OREGON INSTITUTE OF TECHNOLOGY
Mechanical Engineering Program

Mechanical Engineering Assessment Report 2009-10

May 25, 2010

INTRODUCTION

This report documents the assessment done within the Mechanical Engineering (ME) program at Oregon Institute of Technology during the 2009-10 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 2009-10 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

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The Program Educational Objectives of OIT's mechanical engineering program are to produce alumni who:

- *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.*

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 I.

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.

TABLE 1 : Assessment Cycle

Educational Outcome	*2008-09*	*2009-10*	*2010-11*	*TAC*
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	x			b

Educational Outcome	*2008-09*	*2009-10*	*2010-11*	*TAC*
differential equations), basic science and engineering				
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 understand the impact of engineering solutions in a global, economic, environmental, and social context.		x		j
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			

SUMMARY OF 2009-10 ASSESSMENT ACTIVITIES

As seen in the above assessment cycle, outcomes d, f, and h are being assessed during the 2009-10 school year. This being the second year of the three year cycle, the Program Educational Objectives are also being assessed. Each Student Learning Outcome is broken down into several Performance Criteria to be assessed individually.

Following are the assessment results addressed during 2009-10.

Mission Statement & 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's PEOs were revised in the first year of this cycle, 2008-09. The revised, and now current, Mission Statement and Program Educational Objectives for the ME program are presented above. How well the program is meeting these objectives was assessed in 2009-10.

A survey was sent to alumni of the mechanical engineering program which asked the graduates to assess their abilities related to the Program Educational Objectives. Of the 23 graduates, 13 responded to the survey. Table 2 shows these results.

Table 2 : Alumni Survey Results

PEO Measured	Highly Prepared	Prepared	Inadequately Prepared
Succeed in Entry Level Engineering Positions	100%	0%	0%
Ability to Analyze Thermal Systems	69%	23%	0%
Ability to Design Thermal Systems	39%	39%	15%
Ability to Improve Thermal Systems	62%	39%	0%
Ability to Analyze Mechanical Systems	92%	8%	0%
Ability to Design Mechanical Systems	85%	15%	0%
Ability to Improve Mechanical Systems	85%	15%	0%
Ability to Communicate in Writing	77%	23%	0%
Ability to Communicate Orally	92%	8%	0%
Ability to Communicate Visually (sketch/drawings)	85%	8%	0%
Ability to Work on Teams	92%	0%	0%

	Yes	No	Not Yet
Have Gained Professional Registration	0%	0%	92%
Have Pursued Professional Development	55%	0%	46%
Have Pursued Graduate Studies	42%	17%	42%
Have Participated in Research	18%	36%	46%

In addition, employers of MMET graduates were asked to complete a similar survey. This survey is less specific as it includes MET and MFG as well as ME graduates. There are many more MET and MFG than ME graduates working and we don't feel employers can effectively distinguish a graduate's specific degree. Thus, these employer survey results should be viewed with caution. It is seen that the self evaluation for MET and MFG graduates showed lower preparation levels than for the ME graduates. We would expect employer evaluation to follow this trend. The sample size for employer is also small, only 13 employers responded across all three programs. With these caveats the employee survey results are presented in Table 3 and Table 4.

Table 3 : MMET Employer Survey Results

PEO Measured	Exceeds Expectations	Meets Expectations	Below Expectations
Succeed in Entry Level Engineering Positions	100%	0%	0%
Analyze Thermal Systems	69%	23%	0%
Design Thermal Systems	39%	39%	15%
Improve Thermal Systems	62%	39%	0%
Analyze Mechanical Systems	92%	8%	0%
Design Mechanical Systems	85%	15%	0%
Improve Mechanical Systems	85%	15%	0%
Communicate in Writing	77%	23%	0%
Communicate Orally	92%	8%	0%
Communicate Visually (sketch/drawings)	85%	8%	0%
Work on Teams	92%	0%	0%

