Mechanical Engineering
List of PhD-Level Outcomes

1. Mastery of Advanced Principles

PhD-level graduates will master advanced principles of at least one topical area within the field of mechanical engineering, and understand how these principles are applied to perform engineering research.

2. Research Leadership

PhD-level graduates will have the ability to conduct and lead research projects in the field of mechanical engineering.

3. Fundamental Areas of Mechanical Engineering

PhD-level graduates will have a broad understanding of the fundamental areas of mechanical engineering.

4. Communication Skills

PhD-level graduates will be able to communicate their ideas effectively with their technical peers and with others outside their discipline.

5. Written Publications

PhD-level graduates will have the ability to write advanced publications in their area of specialization.
Outcome #1: Mastery of Advanced Principles
PhD-level graduates will master advanced principles of at least one topical area within the field of mechanical engineering, and understand how these principles are applied to perform engineering research.

Assessment Method 1
Final Oral Examination Evaluation Form

Assessment Method Description
All PhD-level students must take and pass a final oral examination. The examination is administered by the student’s Advisory Committee made up of 3-5 faculty members. Contents of the examination include an open (public) session consisting of an oral presentation by the student of their dissertation research, followed by a closed session that consists of questions from the Committee on the student’s dissertation research and graduate coursework, as well as topics from all areas of mechanical engineering. These examinations are graded on a Pass/Fail basis. In addition, the faculty members on the Committees are asked to complete evaluation forms on the students that include some questions related to assessment of the Graduate Program in Mechanical Engineering. The blank evaluation form is given in Appendix A.

For this outcome, the results of question #1 on the evaluation form are used as an assessment method:

1. Mastery of Advanced Principles: Please evaluate the student’s knowledge of the advanced principles of his/her primary area of expertise in the field of mechanical engineering, and his/her understanding of how these principles are applied to perform engineering research.

The Committee Members are asked to use the following scoring rubric: Excellent (5), Good (4), Acceptable (3), Fair (2), and Poor (1). An average score of 3.0 (Acceptable) across the student population evaluated in a given year is considered to be the minimum acceptable value (benchmark value) for this assessment tool.

Findings and Plans for Improvement
Evaluation forms were gathered for 12 PhD students during 2012-2013, and data were extracted from 50 evaluations forms. The average score for question #1 was 4.3. This average number comfortably exceeds the benchmark of 3.0. In addition, the low score for all graduate students was 3. These results indicate that the faculty members serving on the examination committees felt that our PhD-level students demonstrated good mastery of advanced principles on the average, and that all students demonstrated acceptable competency. No action items are planned for this Outcome based on the results of this assessment tool.
Outcome #2: Research Leadership
PhD-level graduates will have the ability to conduct and lead research projects in the field of mechanical engineering.

Assessment Method 1
Final Oral Examination Evaluation Form

Assessment Method Description
All PhD-level students must take and pass a final oral examination. The examination is administered by the student’s Advisory Committee made up of 3-5 faculty members. Contents of the examination include an open (public) session consisting of an oral presentation by the student of their dissertation research, followed by a closed session that consists of questions from the Committee on the student’s dissertation research and graduate coursework, as well as topics from all areas of mechanical engineering. These examinations are graded on a Pass/Fail basis. In addition, the faculty members on the Committees are asked to complete evaluation forms on the students that include some questions related to assessment of the Graduate Program in Mechanical Engineering. The blank evaluation form is given in Appendix A.

For this outcome, the results of question #2 on the evaluation form are used as an assessment method:

2. Research Leadership: Please evaluate the student’s ability to lead and conduct research in the field of mechanical engineering.

The Committee Members are asked to use the following scoring rubric: Excellent (5), Good (4), Acceptable (3), Fair (2), and Poor (1). An average score of 3.0 (Acceptable) across the student population evaluated in a given year is considered to be the minimum acceptable value (benchmark value) for this assessment tool.

Findings and Plans for Improvement
Evaluation forms were gathered for 12 PhD students during 2012-2013, and data were extracted from 50 evaluations forms. The average score for question #2 was 4.4. This average number comfortably exceeds the benchmark of 3.0. In addition, the low score for all graduate students was 3. These results indicate that the faculty members serving on the examination committees felt that our PhD-level students demonstrated good ability to conduct and lead research projects in the field of mechanical engineering on the average, and that all students demonstrated acceptable competency. No action items are planned for this Outcome based on the results of this assessment tool.
Outcome #3: Fundamental Areas of Mechanical Engineering
PhD-level graduates will have a broad understanding of the fundamental areas of mechanical engineering.

