



University of  
West Florida

PROGRAM REVIEW  
EXECUTIVE SUMMARY  
2006 - 2007

Department of Electrical and Computer Engineering  
College of Arts and Sciences

14.0901, Computer Engineering, B.S.E.E.  
14.1001, Electrical Engineering, B.S.E.E.

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# Electrical and Computer Engineering Program Review

## Executive Summary

2006-2007

### Table of Contents

#### Computer Engineering

##### Executive Summary

- Program reviewed 3
- Brief description and nature of re-accreditation review 3
- Directory information on external consultants 3
- Synopsis of prior actions 4
- Academic learning compact 5
- Strengths/Weaknesses/Opportunities/Threats 6
- Recommendations from current review 14

Executed Confirmation of Processes for Academic Program Review 14

#### Electrical Engineering

##### Executive Summary

- Program reviewed 15
- Brief description and nature of re-accreditation review 15
- Directory information on external consultants 15
- Synopsis of prior actions 16
- Academic learning compact 17
- Strengths/Weaknesses/Opportunities/Threats 18
- Recommendations from current review 27

Executed Confirmation of Processes for Academic Program Review 28

## Computer Engineering

14.0901, Computer Engineering, B.S.E.E.

### CONFIRMATION OF PROCESSES FOR ACADEMIC PROGRAM REVIEW

I hereby confirm that the enclosed program review for Computer Engineering has included all processes outlined in Board of Governors requirements:

- **a delineation of the specific academic programs (with levels) that were included in review**

It is a general full general review of the BS program in electrical engineering. We have submitted self-study reports. The ABET team consisted of the following members:

Dr. Richard C. Warder, Jr., PE                      EAC Visit Team Chair Dean, Herff College of Engineering  
The University of Memphis Memphis, TN 38152

Mr. David S. Cochran, PE                      Computer Engineering Senior Engineering Manager  
Program Evaluator Maxtor Corporation 1391 Cuernavaca Circulo Mountain View CA 94040

Dr. Owe Petersen                      Electrical Engineering Professor & Chair                      Program Evaluator  
Electrical Engineering Milwaukee School of Engineering 3565 Tarrytown Rd. Brookfield WI 53005

- **a brief description of the nature of the review and whether it was part of an accreditation review or self-study with external consultant**

The electrical engineering program went through re-accreditation visit from October 18-20, 2006.

- **directory information on the external consultant**

In fall 2005, Dr. Victor Nelson (from Auburn University) reviewed the draft copy of the Self-Study Report for electrical engineering and provided written feedback. He had a conference call on September 16, 2005 with Drs. Cammy Abernathy (UF), Mark Law (UF), Muhammad H. Rashid, Dale Harrell, Mohamed Khabou, and Mohammad Bataineh.

In fall 2005, Dr. James McDonald (from Monmouth University) reviewed the draft copy of the Self-Study Report for computer engineering and provided written feedback. He also had a conference call

on September 23, 2005 with Drs. Cammy Abernathy (UF), Mark Law (UF), Muhammad H. Rashid, Dale Harrell, Mohamed Khabou, and Mohannad Bataineh.

Dr. Ed Jones (from Iowa State) reviewed the draft copy of the Self-Study Reports for both computer engineering and electrical engineering. He had a mock visit on September 28 and 29, 2005. This visit provided feedback on the curriculum, program outcomes, assessments, and the feedback process. The reviewer made a presentation to faculty members who are involved in teaching courses for electrical and computer engineering degrees. The reviewer also met with a group of students and the ECE faculty and shared his recommendations and suggestions to Dean Jane Halonen, Provost Sandra Flake and Director Muhammad Rashid.

• **a synopsis of actions taken as a result of earlier program reviews**

Changes Made To Program Curriculum: The curriculum is subjected to frequent revisions.

STA 4321 - Mathematical Statistics (3 credits) is required for electrical and computer engineering, effective fall 2001

EGM 4313 – Intermediate Engineering Analysis (4 Credits) (Effective Fall 2002) in place of MAP 4403 – Mathematics for Engineers (3 credits)

EGN4034 –Professional Issues is required for electrical and computer engineering, effective fall 2000

EEL 4843 - C++ for Electrical Engineers is required for electrical engineering

Combined the course EEL 3111 (3 credits) and EEL 3303L (1 credit lab) to EEL 3111C in Fall 2002 to follow the UF changes.

Due to problems for multiple sections in different locations and distributing faculty teaching FTE (Full-time-equivalent), the labs are separated for all required courses effective fall 2004. These courses are:

EEL 3701C (4) to EEL 3701 (3) and EEL 3701L (1)

EEL 4744C (4) to EEL 4744 (3) and EEL 4744L (1)

EEL 4712C (4) to EEL 4712 (3) and EEL 4712L (1)

EEL 4713C (4) to EEL 4713 (3) and EEL 4713L (1)

Changes to the Review Process: The review process involves meetings with students, faculty and Council members as well as surveys. It is expected that with the greater constituency involvement, which is now underway, the next round of reviews may produce more changes. The objective review process has resulted in the following issues for which the actions to be taken for improvements.

Issue	Actions to be Taken
Low turn out of the alumni surveys through the postal mails	Conduct web-based alumni and employer surveys, effective fall 2005. After the alumni information is submitted, the alumni will receive an alumni survey form to complete and will be asked to give the employer survey form to his/her supervisor. The results of the surveys will be summarized and submitted to the department annually. The survey form can not be completed by the same alumni within a two year period and the form will be sent automatically to the alumni in every 2 years
Alumni change their jobs and often do not send their updated addresses	Develop web-based updating of the alumni information (effective fall 2005) <a href="http://uwf.edu/ece/alumni/">http://uwf.edu/ece/alumni/</a>
Too many questionnaires	Reduce to the form to one page alumni and employer survey questionnaires
No direct questionnaires to measures program objectives # 3 and # 6	Add a questionnaires on program objectives # 3 and # 6, effective fall 2005
Program objectives should fully match with the ABET's terminology	Review the program objectives, effective Spring 2006.

- **a copy of the Academic Learning Compact for each reviewed baccalaureate degree program.**

### Computer Engineering

The computer engineering curriculum is designed to yield fifteen outcomes which are in consistent with the ABET requirements under Criteria EC-2000. Each upper division course within the curriculum contributes to at least one of these outcomes. A student must demonstrate each outcome achievement in at least two courses to satisfy the graduation requirements.