Table 4 : MMET Employer Survey Results Continued

	Strongly Agree	Agree	Disagree	Strongly Disagree
MMET Graduates capable of pursuing Professional Registration	71%	14%	0%	0%
MMET Graduates pursue Continuing Education	14%	86%	0%	0%
MMET Graduates able to pursue Graduate Education	29%	43%	14%	0%
MMET Graduates capable to doing Research	14%	43%	14%	0%
MMET Graduates are doing Research	14%	43%	14%	0%

These surveys show the mechanical engineering alumni believe they are well prepared for the engineering positions they are holding. None of the graduates has achieved professional registration because these graduates have been out of school only three years, they have not had the required experience to sit for the Professional Engineering exam. It is encouraging that all indicate they have "not yet" sat for the exam, giving some indication they plan to pursue registration. This also holds for continuing education where half of graduates have pursued continuing education while the remaining graduates plan to do so.

The employer survey should be viewed with caution in evaluating ME graduates; however it shows good evaluations of MMET graduates as a whole.

OUTCOME (d) Multi-disciplinary Teams

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

The Performance Criteria to consider in assessing this outcome are:

- Explicitly identify team/group goal/purpose.
- Assume roles and responsibilities as appropriate.
- Interact appropriately with team/group members.
- Recognize and help reconcile differences among team/group members.
- Share appropriately in work of team/group.
- Develop strategies for effective action.

Teamwork is developed throughout the ME Program's educational experience. However, there are several places formal teams pursue solutions to engineering problems. The introductory Orientation courses (MET 111/112), Fluid Mechanics I (MECH 318), and Senior Projects are the predominant examples.

Assessment method: Faculty review of student team experiences

Following the Institution's assessment, faculty involved in a group project assess the group experience. Each faculty advisor assesses group function and dynamics using an analytical rubric. That rubric is

shown in Appendix II. This assessment is done within senior projects. The senior project teams are a mix of the department's three programs, Mechanical Engineering, Mechanical Engineering Technology, and Manufacturing Engineering Technology and in some cases students from outside the department. This gives a good mix of students and an interdisciplinary element to the projects. It also makes assessing Mechanical Engineering students separately difficult.

Table 5 shows the aggregate faculty scores. Here the assessment method was a rubric completed by the faculty with a measurement scale of 1 to 4. Three faculty members were involved in assessing seven projects.

Table 5. Faculty Assessment Results for SLO d, Teamwork

Performance Criteria	Minimum Acceptable Performance	Results
Achieves Goals/Purpose	80% score 3 or 4	100%
Assumes Roles and Responsibilities	80% score 3 or 4	83%
Interacts Appropriately	80% score 3 or 4	83%
Reconciles Differences	80% score 3 or 4	83%
Shares Work Appropriately	80% score 3 or 4	100%
Develops Strategies/Actions	80% score 3 or 4	67%

Strengths: The students met all performance criteria except developing strategies for effective action. In particular the students demonstrated strengths in identifying and achieving the group's goal or purpose, which the faculty emphasize by requiring them to outline specific project goals. The teams also performed strongly in sharing the workload of the group appropriately. The faculty feel this is due to helping students define their roles by recognizing particular student strengths.

Weaknesses: Students did not meet faculty expectations for developing strategies for effective action. If a student group does not have an effective leader, they are unlikely to develop good strategies. The faculty also noted that students who participate in internships tend to perform more strongly as leaders than those who have classroom experience only. It should also be noted that the score for this performance criteria was lower due to the evaluations of one faculty member, pointing to a possible difference in use of the rubric for scoring.

Assessment method: Student review of student team experiences

The same rubric as used by faculty above, employing a 1-4 scale, was used by the students to evaluate teamwork. Again this assessment was done within senior projects involving the same teams as the above faculty assessment. Responses were obtained from 10 ME, 13 MET, and 4 MFG students. Students were asked to rate their team's performance. Table 6 shows the aggregate student scores.

