Academic Assessment Plan

Department of Electrical Engineering

June 2015

Program Goals

The program educational goals for the EE (undergraduate) program, which leads to a Bachelor of Science degree in Electrical Engineering, are to produce graduates who:

1. *Are recruited in a competitive market and valued as reliable and competent employees by a wide variety of industries, in particular electrical engineering industries,*
2. *Succeed, if pursued, in graduate studies such as engineering, science, law, medicine, business, and other professions,*
3. *Understand the need for life-long learning and continued professional development for a successful and rewarding career, and*
4. *Accept responsibility for leadership roles, in their profession, in their communities, and in the global society.*

The EE program educational objectives are published on the UA Catalog of Studies (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/electricalengineeringeleg/), the Undergraduate Handbook and in two locations on the website of the department (www.eleg.uark.edu); namely, the Undergraduate Handbook and the department mission statement under "What is Electrical Engineering".

Student Learning Outcomes

The **Student Learning Outcomes** are those defined by the ABET Accreditation guidelines. Along these guidelines the learning outcomes adopted by the Department of Electrical Engineering are that when a student graduates they will (at a minimum) have:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a 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.

The courses that address these outcomes are shown in Table 1.

Table 1: Map of EE Program Outcomes to Each Required ELEG Course

Course Number	Course Title	EE Program Outcomes										
		a	B	c	d	e	f	g	h	i	j	k
ELEG 2104	Electric Circuits I	✓		✓		✓					✓	✓
ELEG 2114	Electric Circuits II	✓	✓	✓		✓		✓			✓	✓
ELEG 2904	Digital Systems	✓	✓	✓		✓		✓				✓
ELEG 3124	Systems and Signals	✓	✓	✓		✓						✓
ELEG 3143	Probability & Stoch. Proc.	✓				✓	✓	✓		✓	✓	✓
ELEG 3214	Electronics I	✓	✓	✓		✓	✓	✓		✓		✓
ELEG 3224	Electronics II	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
ELEG 3303	Energy Systems	✓	✓			✓	✓	✓			✓	
ELEG 3704	Electromagnetics	✓	✓	✓		✓	✓			✓		✓
ELEG 3924	Micro. System Design		✓	✓		✓						✓
ELEG 4063	EE Senior Design I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ELEG 4071	EE Senior Design II	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

Process for Assessing Student Learning Outcomes:

The assessment process, the expected levels of attainment of the EE program outcomes, summaries of the assessed data and their assessments, and the control of the produced documentation are presented in this section.

Assessment Process

The assessment process for the EE program outcomes consists of three stages as given in Table 4.1; namely, *(i)* Data collection, *(ii)* Data assessment, and *(iii)* EE Program changes when deemed necessary (i.e., future actions). These are briefly described below:

(i) Data Collection

This stage is divided into tools, frequency and responsibility. The used tools are: (a) Evaluation of Students' Ability and/or Knowledge of Program Outcomes by the Students, (b) Evaluation of Students' Ability and/or Knowledge of Program Outcomes by Instructors, (c) Senior Exit Interviews (SEIs), and (d) the Engineering Exit Assessment and Engineering Alumni Assessment

reports from Educational Benchmarking Inc. (EBI). Appendix E provides samples of the forms used for items (a) and (c); the form used for item (b) is similar to the one used for item (a) but completed by the instructor of the course.

Assessment frequencies: Data under (a), (b) and (c) are collected every semester, and data under (d) annually. The Associate/Assistant Department Head is responsible for items (a), (b) and (d), and the Department Head is responsible for item (c).

(ii) Data Assessment

The ELEG Undergraduate Curriculum Committee (UGCC) evaluates the collected data for a particular academic year (i.e., fall and spring semesters) and presents the results for review to the ELEG faculty at one of the meetings that normally takes place during the following academic year. At this meeting, the UGCC may also present suggestions for changes based on the evaluated data.

(iii) EE Program Changes

The ELEG faculty evaluates the data submitted by the UGCC at an ELEG faculty meeting. Any EE program change made by the ELEG faculty becomes effective the following fall semester when they are published in the UA Catalog of Studies after gaining all necessary approvals as mandated by UA procedures.

Expected Levels of Attainment of the EE Program Outcomes

Table 2 identifies collection tools, and Table 3 indicates the associated metrics, and Table 4 provides additional metrics for each specific EE program outcome.