### Content

- Recognize and apply concepts, principles and theories in the following areas:
  - o mathematics, including differential and integral calculus, differential equations, linear algebra, and complex variables, discrete mathematics
  - o core electrical and computer engineering topics: basic circuit analysis, signals and systems, and electronics, digital logic, and microprocessors
  - o digital design, data structure, operating systems. computer hardware and software,
  - o interaction between hardware and software
  - o discrete mathematics
  - o probability and statistics

Describe the interrelatedness of contemporary issues in a global and society context with computer engineering solutions

## **Critical Thinking**

Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design of computer engineering

Identify, formulate and solve novel computer engineering problems

Design and conduct scientific and electrical and computer engineering experiments including analysis and interpretation of data

## **Communication**

Communicate effectively in writing electrical and computer engineering topics.

Convey technical material through oral presentations of computer engineering topics.

## **Project Management**

Function effectively on multi-disciplinary teams

Deliver computer engineering results that meet performance standards for cost, safety, and quality

## **Integrity/Ethics**

Describe the ethical and professional responsibilities of the computer engineer

Make and defend ethical judgments in keeping with professional standards of computer

engineering

Profess commitment to life-long learning to satisfy the ABET accreditation requirement.

- **a summary of program strengths, weaknesses, opportunities, and threats (SWOTs)**

### Program Strengths

1. Faculty members are well-qualified, engaged in the teaching process, and are committed to achieving the educational mission of the computer engineering program. Communication and cooperation is evident.
2. The program is conscious of the needs of its student constituency, which consists substantially of part-time and working non-traditional students.
3. The student body is enthusiastic about the quality of their education and the ready access to the faculty.

## Program Weaknesses

1. **Criterion 2. Program Educational Objectives** Each engineering program is required to have a place detailed published educational objectives that are consistent with the mission of the institution and the engineering criteria and that are developed in consultation with their constituencies. The program has recently revised its objectives to better align with the intent of the criteria. However, the process does not appear to have included all program constituencies and should be strengthened.

**Response:** We were surprised by this weakness due to the history of involvement that we have with the constituents defined as students, alumni, faculty, and employers. We are appending the track record that verifies the time invested in working with the constituents (see Appendix B). However, feedback during the ABET visit suggests that the time we invested in reviewing the objectives may not have sufficiently addressed the potential concerns of the constituents.

**Corrective Action:** We intend to devote one advisory council meeting per year focused on an accountability report that will include discussions with constituents about whether the program objectives should be revised and any program feedback for improvements. We have conducted following surveys since the last ABET visit in October 2006.

We have added new members in computer engineering and regrouped by the Advisory Council by discipline. There are 11 members with electrical engineering background and eight (8) members with computer engineering background (see Table A-1 of Appendix A).

Please find attached a copy of the letter (Table A-2 of Appendix A) from Mr. Lynn Dell, Chair of the Curriculum and Accreditation Committee explaining how the Advisory Council was involved in the review process.

Engineering Advisory Council Surveys (Fall 2006): The summary of survey results is shown in Table 2-1 and the full summary is included in Table B-1 of Appendix B. The complete surveys can be found at <http://www.uwf.edu/ece/abet/criterion2/>.

- Alumni Surveys (Fall 2006): The summary of survey results (6 responses for electrical engineering and 15 responses for electrical engineering), which was conducted in the 2006 Fall semester, is shown in Table 2-2 and the full summary is included in Table B-2 of Appendix B. The completed alumni surveys can be found at

<http://www.uwf.edu/ece/abet/criterion2/>

Students Surveys (Fall 2006): The summary of survey results (4 responses for electrical engineering and 10 responses for electrical engineering), which was conducted in the 2006 Fall semester to a senior level class (EEL 4712 – Advanced Digital Logic), is shown in Table 2-3 and the full summary is included in Table B-3 of Appendix B. The completed student's surveys can be found at <http://www.uwf.edu/ece/abet/criterion2/>

**Table 2-1: Summary of the Employer and Advisory Council Survey results (conducted in Fall 2006)**

#	Accomplishments of our graduates	Rating				
		Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
1a.	Develop electrical engineering solutions either	3 (75%)				1 (25%)

	individually or through interdisciplinary teams within a global and societal context.					
1b	Develop computer engineering solutions either individually or through interdisciplinary teams and act accordingly within a global and societal context	2 (50%)	1 (25%)			1 (25%)
2.	Professionally and ethically, engage in technical or business activity through engineering ability, communication skills, and knowledge.	4 (100%)				
3.	Continue professional growth through post-graduate education, continuing education, or professional activity.	3 (75%)	1 (25%)			
4.	Contribute to the Northwest Florida regional economic development.	3 (75%)	1 (25%)			

**Table 2-2: Summary of the alumni survey results (conducted in Fall 2006)**

#	Accomplishments of our educational objectives	Rating					Total
		Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable	
1a.	Develop electrical engineering solutions either individually or through interdisciplinary teams within a global and societal context.	14(67%)	7(33%)				
1b	Develop computer engineering solutions either individually or through interdisciplinary teams and act accordingly within a global and societal context.	7(33%)	6(29%)			7(33%)	
2.	Professionally and ethically, engage in technical or business activity through engineering ability, communication skills, and knowledge.	13(62%)	8(38%)				
3.	Continue professional growth through postgraduate education, continuing education, or professional activity.	12(57%)	6(29%)	2(9%)		1(5%)	
4.	Contribute to the Northwest Florida regional economic development.	4(19%)	15(71%)			1(5%)	

2. **Criterion 3. Program Outcomes and Assessment** This criterion requires that a program demonstrate students have demonstrated an ability to design and conduct experiments. Although the program provided evidence of students' abilities to design a system, component or process, examples of student work did not include evidence of the ability to design an experiment.

**Response:** In reviewing our syllabi, we recognize that we did not use "design and conduct

experiments" as a formal objective in the seven labs that operate in our curriculum. Six lab experiences are required in the curriculum, and in each course, students must design and conduct experiments.

**Corrective Action:** We have revised the course syllabi to make the desirable outcome more salient. The syllabi for these courses were modified to include even more design and conduct of experiments (see <http://www.uwf.edu/ece/abet/syllabi/>). The following are examples from different courses of how students are involved in the design of experiments.

