

Academic Assessment Plan
Department of Electrical Engineering
Graduate Programs
June 01, 2016

I. PROGRAM OBJECTIVES

The graduate program of the Department of Electrical Engineering offers Master of Science in Electrical Engineering (M.S.E.E.), Master of Science in Electrical Engineering Online (M.S.E.E. Online), and Doctor of Philosophy in Engineering (Ph.D.) degrees. The program goals and objectives for the M.S.E.E. and Ph.D. programs were established in 2007 with a timeline to revise those by the Graduate Studies Committee and the full faculty every two years. When the M.S.E.E. online was introduced in Spring 2014, it was expected to follow the same program objectives and assessment/revision schedule as the regular M.S.E.E. on-campus program. The most recent review of the program objectives was made through Graduate Studies Committee meetings of February 11, 2015 and March 10, 2015 and subsequent meetings of the Department of Electrical Engineering Faculty on April 3, 2015, and January 15, 2016, as stipulated in the continuous monitoring and improvement requirements.

M.S.E.E. Program Objectives (for both on-campus and online programs)

1. Have sufficiently deep knowledge of some specialty area within electrical engineering in order to be recognized as an expert or innovator in that specialty. Graduates should also be competent in related areas of electrical engineering, engineering, science, and mathematics which impact performance in their specialty areas.
2. Formulate a research plan, execute such a research plan, and to generate and analyze original research results.
3. Communicate effectively using both oral and written presentations.
4. Be prepared for successful careers in industry, government, or academia (As part of this they should have the skills required for life-long learning and professional development).
5. Appreciate the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and should be committed to ethical conduct in all areas.
6. Understand the value of leadership and service.

Ph.D. Program Objectives

1. Have sufficiently deep knowledge of some specialty within electrical engineering to be recognized as an expert or innovator in that specialty. Graduates should also be competent in related areas of electrical engineering, engineering, science, and mathematics which impact performance in their specialty areas.

2. Identify pertinent research problems and to formulate a research plan. Graduates should be able to execute research plans, and to generate and analyze original research results.
3. Communicate effectively using both oral and written presentations.
4. Be prepared for successful careers in industry, government, or academia. As part of this they should have the skills required for life-long learning and professional development.
5. Appreciate the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and should be committed to ethical conduct in all areas.
6. Understand the value of leadership and service.

II. PROGRAM LEARNING OUTCOMES

The graduate program of the Department of Electrical Engineering offers Master of Science in Electrical Engineering (M.S.E.E.), Master of Science in Electrical Engineering Online (M.S.E.E. Online), and Doctor of Philosophy in Engineering (Ph.D.) degrees. The program outcomes for the M.S.E.E. and Ph.D. programs were established in 2007 with a timeline to revise those by the Graduate Studies Committee and the full faculty every two years. When M.S.E.E. online was introduced in Spring 2014, it was expected to follow the same program outcomes and assessment/revision schedule as the regular M.S.E.E. on-campus program. The most recent review of the Program Outcomes was made through Graduate Studies Committee meetings of February 11, 2015 and March 10, 2015 and subsequent meetings of the Department of Electrical Engineering Faculty on April 3, 2015, and January 15, 2016, as stipulated in the continuous monitoring and improvement requirements.

M.S.E.E. Program Outcomes (for both on-campus and online programs)

1. Apply knowledge of engineering, science, and mathematics to analyze and solve advanced electrical engineering problems.
2. Locate literature relevant to a specific topic, understand and evaluate it, and apply the information.
3. Conduct independent research, and to make effective use of the tools available for that research.
4. Have an in-depth knowledge of some specialty area within electrical engineering.
5. Communicate effectively using both oral and written presentations.
6. Understand the need for continued learning and professional development, and should understand the need to maintain awareness of current professional issues.
7. Have an appreciation of the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and should be committed to ethical conduct in all areas.

Ph.D. Program Outcomes

1. Apply knowledge of engineering, science, and mathematics to analyze and solve advanced electrical engineering problems.
2. Locate literature and other sources of information relevant to a specific topic, understand and evaluate it, and apply the information.
3. Define and conduct independent research, and to make effective use of the tools available for that research. A student should also be able to develop new tools, methods, and techniques when necessary to accomplish research objectives.
4. Have an in-depth knowledge of some specialty area within electrical engineering, and should have a broad knowledge of related areas in engineering, science, and mathematics.
5. Communicate effectively using both oral and written presentations.
6. Understand the need for continued learning and professional development, and should understand the need to maintain awareness of current professional issues.
7. Have an appreciation of the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and should be committed to ethical conduct in all areas.