Table 6. Assessment Results for SLO d, Teamwork

Performance Criteria	Minimum Acceptable Performance	ME	MET	MFG
Achieves Goals/Purpose	80% score 3 or 4	80%	69%	75%
Assumes Roles and Responsibilities	80% score 3 or 4	80%	77%	75%
Interacts Appropriately	80% score 3 or 4	90%	92%	50%
Reconciles Differences	80% score 3 or 4	90%	85%	100%
Shares Work Appropriately	80% score 3 or 4	100%	77%	50%
Develops Strategies/Actions	80% score 3 or 4	80%	85%	75%

The student ratings tended to be lower than the faculty ratings overall, possibly reflecting the frustrating experience of team-based student projects. While faculty may recognize that students are achieving overall teamwork goals, they may not always know all that is occurring within the teams.

The ME students seem to be more satisfied with the team experience than the engineering technology students. This may be due to the specific projects and team assignments for this year. Table 7 shows the mix of students on each team.

Table 7. Discipline Mix on Senior Project Teams

Project	ME	MET	MFG
Velomobile	4	1	0
Power Assist	1	2	0
Avalanche Control	2	0	1
BHS Sorting	0	3	1
SAE Baja	1	2	2
Formula SAE	0	4	0
Robotics	2	1	0

Assessment Method: MMET Undergraduate Exit Survey

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.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To function on multi-disciplinary teams"*. Table 8 shows the results of this inquiry.

Table 8 : Senior Project Exit Survey, Teamwork

	Highly Prepared	Prepared	Inadequately Prepared
To function on multi-disciplinary teams	56%	44%	0%

The students feel they are prepared or highly prepared for teamwork.

It is interesting to note that the employers surveyed in 2010 thought MMET graduates had the ability to work on team based engineering projects. However, some of their written comments indicated that graduates could improve upon their ability to plan and manage projects, i.e. project management.

OUTCOME (f) Professional and Ethical Responsibility

Graduates will have an understanding of professional and ethical responsibility.

The Performance Criteria to consider in assessing this outcome are:

- Evaluate the ethical issues related to a problem in the discipline.
- Demonstrate knowledge of the professional code of ethics in their discipline.
- Demonstrate professional behavior in the academic environment.

Ethics:

Ethics are learned throughout a student's education at OIT. From the introduction of professional canons in Orientation courses (MECH 111/112) through Senior Projects, ethical conduct is highlighted and expected. One formal course, Ethics in the Professions (PHIL 331), is required in the curriculum. Assessment of this outcome is accomplished near the end of the student's education.

Assessment method: Direct assessment of student work.

Paralleling the institution's assessment, the ME program uses an Institutional rubric created at OIT. This rubric is shown in Appendix II. The faculty assess an upper-division assignment addressing the ASME code of ethics and an ethical scenario. A short paper assigned in senior projects is used. The results of this assessment are shown in Table 9.

Table 9. Assessment Results for SLO f, fall term 2009, Senior Projects, 9 seniors

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Using code of ethics, describes ethical issue(s)	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 100%
Describes parties involved and discusses their points of view.	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100%
Describes and analyzes possible/ alternative approaches	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	89%
Chooses an approach and explains the benefits and risks.	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	90%

The ethics assignment asked students questions about the ASME Canons and then gave an ethics scenario to be evaluated. Their ability to understand and use the ASME Canons were assessed in both, thus two scores for the first Institutional Performance Criteria. Students were asked to describe the parties involved, describe alternatives, and choose a particular approach related to the ethics scenario presented. Each of these were assessed using the Institutional ethics rubric.

For this performance assessment the department set a benchmark to have 80% of students performing at a rubric level of 3 or 4, proficient or highly proficient. As seen in Table 9 students performed above this level related to all Institutional performance criteria.

Students reviewed by this assessment are performing above expectations. They have a good academic knowledge related to ethical issues. These Institutional performance criteria relate to the ME Program's first two performance criteria listed above and show students within the program are meeting this portion of the SLO.

