%	91%	79%
Document results in an appropriate format	100%	100%	83%

Students are meeting, or nearly meeting, our desired 80% proficient or highly proficient criteria. The results are in line with the last assessment evaluations done in 2009.

Assessment Method: Fundamentals of Engineering Exam

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. In 2008 three students sat for the exam while in 2011 eight did.

Results from the FE Exam are broken down into disciplines. Those relevant to mechanical systems are tabulated in Table 9.

Table 9: FE Exam Mechanical System Results

<i>Discipline</i>	<i>2008 Results</i>		<i>2011 Results</i>	
	<i>OIT ME (3)</i>	<i>National Avg.</i>	<i>OIT ME (8)</i>	<i>National Avg.</i>
Mechanical Design & Analysis	30%	35%	62%	71%
Kinematics, Dynamics & Vibrations	85%	68%	58%	61%
Materials & Processing	72%	46%	60%	69%
Measurement, Instrumentation & Controls	56%	46%	40%	57%

FE Exam results in mechanical systems are, in general, slightly below the national average. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam. Another concern is the low number of students sitting for the exam.

Assessment Method: MMET Senior Survey

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, “mechanical systems”, 80% felt they were highly prepared and 20% felt prepared. No respondents reported feeling inadequately prepared.

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

An MMET Department meeting was held June 4, 2012 where assessment results related to the ME Program were discussed and considered. These discussions and resulting actions are documented in this section.

OUTCOME (a): Mathematics, Science & Core Engineering

The conclusion of the faculty was that this outcome is being met. Although the rubric evaluation of pre-exams showed some scatter, the results overall were encouraging. The FE Exam results are of concern. The goal is to be at or very near the national average and this is not being met.

It is also of concern that few students appear to be taking the exam. This is a graduation requirement and acceptance to the exam is a requirement for ENGR 485. It appears students are taking the first step of the FE Exam to satisfy the graduation requirements but not following through and sitting for the exam.

All the students felt they were well prepared related to this outcome.

Discussions regarding the assignments used were undertaken prior to development of the pre-exams. The conclusion of the faculty was to continue using pre-exams in these courses even though they are less than perfect in evaluating the last performance criteria.

OUTCOME (c): Design a System, Component or Process within Realistic Constraints

- Assessment results from Fluid Mechanics and Machine Design showed room for improvement, particularly in “creating a detailed design within realistic constraints”.
- Assessments from senior projects showed at least acceptable performance in all cases.
- Students felt they were adequately prepared.

The results for this outcome are encouraging. The low evaluations for MET 111/112 aren't of concern as these are incoming freshman. The evaluations from senior projects show good performance.

Term long projects were dropped from MECH 318 and MECH 316 this last year. These projects were not adding to the students' knowledge of project planning and management, but did require significant effort. Thus they detracted from the core material of these courses and didn't achieve their main goal. In place of these projects, an elective in project planning was instituted. It is hoped that enough students will take this elective course to impact project planning and management in senior projects. There all students involved will be exposed.

Once projects were dropped from MECH 318 and MECH 316 those courses could not be used for this assessment. It was later realized that all the projects used for this assessment are a mix of engineering and engineering technology students.

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

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

OUTCOME (me1): Thermal Systems

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

OUTCOME (me2): Mechanical Systems

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

CHANGES DUE TO PRIOR ASSESSMENTS

SLO E Assessment Assignments:

A review of the assignments used for SLO E was completed by the faculty prior to this 2011-12 assessment cycle. Although shortcomings were noted, no better assignments were identified. Thus, the same assignments remain in use.

SLO J Assessment Tool:

Problems were recognized when evaluating the 2010-11 assessment results for this SLO. The students were asked to address, in an open session, one of several contemporary issue questions posed. They gave their thoughts but it was difficult to determine from these their comprehension. A dry run of the assessment was done this year asking them to give their position and also give the opposing position. This run through worked noticeably better than last year's assessment and will be used when this SLO is again evaluated.