III. ASSESSMENT TOOLS FOR GRADUATE PROGRAM OBJECTIVES AND OUTCOMES

Graduate Program Objectives and Outcomes are assessed using various tools. The success in achieving the program objectives is measured yearly through formal assessment as well as informal input from the Arkansas Academy of Electrical Engineering (AAEE) members, who are some of the accomplished graduates of our program. Their candid opinions, criticisms, and suggestions about our graduate education are considered a valid measure of the achievement of our education objectives. Since their input is based on their own personal experiences in the corporate world as well as their experience with other graduates (M.S. and Ph.D.) of our program hired by their respective companies, it represents assessment of our program objectives 5-10 years past graduation.

The educational objectives were forwarded to the membership of the AAEE, by email dated April 27, 2015. The members were asked to read the objectives and provide feedback. Only a few responses were received, some of which related to minor wording changes in the objectives. Other comments received were that the “objectives are spot on,” and “I think these cover the educational objectives very well. They are, in my opinion, quite thorough.”

The graduate program outcomes are assessed using the following tools:

1. **Course Evaluation (CourseEval):** Evaluations of the course content pertaining to specific outcomes by students and faculty, and through the grades earned at the end of the semester.

2. **Final Presentation/Thesis/Dissertation Defense Evaluation (FinalEval):** These are also assessed at the final comprehensive exam presentation or thesis/dissertation defense through a questionnaire filled out by the student's advisory/thesis/dissertation committee members and their major advisor.
3. **Exit Interview (ExitInt):** Another important tool used for measuring the success of our program delivering the Program Outcomes is through Exit Interviews of the graduating students conducted by the head of the department.

Not all the abovementioned tools are expected to measure all of the program outcomes; for example, the "CourseEval tool", is not expected to measure all the outcomes for every course — some may measure in-depth knowledge and some other graduate courses may measure student's ability to conduct research through developing new or existing tools.

The success in achieving an outcome is measured on a scale of 1-5, where 1 represents very poor and 5 represents excellent. Achievement of a 3 is considered adequate for satisfying the program outcome goals and an average score of below 3 over two semesters would flag a potential issue for Graduate Studies Committee to discuss and possibly recommend to the faculty a remedial course of action.

Table 1: Electrical Engineering Graduate Program Outcome Assessment Metric Table

| # | M.S.E.E./Ph.D. Program Outcomes | Tools | Metric |
|----|---|------------------------------------|-----------------------|
| 1. | Ability to apply knowledge of engineering, science, and math to solve engineering problems | CourseEval FinalEval ExitInt | A score of 3 or above |
| 2. | Ability to locate literature, understand, and apply to problems at hand | CourseEval FinalEval ExitInt | A score of 3 or above |
| 3. | Ability to define and/or conduct research and to develop and/or use tools to accomplish goals | CourseEval FinalEval ExitInt | A score of 3 or above |
| 4. | Have an in-depth knowledge of some specialty area and a broader knowledge of related areas | CourseEval FinalEval ExitInt | A score of 3 or above |
| 5. | Ability to communicate effectively using both oral and written presentations | CourseEval FinalEval ExitInt | A score of 3 or above |
| 6. | Understand the need for continued learning and professional development | CourseEval ExitInt | A score of 3 or above |
| 7. | Have an appreciation of professional responsibility to society and should be committed to ethical conduct | CourseEval ExitInt | A score of 3 or above |

IV. PROCESS FOR EVALUATING THE EFFICACY OF ELECTRICAL ENGINEERING GRADUATE PROGRAM IN DELIVERING THE STATED OBJECTIVES AND OUTCOMES

The following figure depicts the two-year timeline showing the use of assessment tools to collect data throughout the year, annual review by the Graduate Studies Committee, and the bi-annual review and feedback to improve the program objectives and outcomes.