Professionalism:

Professionalism is taught throughout the ME curriculum. No courses specifically address this education but it is stressed in many ways. Classroom conduct, teamwork, laboratories and other class related activities provide the opportunity for students to learn proper conduct. Also, activities outside formal courses add to this education, such as professional societies on campus.

Assessment Method: Faculty Assessment of Student Actions

To assess professionalism the Program Directors of the ME, MET and MFG programs came together to assess each graduating senior's conduct. Twelve areas were evaluated on a scale of 0 to 2. The desire was for at least 80% of the students to attaining an evaluation of one or two. Table 10 shows the result of this activity for the eight ME students expected to graduate in spring term 2010.

The assessment shows the faculty feel the ME students exhibit professionalism in the areas considered.

Table 10. Faculty Professionalism Assessment

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Timeliness of work	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Quality of work (course expectations)	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Quality of work (work product)	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Attitude toward feedback	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Attitude toward assigned tasks	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Punctuality	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Attendance	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Academic Integrity	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Interpersonal skills	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Knowledge of classroom policies and procedures	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Work ethic	Faculty Rating	0-2 scale	80% at 1 or 2	100%
Appearance	Faculty Rating	0-2 scale	80% at 1 or 2	100%

Assessment Method: MMET Undergraduate Exit Survey

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.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have an understanding of professional and ethical responsibility"*. Table 11 shows the results of this inquiry.

Table 11 : Senior Project Exit Survey, Professional Responsibilities & Ethics

	Highly Prepared	Prepared	Inadequately Prepared
To have an understanding of professional and ethical responsibility	78%	22%	0%

The students feel they are prepared or highly prepared for teamwork.

OUTCOME (h) Impact of Engineering

Graduates will have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.

The Performance Criteria to consider in assessing this outcome are:

- Understand global impact of engineering decisions
- Understand macro-economic impact of engineering solutions
- Understand environmental and social impact of engineering decisions

Much of this SLO is covered broadly in the general education requirements of the Institution. The Humanities and Social Science electives stress similar topics, particularly in a technical directed Institution such as ours. Writing courses also develop an understanding of these performance criteria. ME students are required to take Introduction to Technology, Society, and Values (HUM 125) and Ethics in the Professions (PHIL 331) which directly address this SLO. Besides these formal courses understanding of this SLO is obtained throughout the technical courses within the curriculum.

Although much of the formal training related to this SLO is gained through general education requirements it will be assessed through departmental course work.

Assessment method: Direct assessment of student work.

Towards the end of the student's experience, within Senior Projects, an assignment is given to allow assessment of this SLO. A short paper is required giving the student an opportunity to analyze a topic or situation involving these performance criteria. A rubric developed by the departmental faculty was used to assess this assignment. This rubric is shown in Appendix II.

An assignment was given in senior projects winter term 2010. This asked the students to assess the reality and effects of "Peak Oil". The rubric presented in Appendix II was applied by the faculty members involved in this course sequence. Table 12 presents the results of this assessment for mechanical engineering students.

Table 12. Assessment Results for SLO h, winter term 2010, Senior Projects, 8 seniors

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Understand global impact of engineering decisions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100%
Understand macro-economic impact of engineering solutions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100%
Understand environmental and social impact of engineering decisions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	86%

The assessment shows good performance in all categories.

Assessment Method: MMET Undergraduate Exit Survey

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.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context"*. Table 13 shows the results of this inquiry.

Table 13 : Senior Project Exit Survey, Broad Education

	Highly Prepared	Prepared	Inadequately Prepared
To have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context	56%	33%	11%

In general the students feel they are prepared or highly prepared for teamwork.

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

The assessment results above were discussed during a faculty meeting held May 24, 2010. During this meeting the faculty reviewed the assessment results and developed recommendations for action. Each SLO addressed during this assessment cycle and the faculty's recommendations follow.

