ABET
Self-Study Report

for the

Bachelor of Science in Electrical Engineering

at

University of Colorado Colorado Springs

Colorado Springs, CO

rev. Sept. 7, 2011

CONFIDENTIAL

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BACKGROUND INFORMATION

A. Contact Information:

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B. Program History:

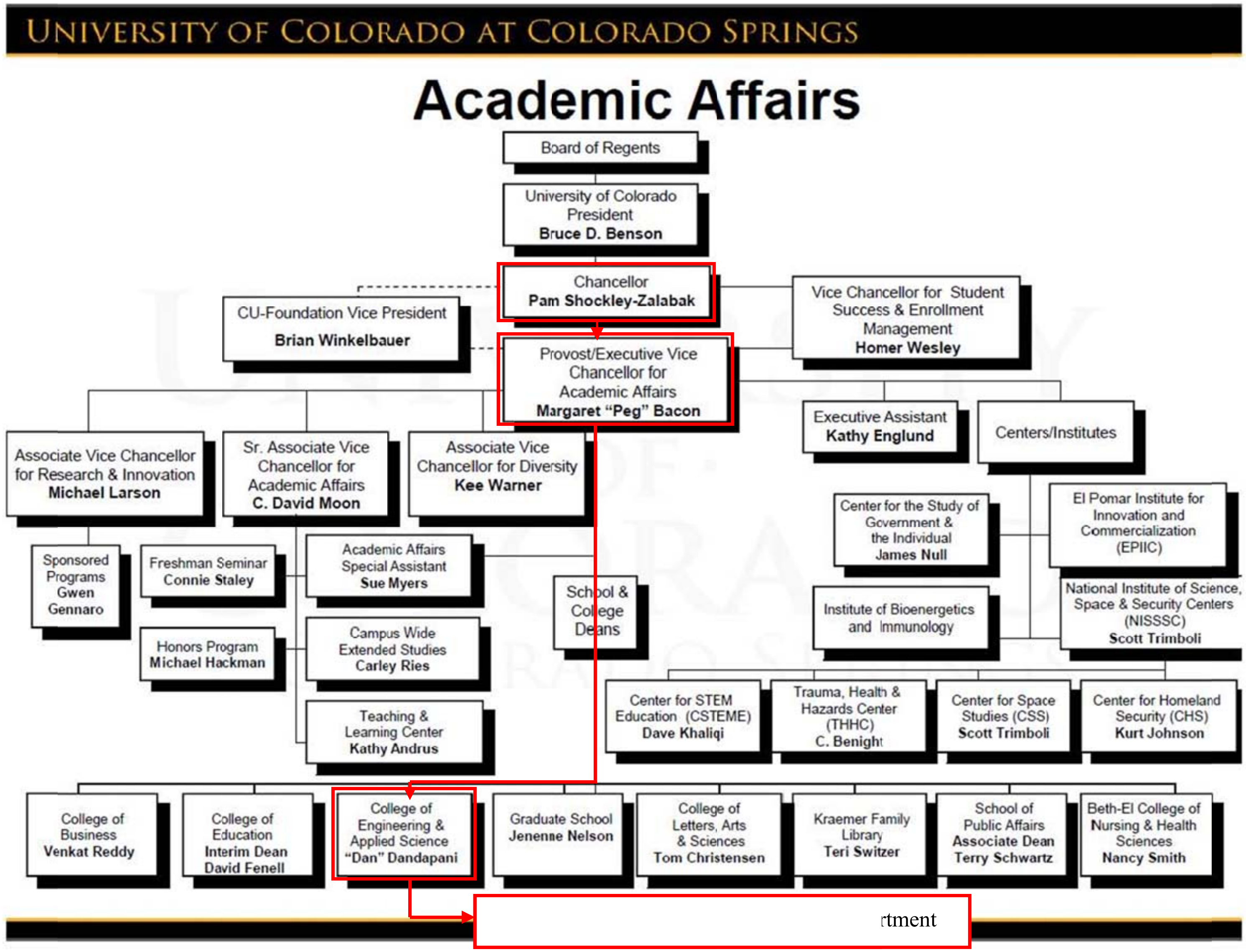
The Bachelor of Science in Electrical Engineering (BSEE) program at the University of Colorado Colorado Springs (UCCS) is a part of the College of Engineering and Applied Science (College) with Dr. Ramaswami Dandapani as the Dean. The program was implemented in 1967. The College has consistently provided accreditation process documentation for the EE program under the ABET Criteria for Accrediting Engineering Programs, including the effective evaluations during 2011-2012 cycle). There have been no changes since the last general review. The last general review was done in the year 2005-2006.

Dr. Kalkur is the chair of the Electrical and Computer Engineering Department (ECE) and oversees the BSEE program administration for BSEE. The BSEE program faculty consists of eight faculty members within the ECE Department. The BSEE program faculty is directly involved in the definition of educational objectives and the assessment process for their programs. This self-study document provides the process details.

C. Organizational Structure:

The University of Colorado (CU) System regulates and administers state-level policies for UCCS. The CU Board of Regents is in charge of the general supervision of the University. The following organizational chart demonstrates the hierarchy of the administration guidance for the program at a local campus level.