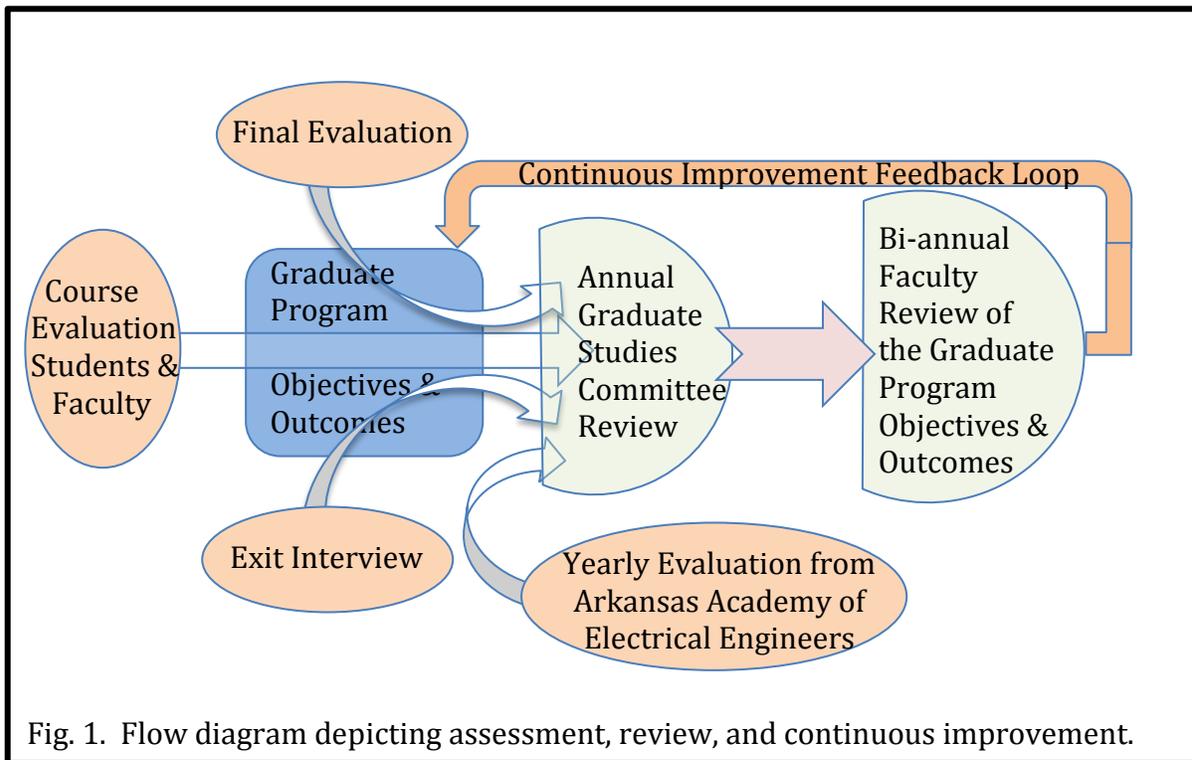


Fig. 1. Flow diagram depicting assessment, review, and continuous improvement.

Members of the Arkansas Academy of Electrical Engineers (AAEE) are asked for informal feedback on the current educational objectives.

As for the outcomes, we use three tools as described before.

1. For each graduate course, graduate students and instructors are asked to complete a form assessing the program outcomes at the end of each semester. This form allows them to express their opinion on how well expected course outcomes were met. This collection process started in the spring 2015 semester (Appendix A).
2. At the end of the final comprehensive exam for the non-thesis M.S.E.E. and M.S.E.E. online students, and at the end of thesis/dissertation defense for the M.S.E.E. (Thesis Option)/Ph.D. students, the student's committee and the thesis/dissertation advisor fill out a questionnaire to evaluate several important program outcomes (Appendix B).

3. Written questionnaire filled by the graduating graduate students. The questionnaire is given under Appendix C. This is supplanted by a face-to-face exit interview with the head of department.

V. SUMMARY OF THE RESULTS OF ASSESSMENT AND IMPROVEMENT

In the past, the assessment tools were run the year before an accreditation visit. Starting in the Spring 2015, the assessment tools are run every semester. Summaries of assessments for Spring 2015 and Fall 2015 are given below. Summaries for Spring 2016 will be made available to the faculty in the Fall 2016 meeting before the semester starts.

Spring 2015

| | A | B | C | D | E | F | G |
|-----------------|------|------|------|------|------|------|------|
| Students | 4.13 | 3.92 | 4.15 | 4.18 | 3.93 | 3.96 | 4.27 |
| Faculty | 4.22 | 4.00 | 4.00 | 4.44 | 4.25 | 4.38 | 4.17 |

Fall 2015

| | A | B | C | D | E | F | G |
|-----------------|------|------|------|------|------|------|------|
| Students | 4.21 | 4.12 | 4.24 | 4.28 | 4.11 | 4.04 | 3.95 |
| Faculty | 4.31 | 4.08 | 3.92 | 4.15 | 3.42 | 3.73 | 3.11 |

APPENDIX A

Course Evaluation Forms for Students and Faculty

ELECTRICAL ENGINEERING OUTCOMES ASSESSMENT FORM

Course #: ELEG XXXX

Semester: _____

The Electrical Engineering Faculty has adopted the following list of abilities and knowledge expected of our MSEE and PhD graduates. These are referred to as “program outcomes”. In order to maintain our status as an electrical engineering graduate program, accredited by the Arkansas Department of Higher Education, we must demonstrate that our graduates do, in fact, have these abilities and knowledge upon graduation.