- *EEL 3701L – Digital Logic Design Laboratory (effective Fall 2006):* Students design their circuits on paper, and then simulate them in Logic Works. Students must on their own develop test vectors to simulate their circuits and ensure that they meet the specifications. Students are also asked to build their circuits and design a testing strategy to test them in hardware. For example, in lab #4 students are asked to design a circuit in different ways and to decide which design is better given certain factors (e.g. propagation delay, number of chips used, etc.). In labs #8 and #9, students are asked to use a 555 timer to supply a clock to a sequential circuit. They are given data sheets and they are asked to find equations to calculate the resistance/capacitance values required to develop a signal with the proper frequency to meet the lab specifications. The students must then devise a test circuit, test the calculated values to see how close they are to the required frequency, and then tweak the resistances until they arrive at the required frequency. Again, they are not given values of resistors; they must experiment with their circuits until they find the right value. They are also asked about the impact on the frequency of raising and lowering the resistor values, and asked to test their hypotheses. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

- *EEL 4304L - Electronics I Laboratory (effective Spring 2007):* There are several labs that require students to design and conduct experiments. For example, in lab #1 on Operational Amplifier-Based Integrators, students have to design the amplifier to satisfy given specifications. Students are responsible for developing a testing plan to make sure the amplifier works as designed. This includes constructing, testing and verifying that their designs work as expected. Also, in lab # 7 on Bipolar Transistor Biasing and Small Signal Behavior, students are required to design a bias circuit such that it is insensitive to change in the  $\beta$  value of the transistor. Students are required "to devise a procedure to extract the value of  $\alpha$ , and  $\beta$  parameters of the transistor." Students have to build the circuit in the lab, collect data to test, verify and compare results with the prelab design and simulation. This procedure includes validating the bias and measuring the small signal performance. See samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>

- *EEL 4306L - Electronics II Laboratory (effective Spring 2007):* Students are given two types of laboratory experiments. In the first experiment type (labs #1, 2, 5, 6, & 7), the data that is to be collected is outlined and the students determine how to build and test circuits in order to obtain the data and compare it to the theoretical calculations performed prior to the lab. For the second type of lab experiments (labs #2, 4, 8, & 9), students are given a set of design specifications. It is up to the students to design and test the circuit and demonstrate that it meets the design specifications. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

- *EEL 4514L – Communication Systems Laboratory (effective Fall 2006):* In this lab course (labs #3 to 9), students are given a procedure that must be followed and questions that must be answered. It is up to the student how to best build the needed components and obtain the experimental data that will be compared to the theoretical pre-lab data. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

*EEL 4657L - Control Systems Laboratory (effective Spring 2007)*: Students take a final exam that requires them to demonstrate how an experiment for the feedback control loop of a DC motor shaft position is to be set up, how measurements are to be taken, and how to interpret the measured data. (See samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>)

*EEL 4712L – Advanced Digital Laboratory (effective Fall 2006)*: Students are required to design, simulate, build, and test several systems. For example, in lab #6 (Bus Structure Design) students design, simulate and test a bus structure containing a number of registers and an external data bus. Students have to design their system so that there is no bus contention. The design is broken down into components that have to be individually designed and simulated using Quartus. The students connect the different components and simulate the operation of the bus structure. In the lab students download their design to their CPLD and design a hardware testing strategy for their system (see lab #6 assignment at <http://www.uwf.edu/mkhabou/EEL4712C/labs/F06-lab6.htm>). In lab #8 (CPLD-Controlled Stepper Motor) students design, simulate, build, and test a control system for a stepper motor. Students have to (1) design and build a motor driver circuit to supply enough power to the motor, (2) design and simulate the VHDL code (using Quartus II software) to program the control unit of the system on a CPLD, and (3) design and build a gear assembly to achieve a precision equal or better than 1°/step. Students are required to test their design in the lab to assure the proper operation of their system and its required precision (see lab #8 assignment at <http://www.uwf.edu/mkhabou/EEL4712C/labs/F06-lab8.htm>)

- *EEL 4744L – Microprocessor and Applications Laboratory (effective Fall 2006)*: Students are required to make a series of design steps. The idea is to require the student to come up with a design methodology that will meet the goals. In the process, the student must design and test several subsystems before putting them all together for the final demonstration. The following are details for two experiments that demonstrate that approach (see samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>):

- In Lab #5, the students are required to figure a way to send characters from a keypad attached to the microprocessor evaluation board to an LCD also attached to the board. The students must take the following logical steps to design the experiment:

- Figure out how to map the keys of a standard keypad to alphabetical characters of their choice;

- Figure out how to connect the decoder/multiplexer combination that is used for driving the keypad to the microprocessor's ports;

- Write an assembly language program that correctly addresses the hardware that the student designed and accomplish the function of moving characters from the source (keypad) to the destination (LCD).

- In Lab #8, the students learn how to design their own interrupt handling mechanism. The steps taken are:

- Design the analog circuitry that interfaces signals from one or more transducers to one or more of the digital inputs that trigger interrupts to the microprocessor;

- Design a systematic flowchart that allows for masking/unmasking interrupts, depending on the outcome of other operations that the microprocessor is performing;

- Write software for serving the interrupts, based on priority criteria that the student must determine and explain in his/her report;

- Include the interrupt-service routines in a larger software program that deals with I/O devices, such as the computer's screen.

*EEL 4914C – Senior Design Project (effective Fall 2006): In this course, a considerable amount of time is devoted to validation and testing plans answering questions such as: what test equipment is needed and when, what standards or protocols apply, and what determines a successful design outcome. These issues are addressed during the weekly or bi-weekly team meeting with the faculty mentor and also during the Preliminary and Critical Design Reviews. Experimental validation and demonstration of a prototype is required. Effective Fall 2006, students are required to describe their design testing approach/methodology in a separate section in their final report (see Section 7 in the revised Senior Design Handbook at <http://ece.uwf.edu/abet/criterion4/F06-Handbook-revised.pdf>). Also, as part of our continuing improvement process, we have determined that there is often not enough time to explore these topics in one semester course. This is an area that will be developed further in our new “design” course sequence: EGN 4xx1 (Capstone Design I) and EGN 4xx2 (Capstone Design II). Beginning in the fall semester of 2008, students who sign up for the two-part senior design course will be required to take the FE exam in the spring semester (they are not required to pass , though) as a requirement in order to pass the second part of the senior design course. Students registering for EGN 4xx1 in fall 2007 will be strongly encouraged to register for FE Exam in fall 2007 and take the FE exam in spring 2008.*

3. **Criterion 4. Professional Component** This criterion requires a major design experience in the latter part of the program that incorporates consideration of multiple realistic constraints and appropriate engineering standards. Although some senior design projects included engineering standards, the program did not demonstrate a systematic inclusion of standards in the design process.

**Response:** Faculty members convey standards in the major design experience, but we have not made a point to make the standards explicit. Reviewing the existing projects produces evidence that the following standards were incorporated into projects.

- RS232 standard applies to any design that uses serial communication
- Wireless communication standard applies to any system that uses any kind of telemetry
- TCP/IP protocol applies to many projects that use the web
- Jtag standard applies to many projects that use programmable logic
- IEEE standards on power/energy distribution

Please find attached the analysis (revised on October 28, 2006) of the Major Design Experience Information for Electrical and Computer Engineering for each of the eight electrical and computer engineering transcripts provided that use EEL 4914C for the senior design project. It includes the title of the project, the number of team members and their names, the constraints that were incorporated into the project as well as a list of any engineering standards used in the project. All the projects include engineering standards (see Tables C-1 and C-2 of Appendix C)

**Corrective Action:** In order to demonstrate a systematic inclusion of engineering standards and multiple realistic constraints in the design process by all students, the Senior Design Handbook has been revised (effective Fall 2006). It now requires that all students clearly specify in their critical design report, final oral presentation, and final report all the engineering standards and realistic constraints that were considered in their projects (see revised Senior Design Handbook at <http://ece.uwf.edu/abet/criterion4/F06-Handbook-revised.pdf>).