SUMMARY

FE Exam Performance:

The faculty decided to offer a review course for the FE Exam starting in fall 2012. This will be an evening course co-taught by faculty. Although not for credit good attendance is anticipated.

FE Exam Participation:

The low number of graduates sitting for the FE Exam was also discussed. It was suggested that we give a mock FE Exam in ENGR 485 and use this for assessment. There are several companies who offer practice exams at a reasonable price. They give similar feedback but without the delays in processing which the FE Exam has. It was decided to continue to require students to sit for the FE Exam but realize the difficulties placed on this requirement by the state board (OSSBLEES).

Adding a practice exam to ENGR 485 will also promote better preparation for the FE Exam and, hopefully, improve student performance.

Project Planning and Management:

This seems to be a continuing challenge for the program. Projects in Fluids and Machine Design were dropped as ineffective. The faculty decided to instead offer a Project Planning and Management elective course. Its effectiveness will be assessed during the next assessment cycle.

ME Specific Projects:

Projects used for evaluation are needed which better targets ME students. The difficulty in finding or developing ME specific projects was discussed. The faculty committed to implementing two projects in more ME specific courses. With less emphasis on project planning and management these projects will be easier to implement but still give assessment opportunities focused on ME students. The specific courses for these projects will be determined during fall 2012 convocation. However, it is anticipated there will be one in a junior course and one in a senior course.

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.

OUTCOME (a): Mathematics, Science & Core Engineering

	<i>Freshman</i>		<i>Sophomore</i>		<i>Junior</i>		<i>Senior</i>	
Fall	CHE 221	E	MATH 252	E	MATH 253N	E	MECH 323	R
	MET 111	I	MET 242	E	MFG 314		MECH 351	R
	WRI 121		PHY 221	E	MECH 318	R	MECH 490	R
	Hum/Soc Sci		WRI 227		MECH 363	E	WRI 321	
			Econ Elec		MET 375	E	MECH Elec	R
							Hum/Soc Sci	
Winter	CHE 222	E	ENGR 211	E	ENGR 212	E	MECH 417	R
	MET 112	I	MATH 254N	E	ENGR 355	E	MECH 436	R
	MFG 103		MATH 361	E	MECH 315	R	MECH 437	R
	WRI 122		PHY 222	E	MECH 360	R	MECH 491	R
					MET 326		WRI 322	
					SPE 321		PHIL 331	
							WRI 322	
Spring	MATH 251	E	ENGR 266	E	HUM 125		IMGT 345	
	MFG 120		ENGR 213	E	MATH 451	E	ENGR 485	
	MET 160	E	ENGR 236	E	MECH 313	R	MECH 480	R
	MET 241	E	MATH 321	E	MECH 316	R	MECH 492	R
	SPE 111		PHY 223	E			WRI 323	
							MECH Elec	R
							Hum/Soc Sci	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (c): Design a System, Component or Process within Realistic Constraints

	<i>Freshman</i>		<i>Sophomore</i>		<i>Junior</i>		<i>Senior</i>	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	R
	MET 111	E	MET 242	R	MFG 314		MECH 351	R
	WRI 121		PHY 221		MECH 318	E	MECH 490	E
	Hum/Soc Sci		WRI 227		MECH 363	R	WRI 321	
			Econ Elec		MET 375	R	MECH Elec	R
							Hum/Soc Sci	
Winter	CHE 222		ENGR 211		ENGR 212	R	MECH 417	R
	MET 112	E	MATH 254N		ENGR 355	R	MECH 436	R
	MFG 103		MATH 361		MECH 315	R	MECH 437	R
	WRI 122		PHY 222		MECH 360		MECH 491	E
					MET 326		WRI 322	
					SPE 321		PHIL 331	
							WRI 322	
Spring	MATH 251		ENGR 266		HUM 125		IMGT 345	
	MFG 120		ENGR 213	R	MATH 451	R	ENGR 485	
	MET 160		ENGR 236		MECH 313	R	MECH 480	R
	MET 241	R	MATH 321		MECH 316	E	MECH 492	E
	SPE 111		PHY 223				WRI 323	
							MECH Elec	R
							Hum/Soc Sci	

