

# Program Assessment Plan Graduate and Professional Programs

## Program: MECHANICAL ENGINEERING

Date: Sept. 24, 2010 (Adopted by ME faculty on Sept. 22, 2010)

### I. Student Learning Benchmarks or Outcomes

A. *What do you want your students to demonstrate?*

Student learning outcomes in the Mechanical Engineering Graduate Program are consistent with the goals of graduate learning at SIUE. We want our students to demonstrate the following in the discipline of Mechanical Engineering:

1. The ability to use advanced mathematics, science, and fundamentals of engineering to solve engineering problems
2. The ability to perform a comprehensive literature review to identify the frontiers of knowledge in a specialized topic of the discipline
3. The ability to define, to formulate, and to apply the knowledge of the discipline in the context of a research project
4. Proficiency in applying experimental, computational, or analytical methods for solving engineering problems
5. The ability to explain their research results based on fundamental theories and principles of the discipline
6. Effective oral and written communication in technical matters.
7. An understanding of the values and ethics of engineering

These outcomes map onto the five goals of the graduate studies at SIUE as follows:

- Breadth and depth of knowledge in the discipline is covered by outcomes 1, 2, 3, 4, and 5.
- Effective communication is covered by outcome 6.
- Ability for analytical thinking is covered by outcomes 4 and 5.
- The best practices, values, and ethics are covered by outcome 7.
- Knowledge of the discipline is covered by outcomes 1, 2, and 5.

### II. Performance Indicators or Assessments

A. *What do you use to measure student learning benchmarks or outcomes? (At least two performance indicators/assessments are recommended. Thesis, final project/performance, exam, portfolio*

*must be used for the graduate programs.) Please attach the measures/tests/rubrics/etc. to this document.*

We measure the student's learning outcomes based on course work and research. The program requires students to complete a research work as a thesis or a research project. This covers the research component of the program and is the main source of program assessment.

The learning outcomes are indicated below, followed by the indicators which are used to measure the corresponding outcomes.

1. The ability to use advanced mathematics, science, and fundamentals of engineering to solve engineering problems:

The students' knowledge of mathematics, science, and fundamentals of engineering will be measured by successful completion of the course work and completion of the thesis or project report. Students are required to take two applied mathematics courses, seven mechanical engineering courses, and one out of department course. The mechanical engineering courses rely heavily on mathematics and science. These courses help students to gain mastery of these subjects and apply the knowledge gained in their research work. The thesis or project will be presented to an examining committee consisting of at least three faculty members.

2. The ability to perform a comprehensive literature review to identify the frontiers of knowledge in a specialized topic of the discipline:

Students are required to perform a literature review of their research topic and to include a discussion of the review and relevant citations in their thesis or project report. The extent and depth of this review together with the presentation of the results to the committee will demonstrate the ability of students to identify the frontiers of knowledge in the specialized topic. This item will be assessed by the examining committee.

3. The ability to define, to formulate, and to apply the knowledge of the discipline in the context of a research project:

Guided by a research advisor, the students will define and formulate a research project. They will apply their knowledge of mechanical engineering in completing the research topic that they have defined. After completion of the research work, this learning outcome will be assessed by the examining committee.

4. Proficiency in applying experimental, computational, or analytical methods for solving engineering problems:

The students will choose to perform their research using one or more of the following methods: experimental, computational, or analytical. A number of graduate courses in mechanical engineering and applied mathematics, together with supervision of the research work by a faculty advisor, will assist students to gain mastery in at least one of these methods. The performance of students in this category will be assessed by the examining committee based on the content of the thesis or project report and the quality of the presentation.

5. The ability to explain their research results based on fundamental theories and principles of the discipline:

During the thesis or project presentation, the committee examines the knowledge of the student by posing questions aimed at the fundamentals and theoretical aspects of the subject. The student response will be evaluated by the committee and will be used for the assessment purpose.

6. Effective oral and written communication in technical matters:

All mechanical engineering graduate students, regardless of their chosen thesis or non-thesis options, are required to have an oral presentation and to defend their research in an open-to-the-public session in front of an audience and an examining committee. The committee will use the written report and the oral presentation for assessment the communication skills of the student in technical matters.

7. An understanding of the values and ethics of engineering:

The students will demonstrate the values and ethics of engineering based on the quality and originality of their thesis or research project work. The proper citation of the relevant research and acknowledgement of the work of others throughout the report will be used by the examining committee to measure this component of the student's learning.