Assessment Method 1
Final Oral Examination Evaluation Form

Assessment Method Description
All PhD-level students must take and pass a final oral examination. The examination is administered by the student’s Advisory Committee made up of 3-5 faculty members. Contents of the examination include an open (public) session consisting of an oral presentation by the student of their dissertation research, followed by a closed session that consists of questions from the Committee on the student’s dissertation research and graduate coursework, as well as topics from all areas of mechanical engineering. These examinations are graded on a Pass/Fail basis. In addition, the faculty members on the Committees are asked to complete evaluation forms on the students that include some questions related to assessment of the Graduate Program in Mechanical Engineering. The blank evaluation form is given in Appendix A.

For this outcome, the results of question #3 on the evaluation form are used as an assessment method:

3. Fundamental Areas of Mechanical Engineering: Please evaluate the student’s broad understanding of the fundamental areas of mechanical engineering.

The Committee Members are asked to use the following scoring rubric: Excellent (5), Good (4), Acceptable (3), Fair (2), and Poor (1). An average score of 3.0 (Acceptable) across the student population evaluated in a given year is considered to be the minimum acceptable value (benchmark value) for this assessment tool.

Findings and Plans for Improvement
Evaluation forms were gathered for 12 PhD students during 2012-2013, and data were extracted from 50 evaluations forms. The average score for question #3 was 4.0. This average number comfortably exceeds the benchmark of 3.0. These results indicate that the faculty members serving on the examination committees felt that our PhD-level students demonstrated broad understanding of the fundamental areas of mechanical engineering on the average, and that all students demonstrated acceptable competency. No action items are planned for this Outcome based on the results of this assessment tool.
Outcome #4: Communication Skills
PhD-level graduates will be able to communicate their ideas effectively with their technical peers and with others outside their discipline

Assessment Method 1
Final Oral Examination Evaluation Form

Assessment Method Description
All PhD-level students must take and pass a final oral examination. The examination is administered by the student’s Advisory Committee made up of 3-5 faculty members. Contents of the examination include an open (public) session consisting of an oral presentation by the student of their dissertation research, followed by a closed session that consists of questions from the Committee on the student’s dissertation research and graduate coursework, as well as topics from all areas of mechanical engineering. These examinations are graded on a Pass/Fail basis. In addition, the faculty members on the Committees are asked to complete evaluation forms on the students that include some questions related to assessment of the Graduate Program in Mechanical Engineering. The blank evaluation form is given in Appendix A.

For this outcome, the results of questions #4 and #5 on the evaluation form are used as an assessment method:

4. **Oral Communication**: Please evaluate the quality of the student’s oral presentation of his/her Ph.D. Dissertation research including clarity of the oral presentation, organization and logic, and the ability of the student to communicate technical ideas orally.

5. **Written Communication**: Please evaluate the quality of the written presentation of the student’s research in his/her Ph.D. Dissertation document including clarity, organization and logic, use of graphics and equations, and the ability of the student to communicate technical ideas in written form

The Committee Members are asked to use the following scoring rubric: Excellent (5), Good (4), Acceptable (3), Fair (2), and Poor (1). An average score of 3.0 (Acceptable) across the student population evaluated in a given year is considered to be the minimum acceptable value (benchmark value) for this assessment tool.

Findings and Plans for Improvement
Evaluation forms were gathered for 12 PhD students during 2012-2013, and data were extracted from 50 evaluations forms. The average scores for questions #3 and #4 were 3.8 and 4.2. These average numbers comfortably exceed the benchmark of 3.0. In addition, the scores for most graduate students were of values 3, 4, and 5 (acceptable, good, and excellent) for both communication categories. These results indicate that the faculty members serving on the examination committees felt that our PhD-level students demonstrated good ability to communicate their ideas effectively on the average, and that most of the students demonstrated acceptable competency (or higher) in both oral and written communication. One student was ranked as having only fair oral communication skills, and one student was ranked as having only fair written communication skills. The Graduate Program Committee studied the cases of these students and found that the two students in question were international students who were using...
English as a second language. The students having issues with oral communication were encouraged to make further use of the language training resources at Auburn, while the student who ranked fair in the written communication worked with his dissertation advisor to improve his document. The Committee will revisit the topic of communication skills next year, and take further actions based on future assessment data.
Outcome #5: Written Publications
PhD-level graduates will be able to write advanced publications in their area of specialization.

Assessment Method 1
Final Oral Examination Evaluation Form

Assessment Method Description
All PhD-level students must take and pass a final oral examination. The examination is administered by the student’s Advisory Committee made up of 3-5 faculty members. Contents of the examination include an open (public) session consisting of an oral presentation by the student of their dissertation research, followed by a closed session that consists of questions from the Committee on the student’s dissertation research and graduate coursework, as well as topics from all areas of mechanical engineering. These examinations are graded on a Pass/Fail basis. In addition, the faculty members on the Committees are asked to complete evaluation forms on the students that include some questions related to assessment of the Graduate Program in Mechanical Engineering. The blank evaluation form is given in Appendix A.