With respect to the forms completed by the students and instructors, the normal scale for evaluating a particular EE program outcome varies from “1 being the worst” to “5 being the best”. A particular EE program outcome is satisfied when the student and instructor evaluations of students’ ability and/or knowledge have average values of 3.0 or higher. The average value and standard deviation over several years are calculated to establish trends. The multiple-year average value enables to determine if a number below 3.0 in a particular semester is an indication of a deficiency in the EE program that requires program changes or an issue that may need closer monitoring by the UGCC and ELEG faculty before enacting any program change to avoid unnecessary changes.

Table 2: Tool, frequency and responsibility for the different stages of the EE program outcome assessment process

EE Program Outcome Assessment Timetable							
	Data Collection			Data Assessment		EE Program Changes	
Program Outcome	**Tool**	**Frequency**	**Responsi-bility**	**Frequency**	**Responsi-bility**	**Frequency**	**Responsi-bility**
(a) through (k)	Evaluation of students' ability and/or knowledge of program outcomes by students	Semester	Associate or Assistant Department Head	Annually	UGCC Committee	Bi-annually	ELEG Faculty
	Evaluation of students' ability and/or knowledge of program outcomes by instructors	Semester	Associate or Assistant Department Head	Annually	UGCC Committee	Bi-annually	ELEG Faculty
	Senior Exit Interviews (SEI)	Semester	Department Head	Annually	UGCC Committee	Bi-annually	ELEG Faculty

Table 3: Metrics for assessing the EE program outcomes

EE Program Outcomes Assessment Metric Table		
Program Outcome	**Tool**	**Metrics**
(a) an ability to apply knowledge of mathematics, science, and engineering (b) an ability to design and conduct experiments, as well as to analyze and interpret data (c) an ability to design a 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 multi-disciplinary 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 (this specifically includes PSPICE and MATLAB)	Evaluation of students' ability and/or knowledge of program outcomes by students	An average of 3.0 or greater (scale of 1 to 5) for each program outcome covered in the course
	Evaluation of students' ability and/or knowledge of program outcomes by instructors	An average of 3.0 or greater (scale of 1 to 5) for each program outcome covered in the course

Table 4: EE program outcomes versus assessment measurements

Program Outcomes	Measurements
(a) an ability to apply knowledge of mathematics, science, and engineering	*A passing grade on all courses required for the BSEE with a cumulative grade point average of 2.00/4.00 or better (see note 1).*
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	*All students are required to design and conduct an experiment(s) in the required courses of ELEG 2904-Digital Design and/or ELEG 3214-ElectronicsII. The experiment will include the taking, analyzing, and interpretation of data. Students must receive a score of 60% or better to satisfy this outcome.*
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	*All students are required to design a system, component, or process to meet specified desired needs and considering realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) in the required courses of ELEG 2214 – Electric Circuits II, ELEG 3224 - Electronics II, ELEG 3704 – Applied Electromagnetics and ELEG 4073 – Electrical Engineering Design II. Students must receive a score of 60% or better on their design to satisfy this outcome.*
(d) an ability to function on multi-disciplinary teams	*All students work as a part of a team in the required senior level EE design courses. Team projects are chosen to involve at least two disciplines. Each student's ability to function satisfactory is graded periodically throughout the courses by the instructor and by the other members of the team. The ability to function satisfactory as a member of the team is a requirement for passing the courses. Passing the courses satisfy this outcome.*
(e) an ability to identify, formulate, and solve engineering problems	*A passing grade on all engineering courses required for the B.S.E.E. with a cumulative grade point average of 2.00/4.00 or better is required to satisfy this outcome (see Note 1).*
(f) an understanding of professional and ethical responsibility	*A Senior Exit Interview (SEI) is required for all senior students as a requirement for graduation. All students will be tested for this understanding as a part of the SEI and 70% of the responses should be classified as satisfactory. The UGCC will develop corrective measurements when the percentage of "not satisfactory" is greater than 30%.*
(g) an ability to communicate effectively	*All students are required to participate in both a written and oral reports on their design projects in the required senior EE design courses. A student must receive a passing grade of 60% or better on all three scores to satisfy this outcome.*
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic,	*A Senior Exit Interview (SEI) is required for all senior students as a requirement for graduation. All students will be tested for this understanding as a part of the SEI and 70% of the responses should be classified as satisfactory. The UGCC will develop corrective measurements when the percentage of "not satisfactory" is greater than 30%.*

environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	*A Senior Exit Interview (SEI) is required for all senior students as a requirement for graduation. All students will be tested for this understanding as a part of the SEI and 70% of the responses should be classified as satisfactory. The UGCC will develop corrective measurements when the percentage of "not satisfactory" is greater than 30%.*
(j) a knowledge of contemporary issues	*A Senior Exit Interview (SEI) is required for all senior students as a requirement for graduation. All students will be tested for this understanding as a part of the SEI and 70% of the responses should be classified as satisfactory. The UGCC will develop corrective measurements when the percentage of "not satisfactory" is greater than 30%.*
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	*All students are required to master the basic skills and techniques of the oscilloscope, C++ programming, PSPICE, and MATLAB. The requirements for demonstrating the techniques and skills of these tools are embedded in the requirements for passing the courses required for the B.S.E.E. degree. A cumulative grade average of 2:00/4:00 or better on the required ELEG courses is required to satisfy this outcome (see Note 1).*

Note 1: Students must have a "C" average (2.0 GPA) on all electrical engineering courses, engineering courses and university courses to be able to graduate with a BSEE. In addition, no more that 15% of the courses presented for the B.S.E.E. degree can have a "D" grade.

Summarized Results from the Assessment Stage

Summaries of the evaluations of the collected data up to spring 2013 are given below.

EE Program Outcome Assessments by Students

Towards the end of each semester, ELEG students enrolled in ELEG required courses (and the instructors) complete a form for each particular course having the EE Program Outcomes indicated in Table 1. Students are asked to indicate whether those outcomes were addressed in the course and how the course helped them to acquire the ability or knowledge indicated in the outcome using the following scale:

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

Figure 1 shows the averages of all EE program outcomes using the inputs from all surveyed ELEG students from fall 2007 (leftmost bar) to spring 2013 (rightmost bar). An analysis of the student data yielded the following:

(1) All averages are above 3.0 for all EE program outcomes satisfying the metrics in Table 3.

(2) EE program outcomes (f), (g) and (j) are below their respective "total averages" within only one standard deviation.

(3) There is no EE program outcome below its respective "total average" by more than one standard deviation.

(4) EE program outcomes (b), (c) and (d) are above their respective "total averages" by more than one standard deviation.

(5) EE program outcomes (a), (e), (h), (i) and (k) are above their respective "total averages" within only one standard deviation.

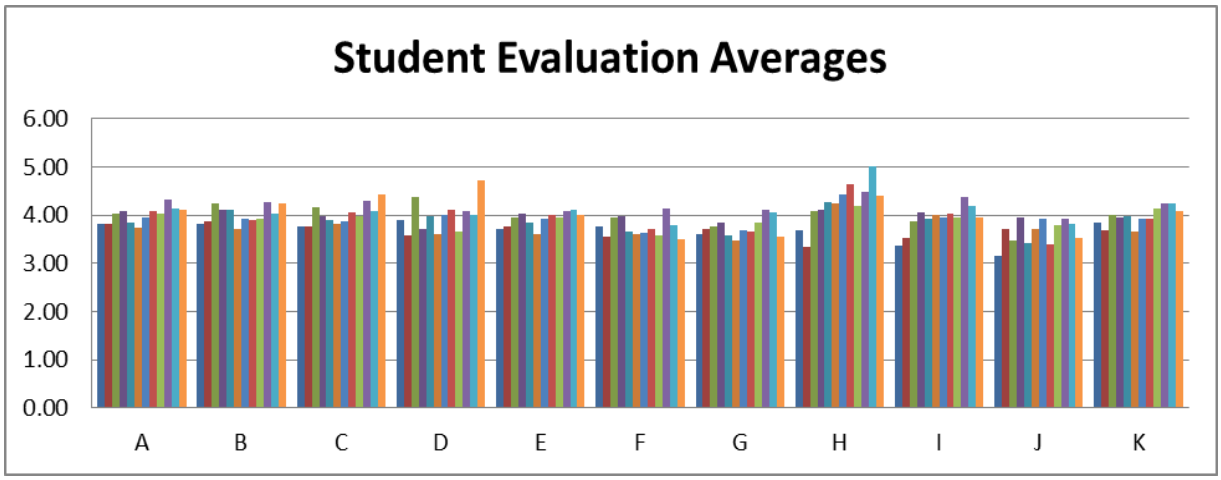

Figure 1 Averages of the EE program outcomes from the student evaluations from fall 2007 to spring 2013.