BACKGROUND INFORMATION



BACKGROUND INFORMATION

D. Program Delivery Modes:

The BSEE program is a traditional program with course offerings both during the day and evening hours. The flexible schedule supports the student population, many of whom are part-time students working during the day.

E. Program Locations:

The program is located at UCCS, 1420 Austin Bluffs Parkway, Colorado Springs, CO 80918. All portions of the program are offered at the UCCS campus. The BSEE program is administered at the College of Engineering and Applied Science and Department of Electrical and Computer Engineering, located in the Engineering Building at the UCCS campus.

F. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them:

There are no deficiencies or weaknesses in the most recent ABET Final Statement, dated September 16-18, 2008.

G. Joint Accreditation:

The BSEE program is neither jointly accredited, nor seeking joint accreditation by more than one commission.

GENERAL CRITERIA

CRITERION 1. STUDENTS

A. Student Admissions:

The BSEE program's admission requirements assure quality graduates. Students applying to the program must meet the admission requirements of not only the College but also UCCS requirements described in the "Admissions" section of the UCCS Catalog[1]. Freshman students must meet the following minimum placement requirements for admission the College and the BSEE program.

Minimum placement requirements for freshman students:

- Rank in the upper 30th percentile of their high school graduating class
- ACT composite score of at least 25/36, or an SAT composite score of at least 1120/1600

Freshman applicants must also have completed the following high school-equivalent course work prior to admission:

- **English**: 4 course units
- **Math**: 4 course units; at least two years of algebra, one year of geometry, and one year of advanced math
- **Natural Science**: 2 course units, government, history, economics, psychology, or sociology
- **Foreign Language**: 2 course units of a single language
- **Academic Electives**: 1 course unit

Freshman who do not meet the above requirements are considered on a case-by-case basis. Students with background course work deficiencies can be admitted into the Engineering Preparatory (EP) program in the College of Letters, Arts and Sciences (LAS), which is specifically designed for students with math, and/or science deficiencies. After completion of the appropriate background courses, including two calculus courses and one required science course, EP students may then initiate a request for acceptance into the BSEE program at the EAS College.

B. Evaluating Student Performance:

Performance Evaluation

Students in the BSEE program are evaluated on class performance consisting of assignments, exams, and design projects throughout their academic engineering career. The Undergraduate Engineering Advisor (EA) guides the students in their program course schedules by performing prerequisite checks to make sure students meet the

[1] Please see Supplementary Information: UCCS Catalog to read more about "Admissions" criteria.

education background of each course prior to enrollment. Students without the pre-requisite may meet with the instructor of the course prior to enrollment, who will evaluate the student's knowledge and ability and determine if the student has the educational background to proceed with enrollment in the course.

All students are encouraged to use the online registration system, ISIS, to register for classes. If a student has not fulfilled the prerequisites for a class, ISIS will not allow the student to register for the class. To allow students who do not meet the prerequisites to register for the class, they must either: 1) be given a permission number, generated through ISIS by someone with the proper access, which will override the requisite check, or 2) submit a paper add form to the UCCS Admissions and Records Office, signed by the instructor of the class. Students may only receive a generated ISIS permission number with instructor consent. However, if a student is currently registered for a prerequisite of a class offered in a future term, ISIS will allow the student to register. For example, if a student is registered for ECE 1021 in the spring, the student will be able to register for ECE 2610 (prereq., ECE 1021) for the fall, even though the student may not have completed that requisite course. The advising system, described in Section D, below, is in place as an additional precaution to prevent the student from enrolling if the student has not met the pre-requisite requirements. Students who enroll without meeting the pre-requisite requirements are administratively removed from the course prior to the semester start.

The prerequisite structure is set such that the students can achieve the required outcomes in a course with required background in electrical engineering, basic sciences and mathematics. For example, the course, ECE 2610, Introduction to Signals and Systems, requires a background in programming which is first learned in course ECE 1021, Computer-Based Modeling and Methods of Engineering, and supplemented by the logic provided in and MATH 1360, Calculus II. By completing these two pre-requisites, the students will have the background knowledge to be successful in ECE 2610.

Monitoring Student Progress

All students in the College must maintain an overall GPA of 2.0 on a scale of 4.0. It is the policy of the College to place and notify any student whose cumulative GPA falls below 2.0 on academic probation. During the following semester, the student's GPA must improve; otherwise the student will be suspended from the College. Suspended students are not allowed to enroll at any campus of the University of Colorado (CU) system during the regular academic year (August – May). Suspended students may enroll in CU courses during the summer session or take courses outside the CU system. Suspended students may apply for re-admission after the second semester following the suspension provided the improved cumulative GPA is at least a 2.0. Students who do not meet the minimum GPA requirement may be considered a "special case" and have their extenuating circumstances evaluated by the EA and final recommendation given by the ECE Chair.