For this outcome, the results of question #6 on the evaluation form are used as an assessment method:

6. **Written Publications**: Please evaluate the ability of the student to write advanced publications in his/her area of specialization.

The Committee Members are asked to use the following scoring rubric: Excellent (5), Good (4), Acceptable (3), Fair (2), and Poor (1). An average score of 3.0 (Acceptable) across the student population evaluated in a given year is considered to be the minimum acceptable value (benchmark value) for this assessment tool.

Findings and Plans for Improvement
Evaluation forms were gathered for 12 PhD students during 2012-2013, and data were extracted from 50 evaluations forms. The average score for question #6 was 4.3. This average number comfortably exceeds the benchmark of 3.0. In addition, the scores for all graduate students were of values 3, 4, and 5 (acceptable, good, and excellent). These results indicate that the faculty members serving on the examination committees felt that our PhD-level students demonstrated good ability to write advanced publications in their area of specialization, and that all students demonstrated acceptable competency (or higher). No action items are planned for this Outcome based on the results of this assessment tool.

Assessment Method 2
Graduating Student Survey

Assessment Method Description
All PhD-level students were asked via email to complete a web-based exit survey covering a variety of questions. This survey is administered near the end of the semester of his/her planned graduation by the Office of Institutional Research and Assessment. A list of the survey questions is given in Appendix B.
For this outcome, the results of questions #8 and #9 on the survey form are used as an assessment method:

8. How many peer reviewed conference papers or posters (single or co-authored) did you present during the period of your graduate studies at Auburn University?
9. How many peer reviewed journal articles (single or co-authored) did you have accepted during the period of your graduate studies at Auburn University?

The department has set a goal that every PhD-level student will have at least three written publication in-print or accepted by the time of graduation, including at least one peer-reviewed journal article. Thus, an average of 3.0 written publication across the student population evaluated in a given year is considered to be the minimum acceptable number (benchmark value) for this assessment tool. The average number of publications per student was obtained by adding the average number of conference papers per student (Question #8) to the average number of journal articles per student (Question #9).

Findings and Plans for Improvement
Survey results were gathered from 16 PhD-level students during 2012-2013. The averages were 4.94 conference papers per student, and 1.31 journal articles per student, for an average of 6.25 written publications per student. This average number comfortably exceeds the benchmark of 3.0 written publications per student. These results demonstrated that our students were able to write publications in their area of specialization (on the average). We were concerned that 3/16 students had no written publications prior to graduation, and that 9/16 students had no published journal articles prior to graduation. The Graduate Program Committee is currently addressing these deficiencies and developing methods to encourage all students to publish in collaboration with their major professor and other collaborators. The Department runs an annual “Elements of Mechanical Engineering” Technical Conference every Fall Semester that provides a venue for students to publish their work on a regional basis (Southeast USA). We are taking additional measures to ensure that all students are aware of this resource and to encourage broad participation.
Appendix A

Final Oral Examination Evaluation Form
Ph.D. Defense Assessment Form for Committee Members
Department of Mechanical Engineering
Auburn University

Graduate Student Name: ___________________________________________

Committee Member Name: __________________________________________

Student Degree Sought: Ph.D.

Ph.D. Dissertation Defense Date (Month/Year): ______/_______

Please evaluate the performance of the Ph.D. student using the following rubric:
Excellent (5), Good (4), Acceptable (3), Fair (2), Poor (1)

<table>
<thead>
<tr>
<th>Score (Circle One)</th>
<th>Metric to be Evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 4 3 2 1</td>
<td>1. Mastery of Advanced Principles: Please evaluate the student’s knowledge of the advanced principles of his/her primary area of expertise in the field of mechanical engineering, and his/her understanding of how these principles are applied to perform engineering research.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>2. Research Leadership: Please evaluate the student’s ability to lead and conduct research in the field of mechanical engineering.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>3. Fundamental Areas of Mechanical Engineering: Please evaluate the student’s broad understanding of the fundamental areas of mechanical engineering.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>4. Oral Communication: Please evaluate the quality of the student’s oral presentation of his/her Ph.D. Dissertation research including clarity of the oral presentation, organization and logic of the presentation, and the ability of the student to communicate technical ideas orally.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>5. Written Communication: Please evaluate the quality of the written presentation of the student’s research in his/her Ph.D. Dissertation document including clarity, organization and logic, use of graphics and equations, and the ability of the student to communicate technical ideas in written form</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>6. Written Publications: Please evaluate the ability of the student to write advanced publications in his/her area of specialization.</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
<td>7. Technical Quality: Please evaluate the overall technical quality of the research performed by the student.</td>
</tr>
</tbody>
</table>
Appendix B

List of Graduating Student Survey Questions
Graduating Graduate Student Survey

GRADUATING GRADUATE STUDENT SURVEY Congratulations! Because you have registered to graduate this term, you are being asked to complete the Graduating Graduate Student Survey. The survey is designed to collect information about your Auburn University educational experience and your career plans after graduation. If you have questions about this survey, please contact the Auburn University Office of Institutional Research and Assessment at (334) 844-4765 or OIRA@auburn.edu. Thank you for your participation.