4. **Criterion 8. Program Criteria** This criterion requires that graduates must demonstrate knowledge of probability and statistics, including applications appropriate to the program name and objectives. Although the curriculum requires a course in mathematical statistics, the program did not provide evidence of applications appropriate to electrical engineering.

**Response:** We accept that the conclusion drawn from the evidence we provided that applications of Probability and Statistics were not effectively presented. Probability and statistics including applications is included in certain courses and we think the specific applications may not have been clearly documented but also think we could have done more to develop this ability.

**Corrective Action:** We have revisited the courses to strengthen the applications of probability and statistics. The syllabi now reflect greater emphasis of applications (<http://ece.uwf.edu/abet/syllabi/>). The program has taken steps in the following courses to further strengthen the applications of probability and statistics.

*EEL 3396 - Solid-State Devices (effective Fall 2006):* Students use different statistical methods to determine the density and motion of electrons and holes in a semiconductor. Both Fermi-Dirac and Maxwell-Boltzmann probability distribution functions are used to determine the density of charge carriers at any energy level in an intrinsic semiconductor. Computing these distributions is a frequent midterm and final exam problem. The statistical analysis, which includes doping density, temperature and other effects, is used to find the carrier concentration in an extrinsic semiconductor. Since the motion of charge carriers is a random function, the average concept is used to find the average value of current through the material and junction in a particular direction, if and when a potential is applied. Students model a semiconductor device based on classical, statistical and quantum mechanics. Also while designing a device, students use statistics to determine some parameters. Some statistical tools such as plotting best-fitted curve are used for the analysis of experimentally measured data. See samples of student work at <http://ece.uwf.edu/abet/criterion8/>.

*EEL 3304 - Electronics I (effective Spring 2007):* The program stresses that the production of electronic devices yields devices whose parameters have a statistical variation about some nominal value. This includes resistors, op-amps, diodes, MOSFETS, and BJTs. Design projects emphasize the use of 5% resistors and a discussion of the effect of statistical parameters on the design results. Students are taught that a design should never depend on a particular value of transistor Beta, etc. Some discussion of signal to noise ratio is also done and students perform the Noise Analysis in PSpice to determine the equivalent input and output noise.

- *EEL 4304L - Electronics I Laboratory (effective Spring 2007):* Parameter extraction is taught in the lab to demonstrate the variation from the spec-sheet values. Linear regression is used as a technique in evaluating parameters and extracting data. Students use PSpice to do Monte Carlo and noise analysis of electronic circuits.

*EEL4744L – Microprocessors and Applications Laboratory (effective Fall 2006):* Students apply the concept of linear regression analysis. For example, the temperature sensor lab assignment requires students to write code for the HC11 to read and display temperature sensor data. These readings are done at room temperature, body temperature (squeeze sensor between fingers), cold temperature (cool sensor with icepack) and hot temperature (use a hair dryer to heat the sensor). While the datasheet lists the device as being linear, measurement noise makes the raw data deviate from a straight line. Students are required to utilize MATLAB to plot the raw data and fit the best straight line using linear regression analysis by writing the necessary MATLAB code. The student best fit straight line is compared to the

one obtained through use of the MATLAB polyfit/polyval commands and any discrepancies are discussed.

*EEL 4514 – Communications Systems (effective Fall 2006)*: Students study the concepts of random variables and probability as it applies to communications. Specifically the Gaussian and uniform density functions are introduced and how they are used to model random noise in Communications. Students learn that the uniform density function has application to quantization in A/D converters. They learn through examples how to generate random probabilistic signals in Matlab with different probability density functions and how to compute the power in the random signal using Matlab as well as numerical methods to determine the power spectral density of the random signals. Students use analytical methods to determine the power spectral density of a random digital waveform using the discrete autocorrelation function of the random data signal. Students are routinely tested on this material in exams. Also, students are assigned projects where they must generate random signals in Matlab and use these to introduce noise into a simulated communications system. See samples of student work at <http://ece.uwf.edu/abet/criterion8/>.

• *STA 4321 – Mathematics Statistics (effective Fall 2006)*: The Math and Statistics Department has revised the course syllabus to include more engineering applications of probability and statistics. Specifically, the following topics were added to the course material (see revised syllabus at <http://ece.uwf.edu/abet/syllabi/>):

- Probability on Circuits (Electrical and Computer Engineering applications) – 1 class
- Reliability functions, Failure rate, Mean time to failure (Electrical and Computer Engineering applications) - 1 class
- Reliability of series and parallel systems (Electrical and Computer Engineering applications) - 1 class
- Random processes: Poisson, Exponential, Gamma (Electrical and Computer Engineering applications) - 1 class

*EEL 3135 – Discrete-Time Signals and Systems (effective Spring 2007)*: The program has revised the course syllabus to include more engineering applications of probability and statistics (see revised syllabus at <http://ece.uwf.edu/abet/syllabi/>).

*EEL 4834: C++ for Engineers (effective Fall 2006)*: Students in this course are typically very early in their program (the vast majority have not even completed circuits I). However, to introduce them to ideas that will help them later in the program, we have included a probability and statistics based assignment in C++ (see samples of student work at

<http://ece.uwf.edu/abet/criterion8/>). In this assignment, students are introduced to the concept of random noise. They use concepts from probability and statistics to generate a floating point sequence of values with a specified mean and variance. The relationship between the limits of a uniform random sequence and its theoretical mean and variance are given, and then the students are asked to develop an algorithm (and program) that develops the noise signal. Part of the program is to calculate the mean and variance of the generated noise signal to make sure that it does meet the specifications. It is explained to the students that these random noise files can be used in later classes to test simulated circuits (such as filters), and introduces the students to an important concept that will be an integral part of later courses.

• **recommendations based on review findings.**

The corrective actions to address the weaknesses are listed above in response to ABET's draft statement report. Dr. Cammy Abernathy, UF's Associate Dean of Engineering, talked to the ABET Team Chair Dr. Dick Warder after our response. The Team Chair's recommendations to ABET will contain no weaknesses for either UF or UWF programs. The ABET's final statement report is expected in August 2007.