Program Educational Objectives

Alumni of the ME program felt overwhelmingly that their education prepared them well for their first employment. The faculty felt this was a positive result and recommended no specific action.

Multi-disciplinary Teamwork

Both faculty evaluations and student self evaluations showed good performance on this SLO. After discussion the faculty felt the best way to improve teamwork was to improve project planning and project management skills. The better their projects are laid out and the direction understood by the team, the better the teams will work together. Assessment results from 2007-08 showed an opportunity to improve student knowledge of project planning and management. The faculty felt emphasis here will pay dividends in improving teamwork. Thus the faculty recommended no specific action beyond continued work on project planning and management education.

Professional and Ethical Responsibility

Assessment results regarding professional and ethical responsibilities were good. The faculty felt no specific action was needed in this area.

Impact of Engineering

Assessment results related to the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context showed good performance. The faculty felt no specific action was needed for this SLO.

RELATED CHANGES DUE TO PRIOR ASSESSMENTS

CURRENT ACTION ITEMS – to be done during 2010-11

Review Pre-Exams

The recommendation, resulting from the 2007-08 assessment effort, suggested a review of Pre-Exams. The purpose was to bring more consistency across the department. Although an effort was made, results from the 2008-09 assessment shows improvements can still be made.

With two new faculty members coming on board fall 2010 this effort needs to continue.

Project Management

A concern was noted in the 2007-08 assessment in student ability to plan and manage an engineering project. Several small, but formal, term-long design projects were placed into the curriculum to give students additional experience before arriving at the capstone course, senior projects. These projects were implemented in MET 111-112, MECH 316 and MECH 318. In the 2008-09 review it was felt that it is too early to judge the effectiveness of these changes but early indications are that they were helping.

During 2009-10 some effort was put into better coordinating and defining these new projects. However, the department is currently experiencing faculty turnover and two new faculty members will be joining the department in the fall of 2010. These changes will effect MECH 318, senior projects, and possibly the MET 111-112 sequence. It was felt a better approach would be to wait until the new faculty are on board and able to help develop coordination in these student projects.

Also, an effort was made in 2009-10 to directly address Standards and Realistic Constraints in student projects. Progress was made but additional work is needed to better integrate these elements into existing projects.

FUTURE ACTION ITEMS – to be addressed before next assessment cycle beginning fall 2011

Although not on the schedule for 2009-10 assessment, the following recommendation are to be completed before the next assessment cycle begins in fall 2011.

Review Assignments used for Assessment

During 2008-2010 assessments it was found that there may be better assignments than the ones selected. The faculty decided to review the work used for assessment before the next assessment cycle beginning in fall 2011. This review will include the following SLOs:

OUTCOME (a): Mathematics, Science & Core Engineering
OUTCOME (e): Identify, Formulate and Solve Engineering Problems

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 (d): Multi-disciplinary Teams

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	
	MET 111	I	MET 242		MFG 314		MECH 351	
	WRI 121		PHY 221		MECH 318	R	MECH 490	E
	Hum/Soc Sci		WRI 227		MECH 363		WRI 321	E
			Econ Elec		MET 375		MECH Elec	
							Hum/Soc Sci	
Winter	CHE 222		ENGR 211		ENGR 212		MECH 417	
	MET 112	I	MATH 254N		ENGR 355		MECH 436	
	MFG 103		MATH 361		MECH 315		MECH 437	
	WRI 122		PHY 222		MECH 360		MECH 491	E
					MET 326		WRI 322	E
					SPE 321	E	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 312		MECH 480	
	MET 241		MATH 321		MECH 313		MECH 492	E
	SPE 111		PHY 223		MECH 316	R	WRI 323	E
							MECH Elec	
							Hum/Soc Sci	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (f): Professional and Ethical Responsibility