Your Graduate Experience at Auburn University

Q1 If you could start over again, would you still go to graduate school?
☑ Yes (1)
☐ No (2)

Q2 Would you still go to Auburn?
☑ Yes (1)
☐ No (2)

Q3 Would you select the same field of study?
☑ Yes (1)
☐ No (2)

Q4 Would you recommend Auburn to someone considering your program?
☑ Definitely not (1)
☑ Probably not (2)
☑ Maybe (3)
☑ Probably yes (4)
☑ Definitely yes (5)

Q5 How would you rate your graduate program at Auburn University?
☑ Excellent (1)
☑ Good (2)
☑ Fair (3)
☑ Poor (4)
Q6 To what extent do you agree with the following statements about your graduate program?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Agree (3)</th>
<th>Strongly Agree (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>My graduate program was academically challenging (1)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Faculty members in my graduate program were good teachers (2)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Faculty members helped graduates of my program find appropriate employment (3)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Faculty members in my graduate program were good researchers (4)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Course requirements and sequences for my graduate program were effective (5)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>The courses I needed were available (6)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Opportunities existed outside of class for interactions between students and faculty members in my graduate program (7)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Faculty members were available to work with me on my research (8)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Graduate teaching/research assistantships were available in my graduate program (9)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Tuition support was available in my program (10)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>My graduate program prepared me to teach (11)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>My graduate program prepared me to carry out research (12)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>My advisor was available when needed (13)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>My graduate program kept pace with recent trends and developments in the field (14)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
</tbody>
</table>

Q7 Please rate your experience with the Graduate School’s MATRICULATION office and staff.

<table>
<thead>
<tr>
<th>Category</th>
<th>Very Dissatisfied (1)</th>
<th>Dissatisfied (2)</th>
<th>Satisfied (3)</th>
<th>Very Satisfied (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpfulness of your Graduate School advisor (1)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Helpfulness of the thesis / dissertation checklist (2)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Availability of on-line forms (3)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>The graduation check process (4)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Responsiveness (5)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Overall (6)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
</tbody>
</table>
Q8 How many peer reviewed conference papers or posters (single or co-authored) did you present during the period of your graduate studies at Auburn University?

- None (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- 6 (7)
- 7 (8)
- 8 (9)
- 9 (10)
- 10 (11)
- More than 10 (12)

Q9 How many peer reviewed journal articles (single or co-authored) did you have accepted during the period of your graduate studies at Auburn University?

- None (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- 6 (7)
- 7 (8)
- 8 (9)
- 9 (10)
- 10 (11)
- More than 10 (12)
Q10  To what extent did the following factors impact your academic progress or time to degree?

<table>
<thead>
<tr>
<th>Factor</th>
<th>No Impact (1)</th>
<th>Some Impact (2)</th>
<th>Major Impact (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family obligations (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of faculty (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course scheduling/availability (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thesis/dissertation research (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, please specify: (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q11  Approximately how much debt did you incur to finance your graduate education at Auburn?
Approximate debt ($) - will be kept confidential (1)

Q12  Plans Following Graduation  What is MOST LIKELY to be your PRINCIPAL activity upon graduation?
- Further study at Auburn University (1)
- Further study at another institution, please indicate where: (2) ________________
- Post-Doctoral Fellowship or Research Associate (3)
- K-12 Teaching Position (4)
- K-12 Administrative Position (5)
- College/University Faculty or Administrative Position (6)
- Other Education (7)
- Business/Industry (8)
- Government Service (9)
- Military Service (10)
- Non-Profit Organization (11)
- Self-Employment (12)
- Not employed, not seeking employment (13)
- Not employed, seeking employment (14)
Q13 Have you located employment that you will begin or continue upon graduation?
- Yes (1)
- No (2)

Q14 If so, please provide information about your job and employer:
- Job title (1)
- Name of employing organization (2)
- Location (3)
- City (4)
- State (5)
- Annual Salary ($) - will be kept confidential (6)
- Start date (7)

Q15 Please select an occupational group, sub-group, and occupational title for your job.

Q16 What will be your employment status in your first job after graduation?
- Full-time (35+ hours per week) (1)
- Part-time (34 hours per week or less) (2)

Q17 How directly is your job related to your major from Auburn University?
- Directly related (1)
- Indirectly related (2)
- Not related (3)

Q18 Additional Comments: Please add any additional comments and recommendations for improving graduate education at Auburn.