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

	<i>Freshman</i>		<i>Sophomore</i>		<i>Junior</i>		<i>Senior</i>	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	E
	MET 111	I	MET 242		MFG 314		MECH 351	E
	WRI 121		PHY 221		MECH 318	E	MECH 490	E
	Hum/Soc Sci		WRI 227		MECH 363	E	WRI 321	
			Econ Elec		MET 375		MECH Elec	E
							Hum/Soc Sci	
Winter	CHE 222		ENGR 211	E	ENGR 212	E	MECH 417	E
	MET 112	I	MATH 254N		ENGR 355	E	MECH 436	E
	MFG 103		MATH 361		MECH 315	E	MECH 437	E
	WRI 122		PHY 222		MECH 360	E	MECH 491	E
					MET 326		WRI 322	
					SPE 321		PHIL 331	
							WRI 322	
Spring	MATH 251		ENGR 266	E	HUM 125		IMGT 345	
	MFG 120		ENGR 213	E	MATH 451	E	ENGR 485	R
	MET 160	I	ENGR 236	E	MECH 313	E	MECH 480	E
	MET 241		MATH 321		MECH 316	E	MECH 492	E
	SPE 111		PHY 223				WRI 323	E
							MECH Elec	E
							Hum/Soc Sci	

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E = Emphasized

OUTCOME (me1): Thermal Systems

	<i>Freshman</i>		<i>Sophomore</i>		<i>Junior</i>		<i>Senior</i>	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	E
	MET 111		MET 242		MFG 314		MECH 351	
	WRI 121		PHY 221		MECH 318	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MECH 363	E	WRI 321	
			Econ Elec		MET 375		MECH Elec	R
							Hum/Soc Sci	
Winter	CHE 222		ENGR 211		ENGR 212		MECH 417	E
	MET 112		MATH 254N		ENGR 355	E	MECH 436	
	MFG 103		MATH 361		MECH 315		MECH 437	E
	WRI 122		PHY 222	I	MECH 360		MECH 491	R
					MET 326		WRI 322	
					SPE 321		PHIL 331	
							WRI 322	
Spring	MATH 251		ENGR 266		HUM 125		IMGT 345	
	MFG 120		ENGR 213		MATH 451		ENGR 485	
	MET 160		ENGR 236		MECH 313	E	MECH 480	
	MET 241		MATH 321		MECH 316		MECH 492	R
	SPE 111		PHY 223				WRI 323	
							MECH Elec	R
							Hum/Soc Sci	

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OUTCOME (me2): Mechanical Systems

	<i>Freshman</i>		<i>Sophomore</i>		<i>Junior</i>		<i>Senior</i>	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	
	MET 111		MET 242		MFG 314		MECH 351	E
	WRI 121		PHY 221	I	MECH 318		MECH 490	R
	Hum/Soc Sci		WRI 227		MECH 363		WRI 321	
			Econ Elec		MET 375		MECH Elec	R
							Hum/Soc Sci	
Winter	CHE 222		ENGR 211	E	ENGR 212	E	MECH 417	
	MET 112		MATH 254N		ENGR 355		MECH 436	E
	MFG 103		MATH 361		MECH 315	E	MECH 437	
	WRI 122		PHY 222		MECH 360		MECH 491	R
					MET 326		WRI 322	
					SPE 321		PHIL 331	
							WRI 322	
Spring	MATH 251		ENGR 266		HUM 125		IMGT 345	
	MFG 120		ENGR 213	E	MATH 451		ENGR 485	
	MET 160		ENGR 236		MECH 313		MECH 480	E
	MET 241		MATH 321		MECH 316	E	MECH 492	R
	SPE 111		PHY 223				WRI 323	
							MECH Elec	R
							Hum/Soc Sci	

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 R = Reinforced
 E = Emphasized