**These items are included in the Executive Summary. Further, each program review was conducted according to University of West Florida approved university policy.**

**Date:** 6/7/2007

**Department or Program Head Date**

**Barbara G. Lyman, Vice Provost  
for Academic Programs and Planning**

**Date:** 6/26/07

**John C. Cavanaugh  
UWF President**

**Date:** 6/25/07

## **Electrical Engineering**

### **14.1001, Electrical Engineering, B.S.E.E.**

#### **CONFIRMATION OF PROCESSES FOR ACADEMIC PROGRAM REVIEW**

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Mr. David S. Cochran, PE                      Computer Engineering Senior Engineering Manager  
Program Evaluator Maxtor Corporation 1391 Cuernavaca Circulo Mountain View CA 94040

Dr. Owe Petersen              Electrical Engineering Professor & Chair                      Program Evaluator  
Electrical Engineering Milwaukee School of Engineering 3565 Tarrytown Rd. Brookfield WI 53005

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Changes Made To Program Curriculum: The curriculum is subjected to frequent revisions.

STA 4321 - Mathematical Statistics (3 credits)) is required for electrical and computer engineering, effective fall 2001

EGM 4313 – Intermediate Engineering Analysis (4 Credits)) (Effective Fall 2002) in place of MAP 4403 – Mathematics for Engineers (3 credits)

EEN4034 –Professional Issues is required for electrical and computer engineering, effective fall 2000

EEL 4843 - C++ for Electrical Engineers is required for electrical engineering

Combined the course EEL 3111 (3 credits) and EEL 3303L (1 credit lab) to EEL 3111C in Fall 2002 to follow the UF changes.

Due to problems for multiple sections in different locations and distributing faculty teaching FTE (Full-time-equivalent), the labs are separated for all required courses effective fall 2004. These courses are:

EEL 3701C (4) to EEL 3701 (3) and EEL 3701L (1)

EEL 4744C (4) to EEL 4744 (3) and EEL 4744L (1)

EEL 4712C (4) to EEL 4712 (3) and EEL 4712L (1)

EEL 4713C (4) to EEL 4713 (3) and EEL 4713L (1)

Changes to the Review Process: The review process involves meetings with students, faculty and Council members as well as surveys. It is expected that with the greater constituency involvement, which is now underway, the next round of reviews may produce more changes. The objective review process has resulted in the following issues for which the actions to be taken for improvements.

<b>Issue</b>	<b>Actions to be Taken</b>
Low turn out of the alumni surveys through the postal mails	Conduct web-based alumni and employer surveys, effective fall 2005. After the alumni information is submitted, the alumni will receive an alumni survey form to complete and will be asked to give the employer survey form to his/her supervisor. The results of the surveys will be summarized and submitted to the department annually. The survey form can not be completed by the same alumni within a two year period and the form will be sent automatically to the alumni in every 2 years

Alumni change their jobs and often do not send their updated addresses	Develop web-based updating of the alumni information (effective fall 2005) <a href="http://uwf.edu/ece/alumni/">http://uwf.edu/ece/alumni/</a> )
Too many questionnaires	Reduce to the form to one page alumni and employer survey questionnaires
No direct questionnaires to measures program objectives # 3 and # 6	Add a questionnaires on program objectives # 3 and # 6, effective fall 2005
Program objectives should fully match with the ABET's terminology	Review the program objectives, effective Spring 2006.

- **a copy of the Academic Learning Compact for each reviewed baccalaureate degree program**

### Electrical Engineering

The electrical engineering curriculum is designed to yield thirteen outcomes which are in consistent with the ABET requirements under Criteria EC-2000. Each upper division course within the curriculum contributes to at least one of these outcomes. A student must demonstrate each outcome achievement in at least two courses to satisfy the graduation requirements.

### Content

- Recognize and apply concepts, principles and theories in the following areas:
  - o mathematics, including differential and integral calculus, differential equations, linear algebra, and complex variables, discrete mathematics
  - o core electrical and computer engineering topics: basic circuit analysis, signals and systems, and electronics, digital logic, and microprocessors
  - o control systems, communications, electromagnetics, and electric power
  - o discrete mathematics
  - o probability and statistics

Describe the interrelatedness of contemporary issues in a global and society context with electrical engineering solutions

### Critical Thinking

Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design of electrical engineering

Identify, formulate and solve novel electrical engineering problems

Design and conduct scientific and electrical engineering experiments including analysis and interpretation of data

## Communication

Communicate effectively in writing electrical engineering topics.

Convey technical material through oral presentations of electrical engineering topics.

## Project Management

Function effectively on multi-disciplinary teams

Deliver electrical engineering results that meet performance standards for cost, safety, and quality

## Integrity/Ethics

Describe the ethical and professional responsibilities of the electrical engineer

Make and defend ethical judgments in keeping with professional standards of electrical engineering

Profess commitment to life-long learning to satisfy the ABET accreditation requirement.

## **a summary of program strengths, weaknesses, opportunities, and threats (SWOTs)**

### Program Strengths

1. Faculty members are well-qualified, are engaged in the teaching process, and are committed to achieving the educational mission of the program. Communication and cooperation is evident.
2. The program understands the needs of its student constituency, which includes a substantial number of part-time and working non-traditional students.
3. The students are enthusiastic about the quality of their education and report having ready access to the faculty.

## **Program Weaknesses**

- 1. Criterion 1. Students** The criterion requires that the institution must have and enforce procedures to ensure that all students meet all program requirements. The current process for certification of graduation requirements relies on a manual advisor check sheet, reviewed by the department academic advisor and the program director. The process is generally not linked directly to the course substitution approval processes. For example, a pre-calculus algebra course was used to satisfy a senior-level general elective. This has resulted in a student being certified for graduation without having met the specific requirements of the electrical engineering program.

### **Response:**

We made a recording error in the example that allowed a senior-level general elective to be satisfied by a pre-calculus algebra course. On further examination of that student's transcript, the student actually met the requirement through COP 2253 not the course that had been written in error. We believe that our students do meet requirements and regret the error that it made it seem as though students could get through the program through less rigorous means. A thorough transcript analysis shows that all students met the graduation requirements of the UF degree. All students completed a minimum of 132 credits (126 required for UF and 6 extra credits required for UWF to address credits in English).

The graduation certification for the program is done by UF Electrical and Computer Engineering Department, which uses the same process as that for UF students. UF has an established graduation certification process and uses The University Student Academic Support System (SASS) Audit. This audit shows the curricular requirements of the degree program and maps the courses completed by the students to their degree requirements. UWF students must meet the UF curriculum requirements. As part of the state university system, UWF also maintains a SASS audit for each student, which shows the student's progress towards meeting the requirements for the degree. Students can access their record of the SASS audit online. A sample SASS Audit for a UWF student is included in Table D-3 of Appendix D.