The average values for spring 2013 (Sp13), the running averages from fall 2007 to spring 2013 (RunAvg) and standard deviations (StDev) are given in Table 5.

Table 5: Student assessment summary: Spring 2013 data, as well as running averages and standard deviations from fall 2007 to spring 2013

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Sp13	4.12	4.25	4.42	4.71	4.00	3.50	3.54	4.39	3.96	3.51	4.08
RunAvg	3.99	3.98	3.98	3.94	3.90	3.71	3.70	4.22	3.90	3.62	3.94
StDev	0.17	0.23	0.22	0.34	0.16	0.21	0.22	0.42	0.28	0.26	0.21

EE Program Outcome Assessments by Faculty

Likewise, Figure 2 displays the averages of all EE program outcomes using all the inputs from all surveyed instructors from fall 2007 (leftmost bar) to spring 2013 (rightmost bar). An analysis of the faculty data yielded the following:

(1) All EE program outcomes have their respective "total averages" above 3.0; the metric set in Table 3.

(2) EE program outcome (j) is above 3.0 but below its respective "total average" within one standard deviation.

(3) There is no EE program outcome below its respective "total average" by more than one standard deviation.

(4) EE program outcomes (c), (e) and (k) are above their respective "total averages" by more than one standard deviation.

(5) EE program outcomes (a), (b), (d), (f), (g), (h) and (i) are above their respective "total averages" within one standard deviation.

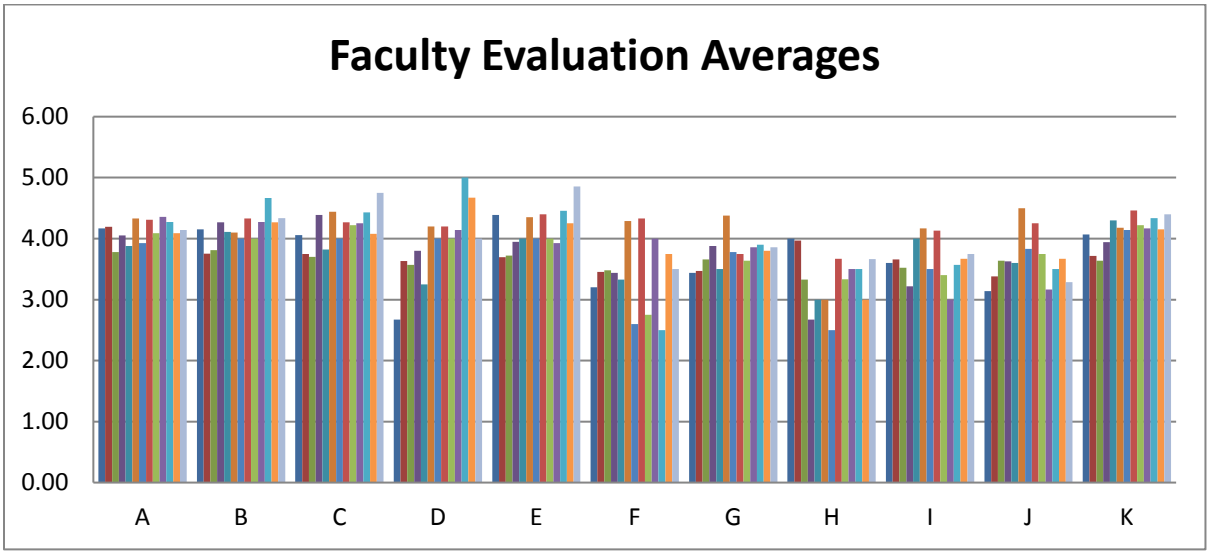

Figure 2 Averages of the EE program outcomes from the faculty evaluations from fall 2007 to spring 2013.

The average values for spring 2013 (Sp13), the running averages from fall 2007 to spring 2013 (RunAvg) and standard deviations (StDev) are given in Table 6.