In the spaces provided, please indicate on the scantron form, how you feel the listed outcomes were addressed in this course and how the course helped you to acquire the ability or knowledge indicated in the outcome.

- A **not addressed** in this course
- B **not improved** after taking this course
- C **slightly improved** after taking this course
- D **improved** after taking this course
- E **significantly improved** after taking this course
- F **greatly improved** after taking this course

On the scantron, in the section for name, please DO NOT list your name. Instead, put in ELEG, and in the Identification section, put in the course number. DO NOT put any information in the birthdate section or the special codes section.

- (1) Ability to apply knowledge of engineering, science, and mathematics to analyze and solve advanced electrical engineering problems.
- (2) Ability to locate literature relevant to a specific topic, understand and evaluate it, and apply the information.
- (3) Ability to conduct independent study, such as research or a design project, and to make effective use of the tools available for those studies.
- (4) Ability to have an in-depth knowledge of some specialty area within electrical engineering.
- (5) Ability to communicate effectively using both oral and written presentations.
- (6) Ability to understand the need for continued learning and professional development, and the ability to understand the need to maintain awareness of

current professional issues.

- (7) Ability to have an appreciation of the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and is committed to ethical conduct in all areas.

ELECTRICAL ENGINEERING OUTCOMES ASSESSMENT FORM

Course #: **ELEG ******

Semester: _____

The Electrical Engineering Faculty has adopted the following list of abilities and knowledge expected of our MSEE and PhD graduates. These are referred to as “program outcomes”. In order to maintain our status as an electrical engineering graduate program, accredited by the Arkansas Department of Higher Education, we must demonstrate that our graduates do, in fact, have these abilities and knowledge upon graduation.

In the spaces provided, please indicate which of the outcomes were addressed in this course and how the course helped you to acquire the ability or knowledge indicated in the outcome.

- NA **not addressed** in this course
- 1 **not improved** after taking this course
- 2 **slightly improved** after taking this course
- 3 **improved** after taking this course
- 4 **significantly improved** after taking this course
- 5 **greatly improved** after taking this course

In the spaces provided under each outcome, please write down the instrument used to evaluate the outcome (for example, problem #3 of the “Fourier series,” homework assignment, or exam covering “induction machine”). In addition, provide the grade distributions for the particular instrument used to evaluate that outcome (for example, students’ grades for the “Fourier series” assignments were distributed as follows: 30% between 100% and 90%, 40% between 89% and 80%, and 30% between 78% and 70%.)

| | | NA | 1 | 2 | 3 | 4 | 5 |
|--|---|----|---|---|---|---|---|
| <p>(1) Ability to apply knowledge of engineering, science, and mathematics to analyze and solve advanced electrical engineering problems.</p> <hr style="border: 0; border-top: 1px solid black; margin: 10px 0;"/> <p>100-90 <60 <input style="width: 40px; height: 20px;" type="text"/> 89-80 <input style="width: 40px; height: 20px;" type="text"/> 79-70 <input style="width: 40px; height: 20px;" type="text"/> 69-60 <input style="width: 40px; height: 20px;" type="text"/></p> | <p style="margin: 0;">○ ○ ○ ○ ○ ○</p> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 5px auto;"></div> | | | | | | |
| <p>(2) Ability to locate literature relevant to a specific topic, understand and evaluate it, and apply the information.</p> <hr style="border: 0; border-top: 1px solid black; margin: 10px 0;"/> <p>100-90 <60 <input style="width: 40px; height: 20px;" type="text"/> 89-80 <input style="width: 40px; height: 20px;" type="text"/> 79-70 <input style="width: 40px; height: 20px;" type="text"/> 69-60 <input style="width: 40px; height: 20px;" type="text"/></p> | <p style="margin: 0;">○ ○ ○ ○ ○ ○</p> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 5px auto;"></div> | | | | | | |
| <p>(3) Ability to conduct independent study, such as research or a design project, and to make effective use of the tools available for those studies.</p> <hr style="border: 0; border-top: 1px solid black; margin: 10px 0;"/> | <p style="margin: 0;">○ ○ ○ ○ ○ ○</p> | | | | | | |

100-90 89-80 79-70 69-60
<60

- (4) Ability to have an in-depth knowledge of some specialty area within electrical engineering.

100-90 89-80 79-70 69-60 ○ ○ ○ ○
<60

- (5) Ability to communicate effectively using both oral and written presentations.