## **B. *Criteria for Passing***

After completion of the course work, students present and defend the thesis or research project. A draft copy of the thesis/project is given to the members of the examining committee. The committee reviews the report and evaluates the work during the presentation session. The presentation is open to the public.

At the end of the presentation, the committee examines the student on the details of research work and the topics relevant to the area of research. In

addition to the thesis-specific questions, the committee often questions the student on various technical topics covered in the course work.

After the presentation, the committee completes a copy of the assessment form shown in Table 1. The scoring rubric is attached in Table 2. The items covered in each row of the assessment table correspond to the learning goals of the mechanical engineering graduate program.

The above items are scored in three categories:

- Exceeds expectations
- Meets expectations
- Does not meet expectations

The criterion for passing is the overall assessment score of 'Meets Expectations' or 'Exceeds Expectations'.

**Table 1 - Mechanical Engineering Assessment of the Final Thesis/Project Defense**

Student Name:

Date:

Research Title:

Committee Members:

Criterion/Trait	Exceeds Expectations	Meets Expectations	Does Not Meet Expectations
1. The ability to use advanced mathematics, science, and fundamentals of engineering to solve engineering problems			
2. The ability to perform a comprehensive literature review to identify the frontiers of knowledge in a specialized topic of the discipline			
3. The ability to define, to formulate, and to apply the knowledge of the discipline in the context of a research project			
4. Proficiency in applying experimental, computational, or analytical methods for solving engineering problems			
5. The ability to explain their research results based on fundamental theories and principles of the discipline			
6. Effective communication in technical matters:			
a. oral communication			
b. written communication			
7. An understanding of the values and ethics of engineering			
<b>Overall Assessment:</b>			

**Thesis/Project Report:**  Acceptable as is;  Acceptable with revisions;  Unacceptable

**Oral defense:**  Pass  Fail

**Table 2 - Mechanical Engineering Assessment Rubric**

<b>Criterion/Trait</b>	<b>Exceeds Expectations</b>	<b>Meets Expectations</b>	<b>Does Not Meet Expectations</b>
1. The ability to use advanced mathematics, science, and fundamentals of engineering to solve engineering problems	Use substantial amount of math and engineering science in problem solving	Use adequate math and engineering science in problem solving	Use little or no math and engineering science in problem solving
2. The ability to perform a comprehensive literature review to identify the frontiers of knowledge in a specialized topic of the discipline	Cite substantial amount of literature in a comprehensive way	Cite adequate amount of literature	Cite few literature in a disjointed way
3. The ability to define, to formulate, and to apply the knowledge of the discipline in the context of a research project	Demonstrate substantial knowledge to define, formula and solve problem	Demonstrate adequate knowledge to define, formula and solve problem	Demonstrate poor knowledge to define, formula and solve problem
4. Proficiency in applying experimental, computational, or analytical methods for solving engineering problems	Demonstrate mature proficiency in applying experimental, computational, or analytical methods for solving engineering problems	Demonstrate adequate proficiency in applying experimental, computational, or analytical methods for solving engineering problems	Did not demonstrate proficiency in applying experimental, computational, or analytical methods for solving engineering problems
5. The ability to explain their research results based on fundamental theories and principles of the discipline	Explain well of their research results based on fundamental theories and principles of the discipline	Adequate explanation of their research results based on fundamental theories and principles of the discipline	Poor explanation of their research results based on fundamental theories and principles of the discipline
6. Effective communication in technical matters:			
a. oral communication	Oral presentation is clear and effective with excellent audio visual aids	Oral presentation is somewhat clear and use proper excellent audio visual aids	Oral presentation is poor and ineffective and did not use audio visual aids
b. written communication	Thesis/report is written in a sound technical format with good English that clearly and logically summarizes every aspect of the research	Thesis/report is written in good technical format that logically summarize all aspects of the research	Thesis/report is written in poor technical format that did not logically summarize all aspects of the research
7. An understanding of the values and ethics of engineering	1) Excellent and consistent quotations and literature citations	1) Adequate quotations and liter literature citations in the thesis/report;	1) Poor quotations and literature citations in the thesis/report;

	in the thesis/report; 2) Excellent narration and discussion of the related ethical issues of the research conducted	2) Good narration and discussion of the related ethical issues of the research conducted	2) Inadequate discussion of the related ethical issues of the research conducted
<b>Overall Assessment:</b>			
	Overall assessment will be given by the defense committee based on the graduate's performance in all criteria areas		

*C. Where are the benchmarks or outcomes assessed in your program?*

The learning outcomes will be assessed in the following areas:

- 1) the quality of written report and oral presentation, by the final defense committee
- 2) the graduate exit survey;
- 3) the Essay on Ethics written by each graduate, by the final defense committee.