Table 6: Student assessment summary: Spring 2013 data, as well as running averages and standard deviations from fall 2007 to spring 2013

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Sp13	4.12	4.13	4.12	3.86	4.08	3.40	3.75	3.32	3.62	3.67	4.11
RunAvg	4.12	4.14	4.12	3.92	4.09	3.42	3.75	3.29	3.62	3.67	4.11
StDev	0.18	0.24	0.25	0.59	0.25	0.58	0.24	0.45	0.33	0.38	0.23

Senior Exit Interviews

All graduating seniors complete the SEI questionnaire, even that completion is not a requirement for graduation; the departmental executive secretary works diligently with all graduating seniors so everyone completes the questionnaire. A score of 1 is the lowest and a score of 5 is the highest.

Thirty (30) senior students graduated in the spring 2013; an analysis of their responses to the SEI questions yielded the following:

(1) The averages for the first set of questions (see Appendix E) were above 3.0 with the lowest being 3.57 for "I am satisfied with the advising I received regarding my future career pursuing a graduate degree or obtaining a professional job".

(2) The averages for the question "Please rate yourself on your ability to use the following engineering tools: programmable calculator, personal computer, internet use/search, C/C++, library/literature search, oscilloscope, digital multi-meter, function generator, PSpice or Saber, Matlab" are above 4.0 with the exception of "library/literature search" and "C/C++" which are at 3.7 and 3.83, respectively.

(3) The averages for the question "Of the following tools (programmable calculator, personal computer, internet use/search, C/C++, library/literature search, oscilloscope, digital multi-meter, function generator, PSpice or Saber, Matlab), which would you have wanted to receive more education/experience" (here, 5 being least instruction, and 1 being more) are above 3.0 with the exception of "function generator", "PSpice or Saber" and "Matlab" which are at 2.97, 2.93 and 2.87, respectively.

(4) 70% of the students responded correctly to "What is the main purpose of a code of ethics like IEEE Code of Ethics or the COE Code of Ethics?"

(5) 93% of the students responded correctly to "What would your reaction be if confronted with an ethical issue not addressed in the code of ethics"?

(6) All students responded correctly to "Designing a product for sale outside the US: Do you think that you and your team members need to learn about the cultures of the country?"

(7) 87% of the students responded correctly to "Please, identify three opportunities for life-long learning".

The averages for the first set of questions in the senior exit interview form from fall 2008 to fall 2013 are given in Figure 3 (see Appendix for a sample form); all averages are above 3.0.