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	
	MET 111	I	MET 242		MFG 314		MECH 351	
	WRI 121		PHY 221		MECH 318		MECH 490	E
	Hum/Soc Sci	R	WRI 227		MECH 363		WRI 321	E
			Econ Elec	R	MET 375		MECH Elec	
							Hum/Soc Sci	R
Winter	CHE 222		ENGR 211		ENGR 212		MECH 417	
	MET 112	I	MATH 254N		ENGR 355		MECH 436	
	MFG 103		MATH 361		MECH 315		MECH 437	
	WRI 122		PHY 222		MECH 360		MECH 491	E
					MET 326		WRI 322	E
					SPE 321		PHIL 331	E
							WRI 322	
Spring	MATH 251		ENGR 266		HUM 125		IMGT 345	
	MFG 120		ENGR 213		MATH 451		ENGR 485	
	MET 160		ENGR 236		MECH 312		MECH 480	
	MET 241		MATH 321		MECH 313		MECH 492	E
	SPE 111		PHY 223		MECH 316		WRI 323	E
							MECH Elec	
							Hum/Soc Sci	R

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (h): Impact of Engineering Solutions

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 221		MATH 252		MATH 253N		MECH 323	
	MET 111	I	MET 242		MFG 314		MECH 351	
	WRI 121		PHY 221		MECH 318		MECH 490	E
	Hum/Soc Sci	R	WRI 227	R	MECH 363		WRI 321	E
			Econ Elec	R	MET 375		MECH Elec	
							Hum/Soc Sci	R
Winter	CHE 222		ENGR 211		ENGR 212		MECH 417	
	MET 112	I	MATH 254N		ENGR 355		MECH 436	
	MFG 103		MATH 361		MECH 315		MECH 437	
	WRI 122	I	PHY 222		MECH 360		MECH 491	E
					MET 326		WRI 322	E
					SPE 321	R	PHIL 331	E
							WRI 322	
Spring	MATH 251		ENGR 266		HUM 125	E	IMGT 345	
	MFG 120		ENGR 213		MATH 451		ENGR 485	
	MET 160		ENGR 236		MECH 312		MECH 480	
	MET 241		MATH 321		MECH 313		MECH 492	E
	SPE 111	R	PHY 223		MECH 316		WRI 323	E
							MECH Elec	
							Hum/Soc Sci	R

I = Introduced
R = Reinforced
E = Emphasized

APPENDIX II
Rubrics

The following rubrics are used in assessing associated SLOs.

Rubric for Teamwork

TAC SLO
EAC SLO d: Graduates will be able to function on multi-disciplinary teams.

PAGE 1:

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)
Identify and achieve 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.
Assume Roles and Responsibilities	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.
Interact Appropriately	Members do not communicate openly and respectfully. Members do not listen to each other. Communication patterns foster a negative climate that undermines teamwork and contributes to a lack of trust and low morale. Humor used is not appropriate.	Members may not consistently communicate openly and respectfully. Members may not listen to each other. Humor used may not be appropriate at times.	Members usually communicate openly and respectfully. Members often listen to most ideas. Members usually support and encourage each other. Humor used is generally appropriate.	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. Humor used is always appropriate and motivating.

Rubric for Teamwork (page 2)

PAGE 2:

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)
Reconcile Differences	Members do not welcome disagreement. Difference often results in voting. Decision processes increase ego involvement. Subgroups are present.	Few members welcome disagreement. Difference often results in voting. Decision processes reduce ego involvement. 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. Decision processes reduce ego involvement. 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. Decision processes reduce ego involvement. All members respect and accept disagreement and employ effective conflict resolution skills. Subgroups absent.
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.
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.

Rubric for Ethics

TAC SLO
EAC SLO f: Graduates will have an understanding of professional and ethical responsibility.

Performance Criteria	Limited of No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
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, demonstrates 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 on 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.	

Rubric for Impact of Engineering Solutions- Peak Oil

TAC SLO j: A respect for diversity and a knowledge of contemporary professional, societal and global issues.
EAC SLO h: Graduates will have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Understand 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.	
Understand 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.	
Understand environmental and 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.	