### **Corrective Action:**

We have made specific improvement to the check sheet, such as automatic GPA computerization, that will help us avoid any computational error and clarify its purposes (see Table D-1 in Appendix D for Automatic GPA calculations). UF reviews the check sheet as the final review for UF SASS audits. Effective, Spring 2009, UWF will depend only on the UWF SASS Audit for graduation certification. There will be no need for the check sheet. The SASS Audit is the mapping of curricular requirements for the degree.

To avoid any future misunderstanding and the use of any 1000-level course such as MAS 1105 – College Algebra for the General Elective, we have restricted its use with immediate effect by changing the requirement to “General Elective” – 3 credits (Any 1000 or higher level course, but it can not be a co-requisite, a pre-requisite, or a course within the curriculum for the degree.)

To be consistent with its level for freshman or sophomore, the ‘General Elective’ is moved from the 7th semester to the 5th semester in the advising sheet for the UF

electrical

engineering students (see Table D-2 in Appendix D for the revised advising sheet for electrical engineering). Note: The UWF degree (effective Spring 2009) will not require any 'General Elective' course.

2. **Criterion 2. Program Educational Objectives** Each engineering program is required to have a place detailed published educational objectives that are consistent with the mission of the institution and the engineering criteria and that are developed in consultation with their constituencies. The program has recently revised its objectives to better align with the intent of the criteria. However, the process does not appear to have included all program constituencies and should be strengthened.

**Response:** We were surprised by this weakness due to the history of involvement that we have with the constituents defined as students, alumni, faculty, and employers. We are appending the track record that verifies the time invested in working with the constituents (see Appendix B). However, feedback during the ABET visit suggests that the time we invested in reviewing the objectives may not have sufficiently addressed the potential concerns of the constituents.

**Corrective Action:** We intend to devote one advisory council meeting per year focused on an accountability report that will include discussions with constituents about whether the program objectives should be revised and any program feedback for improvements. We have conducted following surveys since the last ABET visit in October 2006.

We have added new members in computer engineering and regrouped by the Advisory Council by discipline. There are 11 members with electrical engineering background and eight (8) members with computer engineering background (see Table A-1 of Appendix A).

Please find attached a copy of the letter (Table A-2 of Appendix A) from Mr. Lynn Dell, Chair of the Curriculum and Accreditation Committee explaining how the Advisory Council was involved in the review process.

Engineering Advisory Council Surveys (Fall 2006): The summary of survey results is shown in Table 2-1 and the full summary is included in Table B-1 of Appendix B. The complete surveys can be found at <http://www.uwf.edu/ece/abet/criterion2/>.

- Alumni Surveys (Fall 2006): The summary of survey results (6 responses for electrical engineering and 15 responses for electrical engineering), which was conducted in the 2006 Fall semester, is shown in Table 2-2 and the full summary is included in Table B-2 of Appendix B. The completed alumni surveys can be found at <http://www.uwf.edu/ece/abet/criterion2/>

Students Surveys (Fall 2006): The summary of survey results (4 responses for electrical engineering and 10 responses for electrical engineering), which was conducted in the 2006 Fall semester to a senior level class (EEL 4712 – Advanced Digital Logic), is shown in Table 2-3 and the full summary is included in Table B-3 of Appendix B. The completed student's surveys can be found at <http://www.uwf.edu/ece/abet/criterion2/>

**Table 2-1: Summary of the Employer and Advisory Council Survey results  
(conducted in Fall 2006)**

#	Accomplishments of our graduates	Rating				
		Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
1a.	Develop electrical engineering solutions either individually or through interdisciplinary teams within a global and societal context.	3 (75%)				1 (25%)
1b	Develop computer engineering solutions either individually or through interdisciplinary teams and act accordingly within a global and societal context	2 (50%)	1 (25%)			1 (25%)
2.	Professionally and ethically, engage in technical or business activity through engineering ability, communication skills, and knowledge.	4 (100%)				
3.	Continue professional growth through post-graduate education, continuing education, or professional activity.	3 (75%)	1 (25%)			
4.	Contribute to the Northwest Florida regional economic development.	3 (75%)	1 (25%)			

**Table 2-2: Summary of the alumni survey results (conducted in Fall 2006)**

#	Accomplishments of our educational objectives	Rating					Total
		Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable	
1a.	Develop electrical engineering solutions either individually or through interdisciplinary teams within a global and societal context.	14(67%)	7(33%)				
1b	Develop computer engineering solutions either individually or through interdisciplinary teams and act accordingly within a global and societal context.	7(33%)	6(29%)			7(33%)	
2.	Professionally and ethically, engage in technical or business activity through engineering ability, communication skills, and knowledge.	13(62%)	8(38%)				
3.	Continue professional growth through postgraduate education, continuing education, or professional activity.	12(57%)	6(29%)	2(9%)		1(5%)	
4.	Contribute to the Northwest Florida regional economic development.	4(19%)	15(71%)			1(5%)	

3. **Criterion 3. Program Outcomes and Assessment** This criterion requires that a program demonstrate students have demonstrated an ability to design and conduct experiments. Although the program provided evidence of students' abilities to design a system, component or process, examples of student work did not include evidence of the ability to design an experiment.

**Response:** In reviewing our syllabi, we recognize that we did not use "design and conduct experiments" as a formal objective in the seven labs that operate in our curriculum. Six lab experiences are required in the curriculum, and in each course, students must design and conduct experiments.

**Corrective Action:** We have revised the course syllabi to make the desirable outcome more salient. The syllabi for these courses were modified to include even more design and conduct of experiments (see <http://www.uwf.edu/ece/abet/syllabi/>). The following are examples from different courses of how students are involved in the design of experiments.

- *EEL 3701L – Digital Logic Design Laboratory (effective Fall 2006):* Students design their circuits on paper, and then simulate them in Logic Works. Students must on their own develop test vectors to simulate their circuits and ensure that they meet the specifications. Students are also asked to build their circuits and design a testing strategy to test them in hardware. For example, in lab #4 students are asked to design a circuit in different ways and to decide which design is better given certain factors (e.g. propagation delay, number of chips used, etc.). In labs #8 and #9, students are asked to use a 555 timer to supply a clock to a sequential circuit. They are given data sheets and they are asked to find equations to calculate the resistance/capacitance values required to develop a signal with the proper frequency to meet the lab specifications. The students must then devise a test circuit, test the calculated values to see how close they are to the required frequency, and then tweak the resistances until they arrive at the required frequency. Again, they are not given values of resistors; they must experiment with their circuits until they find the right value. They are also asked about the impact on the frequency of raising and lowering the resistor values, and asked to test their hypotheses. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