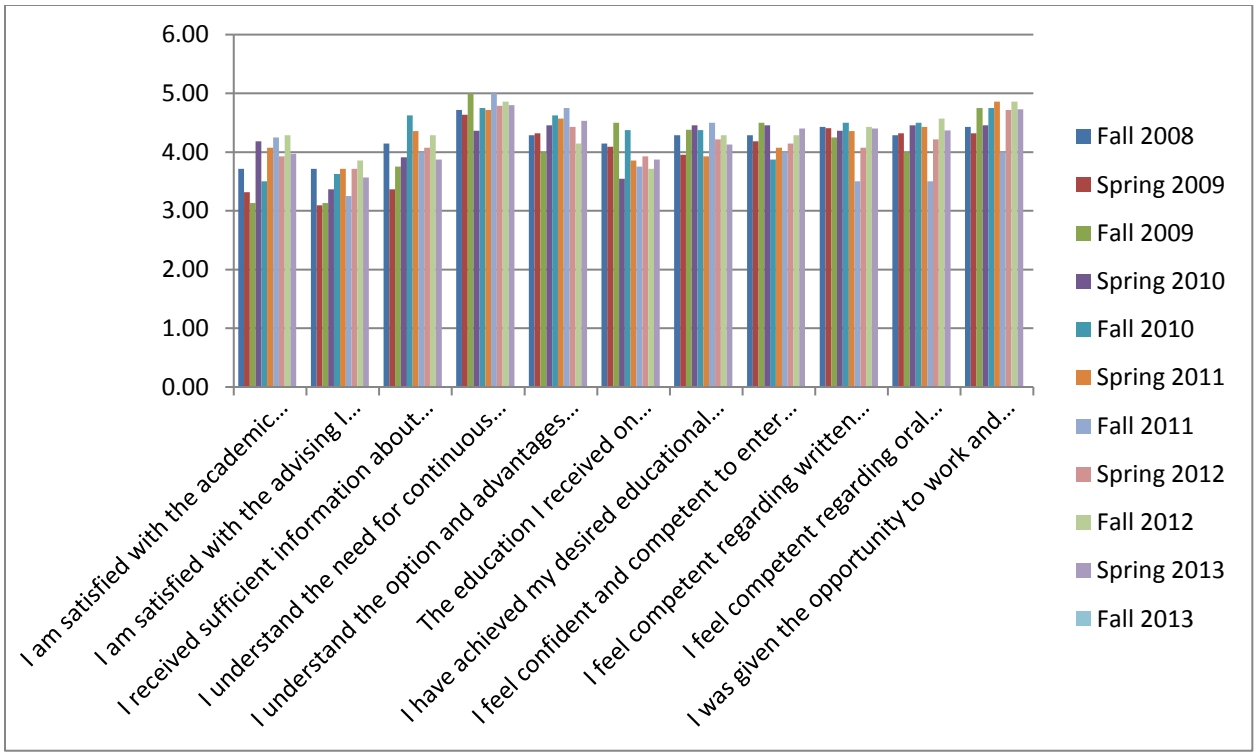

Figure 3 Averages for the first set of questions on the senior exit interviews from fall 2008 to fall 2013.

Appendix

Senior Exit Interview Form

University of Arkansas

Department of Electrical Engineering

Senior Exit interview Document

Congratulations on your academic achievements in Electrical Engineering! As part of our effort to continuously improve our educational process we would very much appreciate your thoughtful input based on your personal experience while pursuing the BSEE degree at the University of Arkansas. Your responses will be reviewed along with those of other graduating seniors to determine areas where changes may need to be made.

Please answer the following questions with 1 being "least" and 5 being "best":

1. I am satisfied with the academic advising I received while pursuing my BSEE degree.

○1 ○2 ○3 ○4 ○5

2. I am satisfied with the advising I received regarding my future career pursuing a graduate degree or obtaining a professional job.

○1 ○2 ○3 ○4 ○5

3. I received sufficient information about the opportunities concerning Co-op (internship).

○1 ○2 ○3 ○4 ○5

4. I understand the need for continuous life-long learning in order to stay professionally competent.

○1 ○2 ○3 ○4 ○5

5. I understand the option and advantages of earning a graduate degree.

○1 ○2 ○3 ○4 ○5

6. The education I received on professional ethical issues has prepared me to address potential ethical questions and to resolve conflicts that may arise at the start of my professional career.

○1 ○2 ○3 ○4 ○5

7. I have achieved my desired educational goals through the BSEE level and received a strong foundation in electrical engineering principles.

○1 ○2 ○3 ○4 ○5

8. I feel confident and competent to enter the electrical engineering profession or to pursue a graduate degree.

○1 ○2 ○3 ○4 ○5

9. I feel competent regarding written communication skills.

o1 o 2 o 3 o 4 o 5

10. I feel competent regarding oral communication skills.

o1 o 2 o 3 o 4 o 5

11. I was given the opportunity to work and function in a group environment.

o1 o 2 o 3 o 4 o 5

12. Please rate yourself on your ability to use the following engineering tools:

a. programmable calculator	o1	o 2	o 3	o 4	o 5
b. personal computer	o1	o 2	o 3	o 4	o 5
c. internet use/search	o1	o 2	o 3	o 4	o 5
d. C/C++	o1	o 2	o 3	o 4	o 5
e. Library/Literature Search	o1	o 2	o 3	o 4	o 5
f. oscilloscope	o1	o 2	o 3	o 4	o 5
g. Digital multi-meter	o1	o 2	o 3	o 4	o 5
h. Function Generator	o1	o 2	o 3	o 4	o 5
i. PSPICE or Saber	o1	o 2	o 3	o 4	o 5
j. MATLAB	o1	o 2	o 3	o 4	o 5

13. Of the following tools, which would you have wanted to receive more education/experience during your undergraduate program? (5 being “least” education/experience and 1 being “more” education/experience.)