100-90 89-80 79-70 69-60 ○ ○ ○ ○
<60

- (6) Ability to understand the need for continued learning and professional development, and the ability to understand the need to maintain awareness of current professional issues.

100-90 89-80 79-70 69-60 ○ ○ ○ ○
<60

- (7) Ability to have an appreciation of the importance of professional responsibility to society in such areas as the environment, social issues, and safety, and is committed to ethical conduct in all areas.

100-90 89-80 79-70 69-60 ○ ○ ○ ○
<60

APPENDIX B

Final Comprehensive Exam/Thesis/Dissertation Evaluation

| Assessment of Abilities | | | | | | |
|---|--|---|----------|----------|----------|---------|
| Master of Science in Electrical Engineering (MSEE) | | | | | | |
| Thesis Option | | | | | | |
| Student | | Student ID | | Semester | | |
| Graduate Committee | | Chair/Advisor | | | | |
| | | Member 1 | | | | |
| | | Member 2 | | | | |
| | | Member 3 | | | | |
| OUTCOMES | | | | | | |
| Apply knowledge of engineering, science, and mathematics to analyze and solve advanced electrical engineering problems | | Assessment of Abilities Score (1-5 Scale) | | | | |
| | | Chair | Member 1 | Member 2 | Member 3 | Average |
| | | | | | | |
| Comments | | | | | | |
| Locate literature relevant to a specific topic, understand and evaluate it, and apply the | | Assessment of Abilities Score (1-5 Scale) | | | | |
| | | Chair | Member 1 | Member 2 | Member 3 | Average |
| | | | | | | |
| Comments | | | | | | |
| Conduct independent study, such as research or a design project, and make effective use of the tools available for those studies. | | Assessment of Abilities Score (1-5 Scale) | | | | |
| | | Chair | Member 1 | Member 2 | Member 3 | Average |
| | | | | | | |
| Comments | | | | | | |
| Have an in-depth knowledge of some specialty area within electrical engineering. | | Assessment of Abilities Score (1-5 Scale) | | | | |
| | | Chair | Member 1 | Member 2 | Member 3 | Average |
| | | | | | | |
| Comments | | | | | | |
| Communicate effectively using both oral and written presentations | | Assessment of Abilities Score (1-5 Scale) | | | | |
| | | Chair | Member 1 | Member 2 | Member 3 | Average |
| | | | | | | |
| Comments | | | | | | |

APPENDIX C

Form for Assessment of Students Abilities

Questions to Ask Grad Students at Graduate Exit Interviews

(Schedule the Interview *after* the Defense)

1. What do you think are the main strengths of our graduate program?
2. What are the main weaknesses of our graduate program (especially of its structure)?
3. Can you think of any very specific strengths or weaknesses?
4. What could we do to make our graduate program better?
5. How did you first hear about the University of Arkansas?
6. What did people say about it? Be honest & complete!
7. What could we do to recruit more students like you?

Continued Learning Questions for Graduate Student Exit Interviews

1. As time passes, things learned in engineering become obsolete. Think about vacuum tubes, DTL logic, etc. How many years do you think it will be until half of the stuff you learned in graduate school is no longer very useful because of being obsolete?
2. Before this happens, what will you need to do to stay on top of new information/technology?
3. Describe the things likely to happen in your career if you don't learn very much after you graduate. Be as specific as possible.
4. What are good ways of learning new technical material after you have left college?
5. What are some current professional issues in your research specialty? (widely discussed and/or hotly debated topics)
6. Will it be important to stay aware of current professional issues after you leave school? Why? Be specific.

Professional Responsibility to Society

1. Is it important to society for engineers to try to protect the environment? What difference will it make?
2. What are some ways in which engineers can improve the environment?
3. What are some examples of engineering decisions that harmed the environment?
4. Suppose your employer plans to dump toxic waste. As an engineer who knows about it, are you responsible to report him? Would you do it if you knew it would cost your job?
5. How important is it to society for engineers to go the extra mile to protect consumers & the public from hazards? Is it reasonable to rely on owners, managers & the government to look out for safety? Why or why not?
6. What are some examples of hazards that engineers should help protect the public from?
7. If you know about a hazard, but don't do anything about it because your boss refuses and it might cost you your job, are you responsible for the harm done to people?
8. What are some social issues that an electrical engineer might be involved in professionally?
9. Are engineers involved in issues of fair employment? (race, gender, etc.)
10. Should engineers be involved in issues like patent or copyright reform? Why or why not?
11. Do engineers make decisions that impact online privacy? Are they morally responsible for those decisions?