*EEL 4304L - Electronics I Laboratory (effective Spring 2007):* There are several labs that require students to design and conduct experiments. For example, in lab #1 on Operational Amplifier-Based Integrators, students have to design the amplifier to satisfy given specifications. Students are responsible for developing a testing plan to make sure the amplifier works as designed. This includes constructing, testing and verifying that their designs work as expected. Also, in lab # 7 on Bipolar Transistor Biasing and Small Signal Behavior, students are required to design a bias circuit such that it is insensitive to change in the  $\beta$  value of the transistor. Students are required "to devise a procedure to extract the value of  $\alpha$ , and  $\beta$  parameters of the transistor." Students have to build the circuit in the lab, collect data to test, verify and compare results with the prelab design and simulation. This procedure includes validating the bias and measuring the small signal performance. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

- *EEL 4306L - Electronics II Laboratory (effective Spring 2007):* Students are given two types of laboratory experiments. In the first experiment type (labs #1, 2, 5, 6, & 7), the data that is to be collected is outlined and the students determine how to build and test circuits in order to obtain the data and compare it to the theoretical calculations performed prior to the lab. For the second type of lab experiments (labs #2, 4, 8, & 9),

students are given a set of design specifications. It is up to the students to design and test the circuit and demonstrate that it meets the design specifications. See samples of student work at

<http://www.uwf.edu/ece/abet/criterion3/>

- *EEL 4514L – Communication Systems Laboratory (effective Fall 2006):*

In this lab course (labs #3 to 9), students are given a procedure that must be followed and questions that must be answered. It is up to the student how to best build the needed components and obtain the

experimental data that will be compared to the theoretical pre-lab data. See samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>

*EEL 4657L - Control Systems Laboratory (effective Spring 2007):* Students take a final exam that requires them to demonstrate how an experiment for the feedback control loop of a DC motor shaft position is to be set up, how measurements are to be taken, and how to interpret the measured data. (See samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>)

*EEL 4712L – Advanced Digital Laboratory (effective Fall 2006):* Students are required to design, simulate, build, and test several systems. For example, in lab #6 (Bus Structure Design) students design, simulate and test a bus structure containing a number of registers and an external data bus. Students have to design their system so that there is no bus contention. The design is broken down into components that have to be individually designed and simulated using Quartus. The students connect the different components and simulate the operation of the bus structure. In the lab students download their design to their CPLD and design a hardware testing strategy for their system (see lab #6 assignment at <http://www.uwf.edu/mkhabou/EEL4712C/labs/F06-lab6.htm>). In lab #8 (CPLD-Controlled Stepper Motor) students design, simulate, build, and test a control system for a stepper motor. Students have to (1) design and build a motor driver circuit to supply enough power to the motor, (2) design and simulate the VHDL code (using Quartus II software) to program the control unit of the system on a CPLD, and (3) design and build a gear assembly to achieve a precision equal or better than 1°/step. Students are required to test their design in the lab to assure the proper operation of their system and its required precision (see lab #8 assignment at <http://www.uwf.edu/mkhabou/EEL4712C/labs/F06-lab8.htm>)

- *EEL 4744L – Microprocessor and Applications Laboratory (effective Fall 2006):* Students are required to make a series of design steps. The idea is to require the student to come up with a design methodology that will meet the goals. In the process, the student must design and test several subsystems before putting them all together for the final demonstration. The following are details for two experiments that demonstrate that approach (see samples of student work at <http://www.uwf.edu/ece/abet/criterion3/>):

- In Lab #5, the students are required to figure a way to send characters from a keypad attached to the microprocessor evaluation board to an LCD also attached to the board. The students must take the following logical steps to design the experiment:
  - Figure out how to map the keys of a standard keypad to alphabetical characters of their choice;
  - Figure out how to connect the decoder/multiplexer combination that is used for driving the keypad to the microprocessor's ports;
  - Write an assembly language program that correctly addresses the

hardware that the student designed and accomplish the function of moving characters from the source (keypad) to the destination (LCD).

- In Lab #8, the students learn how to design their own interrupt handling mechanism. The steps taken are:
  - Design the analog circuitry that interfaces signals from one or more transducers to one or more of the digital inputs that trigger interrupts to the microprocessor;
  - Design a systematic flowchart that allows for masking/unmasking interrupts, depending on the outcome of other operations that the microprocessor is performing;
  - Write software for serving the interrupts, based on priority criteria that the student must determine and explain in his/her report;
  - Include the interrupt-service routines in a larger software program that deals with I/O devices, such as the computer's screen.

*EEL 4914C – Senior Design Project (effective Fall 2006):* In this course, a considerable amount of time is devoted to validation and testing plans answering questions such as: what test equipment is needed and when, what standards or protocols apply, and what determines a successful design outcome. These issues are addressed during the weekly or bi-weekly team meeting with the faculty mentor and also during the Preliminary and Critical Design Reviews. Experimental validation and demonstration of a prototype is required. Effective Fall 2006, students are required to describe their design testing approach/methodology in a separate section in their final report (see Section 7 in the revised Senior Design Handbook at <http://ece.uwf.edu/abet/criterion4/F06-Handbook-revised.pdf>). Also, as part of our continuing improvement process, we have determined that there is often not enough time to explore these topics in one semester course. This is an area that will be developed further in our new “design” course sequence: EGN 4xx1 (Capstone Design I) and EGN 4xx2 (Capstone Design II). Beginning in the fall semester of 2008, students who sign up for the two-part senior design course will be required to take the FE exam in the spring semester (they are not required to pass, though) as a requirement in order to pass the second part of the senior design course. Students registering for EGN 4xx1 in fall 2007 will be strongly encouraged to register for FE Exam in fall 2007 and take the FE exam in spring 2008.

- 4. Criterion 4. Professional Component** This criterion requires a major design experience in the latter part of the program that incorporates consideration of multiple realistic constraints and appropriate engineering standards. Although some senior design projects included engineering standards, the program did not demonstrate a systematic inclusion of standards in the design process.

**Response:** Faculty members convey standards in the major design experience, but we have not made a point to make the standards explicit. Reviewing the existing projects produces evidence that the following standards were incorporated into projects.

- RS232 standard applies to any design that uses serial communication
- Wireless communication standard applies to any system that uses any kind of telemetry
- TCP/IP protocol applies to many projects that use the web

- Jtag standard applies to many projects that use programmable logic
- IEEE standards on power/energy distribution

Please find attached the analysis (revised on October 28, 2006) of the Major Design Experience Information for Electrical and Computer Engineering for each of the eight electrical and computer engineering transcripts provided that use EEL 4914C for the senior design project. It includes the title of the project, the number of team members and their names, the constraints that were incorporated into the project as well as a list of any engineering standards used in the project. All the projects include engineering standards (see Tables C-1 and C-2 of Appendix C) **Corrective Action:** In order to demonstrate a systematic inclusion of engineering standards and multiple realistic constraints in the design process by all students, the Senior Design Handbook has been revised (effective Fall 2006). It now requires that all students clearly specify in their critical design report, final oral presentation, and final report all the engineering standards and realistic constraints that were considered in their projects (see revised Senior Design Handbook at <http://ece.uwf.edu/abet/criterion4/F06-Handbook-revised.pdf>).