a. programmable calculator	o1	o 2	o 3	o 4	o 5
b. personal computer	o1	o 2	o 3	o 4	o 5
c. internet use/search	o1	o 2	o 3	o 4	o 5
d. C/C++	o1	o 2	o 3	o 4	o 5
e. Library/Literature Search	o1	o 2	o 3	o 4	o 5
f. oscilloscope	o1	o 2	o 3	o 4	o 5
g. Digital multi-meter	o1	o 2	o 3	o 4	o 5
h. Function Generator	o1	o 2	o 3	o 4	o 5
i. PSPICE or Saber	o1	o 2	o 3	o 4	o 5

j. MATLAB ○1 ○ 2 ○ 3 ○ 4 ○ 5

Please answer the following additional questions:

14. What influenced you to study engineering?

    _____

    _____

15. Why did you choose to study at the University of Arkansas, Fayetteville?

    _____

    _____

16. If you were beginning your college education today, what would you do differently?

    _____

    _____

17. While in school how many hours per week did you work in order to support yourself?

    ○ none ○ 1-5 ○ 5-10 ○ 10-15 ○ 15-20 ○ more than 20

18. What is your cumulative GPA?

    ○ 2.0 - 2.5 ○ 2.5 - 3.0 ○ 3.0 – 3.5 ○ 3.5 – 4.0

19. What suggestions do you have that would help improve the learning experience in the Department of Electrical Engineering?

    _____

    _____

    _____

20. What is the main purpose of a code of ethics like the IEEE Code of Ethics or the College of Engineering Code of Ethics?

    _____

    _____

21. What would your reaction be if confronted with an ethical issue not addressed in the code of ethics of your professional society?

22. Suppose that you are leading a design team designing a product for sale outside the United States. Do you think that you and your team members need to learn about the cultures of the country in which the product will be sold? Would it be sufficient to just design the product to specifications you were given? Please, justify your answers.

23. Please identify three opportunities for life-long learning that you will have during your professional career.

24. Please explain the value of continuing learning about your profession as you move along your professional career.

25. Please write down three contemporary issues that you feel will be very relevant to future world events and discuss how engineering impacts these issues.

EVALUATION OF OVERALL FACULTY TEACHING PERFORMANCE
BY GRADUATING SENIORS

SEMESTER: _____

Please rate the following faculty members on their overall teaching performance based on your personal experience. If you have not taken at least one three-hour course from a faculty member, **PLEASE DO NOT RATE THAT FACULTY MEMBE**R. Use a rating scale of one (1) for POOR to five (5) for EXCELLENT.

NOTE: Individual student responses on this form are held in strictest confidence.

NAME	(1)	(2)	(3)	(4)	(5)
Ang, Simon	O	O	O	O	O
Balda, Juan	O	O	O	O	O
Brown, Randy	O	O	O	O	O
El-Ghazaly, Samir	O	O	O	O	O
El-Shenawee, Magda	O	O	O	O	O
Manasreh, Omar	O	O	O	O	O
Mantooth, Alan	O	O	O	O	O
Martin, Terry	O	O	O	O	O
McCann, Roy	O	O	O	O	O
Naseem, Hameed	O	O	O	O	O
Overbey, Randle	O	O	O	O	O
Rankin, James	O	O	O	O	O
Saunders, Robert	O	O	O	O	O
Varadan, Vijay	O	O	O	O	O
Wu, Jingxian	O	O	O	O	O
Yang, Jing	O	O	O	O	O
Yu, Shui-Qing	O	O	O	O	O

The following information is requested in order that the department can compile statistics on our graduates and can contact you in case a need arises.

1. Have you accepted a job yet (YES or NO)?

   If YES, please give company name and location:

   _____

   (NAME)

   _____

   (LOCATION)

   Starting salary: _____ per year.

2. If you have not accepted a job at this time, are you planning to attend graduate school (YES or NO)?

   If YES, please give the school name and location:

   _____

   (NAME)

   _____

   (LOCATION)

3. If you have not accepted a job and are not planning to attend graduate school, do you want to be contacted in case companies contact the department looking for electrical engineering graduates (YES or NO)?

   If YES, please provide the following information:

   Address where you can be reached: _____

_____

_____

Phone number where you can be reached: _____

4. If you have not accepted a job yet and are not planning on attending graduate school, is there any way the department can assist you at this time?

NAME: _____