<b>Benchmark/Outcome</b>	<b>Performance Indicator or Assessment</b>	<b>Criteria for Passing</b>	<b>Where Are the Benchmarks/ Outcomes Assessed?</b>
1. The ability to use advanced mathematics, science, and fundamentals of engineering to solve engineering problems	Mathematics, science, and fundamentals of engineering used in the thesis or project report and defense.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)
2. The ability to perform a comprehensive literature review to identify the frontiers of knowledge in a specialized topic of the discipline	Literature review section of the research report including a discussion on the related research; proper reference citation.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)
3. The ability to define, to formulate, and to apply the knowledge of the discipline in the context of a research project	The novelty of the research topic as seen in the thesis or project report and as judged by the committee during the defense.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)

4. Proficiency in applying experimental, computational, or analytical methods for solving engineering problems	The accuracy of the measurements, computations, or analytical work as documented in the thesis or research project report.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)
5. The ability to explain their research results based on fundamental theories and principles of the discipline	Questions on fundamentals and theory of the research work posed by the committee during the defense.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)
6. Effective oral and written communication in technical matters	Written report of thesis or research project; oral presentation skills demonstrated during the presentation.	'Meets expectations' or 'Exceeds expectations'	The outcomes are assessed by 1) and 2)
7. An understanding of the values and ethics of engineering	Originality and accuracy of the research work; proper acknowledgement of the work of other researchers and contributor, the understanding of the impact of the research on society in general in an ethical manner	'Meets expectations' or 'Exceeds expectations'	<b>The outcomes are assessed by 1) , 2) and 3)</b>

# Mechanical Engineering

## Graduate Student Exit Survey

All ME graduates are required to filled out the Graduate Student Exit Survey. The survey serves as part of the assessment plan that is intended to improve our graduate program. Your honest opinion is appreciated.

Indicate your concentration of study:     \_\_\_Control     \_\_\_Design     \_\_\_Dynamics     \_\_\_Thermal/Fluid

***Please make One mark on each line at the appropriate column***

	Excellent (4)	Good (3)	Average (2)	Poor (1)	Not Applicable
<b>Advising</b>					
Initial advisement by the Graduate Program Director					
Advisement by your major advisor					
Communication with the Graduate Program Director/Department					
<b>Course Scheduling and Content</b>					
Course scheduling					
ME course content and rigor (taught by ME faculty or call staff)					
Non-ME engineering course content and rigor (taught by other departments)					
MATH course content and rigor					
<i>MATH course</i> (6 hours) content to prepare you to use advanced mathematics to solve engineering problems					
<i>ME graduate course</i> (15 hours) content to prepare you to use science, and fundamentals of engineering to solve engineering problems					

<i>ME undergraduate course (6 hours)</i> content to prepare you to use science, and fundamentals of engineering to solve engineering problems					
<b>Research Experience</b>					
<i>The improvement</i> on your ability to perform a comprehensive literature review in your research area					
As part of your research experience in the program, <i>the improvement in your ability</i> to define, to formulate, and to apply the knowledge of the discipline					
As part of your research experience in the program, <i>your proficiency</i> in applying experimental, computational, or analytical methods for solving engineering problems					
<b>Communication skills</b>					
As the result of your research experience, the improvement in your technical oral and written communication					
<b>Ethics</b>					
As the result of your research experience, <i>your understanding</i> of the values and ethics of engineering					
<b>Graduation Information</b>					
(Answer the following question <b>Y</b> or <b>N</b> )	<b>Yes</b>	<b>No</b>			
Do you have a job interview already?					
Do you have a job offer already?					

If <b>Yes</b> to the above question, is this a mechanical engineering related job?		
Do you plan to continue your study for a Ph.D.?		
If Yes for Ph.D. -- In SIUE?		
Ph.D. in which University?		

## **Essay on Ethics**

The Department of Mechanical Engineering requires all graduate students to write an Essay on Ethics. Each student is required to submit the Essay on Ethics to his/her major Adviser before a thesis/project defense is scheduled. The Essay on Ethics is used by the Graduate Defense Committee for the Ethics content assessment during the defense.

The Essays on Ethics should include the following contents as minimum:

- 1) a statement of originality and accuracy of the research work;
- 2) the understanding of the impact of the conducted research on environment and society in general in an ethical manner