5. **Criterion 8. Program Criteria** This criterion requires that graduates must demonstrate knowledge of probability and statistics, including applications appropriate to the program name and objectives. Although the curriculum requires a course in mathematical statistics, the program did not provide evidence of applications appropriate to electrical engineering.

**Response:** We accept that the conclusion drawn from the evidence we provided that applications of Probability and Statistics were not effectively presented. Probability and statistics including applications is included in certain courses and we think the specific applications may not have been clearly documented but also think we could have done more to develop this ability.

**Corrective Action:** We have revisited the courses to strengthen the applications of probability and statistics. The syllabi now reflect greater emphasis of applications (<http://ece.uwf.edu/abet/syllabi/>). The program has taken steps in the following courses to further strengthen the applications of probability and statistics.

*EEL 3396 - Solid-State Devices (effective Fall 2006):* Students use different statistical methods to determine the density and motion of electrons and holes in a semiconductor. Both Fermi-Dirac and Maxwell-Boltzmann probability distribution functions are used to determine the density of charge carriers at any energy level in an intrinsic semiconductor. Computing these distributions is a frequent midterm and final exam problem. The statistical analysis, which includes doping density, temperature and other effects, is used to find the carrier concentration in an extrinsic semiconductor. Since the motion of charge carriers is a random function, the average concept is used to find the average value of current through the material and junction in a particular direction, if and when a potential is applied. Students model a semiconductor device based on classical, statistical and quantum mechanics. Also while designing a device, students use statistics to determine some parameters. Some statistical tools such as plotting best-fitted curve are

used for the analysis of experimentally measured data. See samples of student work at <http://ece.uwf.edu/abet/criterion8/>).

*EEL 3304 - Electronics I (effective Spring 2007)*: The program stresses that the production of electronic devices yields devices whose parameters have a statistical variation about some nominal value. This includes resistors, op-amps, diodes, MOSFETS, and BJTs. Design projects emphasize the use of 5% resistors and a discussion of the effect of statistical parameters on the design results. Students are taught that a design should never depend on a particular value of transistor Beta, etc. Some discussion of signal to noise ratio is also done and students perform the Noise Analysis in PSpice to determine the equivalent input and output noise.

*EEL 4304L - Electronics I Laboratory (effective Spring 2007)*: Parameter extraction is taught in the lab to demonstrate the variation from the spec-sheet values. Linear regression is used as a technique in evaluating parameters and extracting data. Students use PSpice to do Monte Carlo and noise analysis of electronic circuits.

*EEL4744L – Microprocessors and Applications Laboratory (effective Fall 2006)*: Students apply the concept of linear regression analysis. For example, the temperature sensor lab assignment requires students to write code for the HC11 to read and display temperature sensor data. These readings are done at room temperature, body temperature (squeeze sensor between fingers), cold temperature (cool sensor with icepack) and hot temperature (use a hair dryer to heat the sensor). While the datasheet lists the device as being linear, measurement noise makes the raw data deviate from a straight line. Students are required to utilize MATLAB to plot the raw data and fit the best straight line using linear regression analysis by writing the necessary MATLAB code. The student best fit straight line is compared to the one obtained through use of the MATLAB polyfit/polyval commands and any discrepancies are discussed.

*EEL 4514 – Communications Systems (effective Fall 2006)*: Students study the concepts of random variables and probability as it applies to communications. Specifically the Gaussian and uniform density functions are introduced and how they are used to model random noise in Communications. Students learn that the uniform density function has application to quantization in A/D converters. They learn through examples how to generate random probabilistic signals in Matlab with different probability density functions and how to compute the power in the random signal using Matlab as well as numerical methods to determine the power spectral density of the random signals. Students use analytical methods to determine the power spectral density of a random digital waveform using the discrete autocorrelation function of the random data signal. Students are routinely tested on this material in exams. Also, students are assigned projects where they must generate random signals in Matlab and use these to introduce noise into a simulated communications system. See samples of student work at <http://ece.uwf.edu/abet/criterion8/>).

- *STA 4321 – Mathematics Statistics (effective Fall 2006)*: The Math and Statistics Department has revised the course syllabus to include more engineering applications of probability and statistics. Specifically, the following topics were added to the course material (see revised syllabus at <http://ece.uwf.edu/abet/syllabi/>):

- Probability on Circuits (Electrical and Computer Engineering applications) – 1 class
- Reliability functions, Failure rate, Mean time to failure (Electrical and

Computer  
Engineering applications) - 1 class

– Reliability of series and parallel systems (Electrical and Computer  
Engineering  
applications) - 1 class

– Random processes: Poisson, Exponential, Gamma (Electrical and  
Computer Engineering applications) - 1 class

*EEL 3135 – Discrete-Time Signals and Systems (effective Spring 2007):* The program has revised the course syllabus to include more engineering applications of probability and statistics (see revised syllabus at <http://ece.uwf.edu/abet/syllabi/>).

*EEL 4834: C++ for Engineers (effective Fall 2006):* Students in this course are typically very early in their program (the vast majority have not even completed circuits I). However,

to introduce them to ideas that will help them later in the program, we have included a probability and statistics based assignment in C++ (see samples of student work at <http://ece.uwf.edu/abet/criterion8/>). In this assignment, students are introduced to the concept of random noise. They use concepts from probability and statistics to generate a floating point sequence of values with a specified mean and variance. The relationship between the limits of a uniform random sequence and its theoretical mean and variance are given, and then the students are asked to develop an algorithm (and program) that develops the noise signal. Part of the program is to calculate the mean and variance of the generated noise signal to make sure that it does meet the specifications. It is explained to the students that these random noise files can be used in later classes to test simulated circuits (such as filters), and introduces the students to an important concept that will be an integral part of later courses.

• **recommendations based on review findings.**

The corrective actions to address the weaknesses are listed above in response to ABET's draft statement report. Dr. Cammy Abernathy, UF's Associate Dean of Engineering, talked to the ABET Team Chair Dr. Dick Warder after our response. The Team Chair's recommendations to ABET will contain no weaknesses for either UF or UWF programs. The ABET's final statement report is expected in August 2007.

These items are included in the Executive Summary. Further, each program review was conducted according to University of West Florida approved university policy.



Date: 6/7/2007

Department or Program Head Date



Barbara G. Lyman, Vice Provost  
for Academic Programs and Planning

Date: 6/26/07

John C. Cavanaugh  
UWF President



Date: 6/25/07