C. Transfer Students and Transfer Courses:

Transfer applications to the College are decided on a case-by-case basis by the EA and the UCCS Office of Admissions and Records (A&R). Transfer student applications are evaluated for admission based on the amount of transferrable credit earned. The following two guidelines determine how the evaluation for admission is reviewed.

1. Students with fewer than 12 transferrable credit hours are evaluated based on freshman criteria[2], provided the student was in good standing with the school from which they are transferring.

2. Students with 12 or more transferable credit hours are evaluated solely on transfer work. Generally, students with a 2.5 GPA and course work completion in math[3] and natural science will be considered for full admission to the College.

Transfer students who do not meet the above minimum criteria for either level of admission will be considered for the EP program or refused from the College.

Transfer Credit Evaluation Process

The College will accept transferred courses with an earned grade of C- or better only[4]. After a prospective transfer student has applied to the program and submitted transcripts to UCCS, the Office of Admissions and Records (A&R) issues a computer-generated student transfer credit evaluation that lists each accepted course, including the number of credits accepted and the subject. Once the student receives the transfer evaluations, the student will meet with the EA to review the transfer credits as applicable to a degree in the College. Students may transfer courses throughout their academic career, but are limited to 72 hours of transfer credit from a community college and a maximum of 102 hours of transfer credit toward a degree.

Guaranteed Transfer State Policy

Colorado has developed a statewide guaranteed transfer policy for all public institutions of higher education. UCCS complies with this program. Information about the Colorado Guaranteed Transfer Program can be found at in Supplementary Information attached with this document.

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[2] Transfer Criteria for Undergraduate Students is stated in the UCCS Catalog and attached as Supplementary Information.

[3] Student must complete at least Calculus I.

[4] Grades of “pass,” “satisfactory,” “honors,” etc. are also accepted for transfer.

D. Advising and Career Guidance:

Program Advising

Entering BSEE students are initially advised by the undergraduate EA. A new freshman is required to attend a one-day orientation session during the summer prior to enrollment. The orientation session offers placement tests such as math and natural science in which the student is advised and placed based on earned scores. ACT or SAT verbal scores determine English placement. At the orientation session, the student is introduced to the EA and one or more ECE faculty. After the initial advising session with the EA, ECE faculty members take over the advising of the students during subsequent semesters.

After completion of the first semester, students in the BSEE program as assigned to an ECE faculty member as an advisor for the program. Each semester students meet with their assigned advisor prior to registration for the next semester. During this advising session, the advisor reviews the student's progress in the program ensures that the student has completed all pre-requisites prior to enrollment in new courses. And advising sheet is prepared for each student and signed by the advisor prior to opening registration for the student. If a student does not meet with his or her assigned advisor, the student must meet with the EA to undergo the review process before being able to enroll for the next semester. The advising sheets are filed and maintained with the EA. Students are encouraged to meet with their faculty advisor to make sure that the student is still in communication and undergoing review of progress with their faculty advisor.

BSEE students are required to complete advising each semester prior the next semester enrollment. ECE faculty members help their students to understand the different electrical engineering specialties and to select classes based on interest as well as academic requirements. ECE faculty members monitor each student's progress through the BSEE degree program.

Career Advising

BSEE Students have multiple opportunities for career advising. The EAS Internship Coordinator advises students and provides information about the career and internship opportunities available locally, regionally, nationally and internationally, specific to careers in engineering fields. UCCS also provides a campus-wide Career Center to advise students on additional career opportunities. The BSEE program includes multiple opportunities for industry professionals to meet and discuss with students the different careers and educational opportunities from their perspective.

E. Work in Lieu of Courses:

Advanced Placement Credits

Students may earn advanced placement credits based on an official score report from the College Entrance Examination Board, Advanced Placement Exams (AP), and/or College Level Examination Program (CLEP) credits. Students may also earn advanced placement credits during pre-enrollment orientation sessions. No tuition shall be charged for these credits. Advanced Placement Credits do not apply toward a cumulative GPA at UCCS and scores are evaluated for placement and interpretation by the EA.

International Baccalaureate (IB) Credit

Students admitted to UCCS after June 30, 2003, who have graduated from high school successfully completing an International Baccalaureate (IB) Diploma Program, can earn at least 24 semester hours of college credit. No tuition shall be charged for these credits. These credits shall be granted, however, only if the student receives a score of 4 or better on an examination administered as part of the IB diploma program. Students who completed four Higher Level (HL) exams will receive 6-8 hours of credit for each exam. Students who completed three HL exams and three Standard Level (SL) exams will receive 6-8 hours of credit for each individual HL exam and a total of 6 hours of elective credit for all three of the SL exams in aggregate, as long as at least one of the SL exams has a score of 4 or better.

Students who do not complete the entire IB Diploma Program will receive credit for up to four Higher Level (HL) exams completed with scores of 4 or better. No credit will be awarded for Standard Level (SL) exams. Credit is not granted for an IB score if the student completes an equivalent college course or Advanced Placement (AP) course. IB Credits do not apply toward a cumulative GPA at UCCS and scores are evaluated for placement and interpretation by the EA.

Project Lead the Way

Project Lead the Way (PLTW) is a national program which forms partnerships among public schools, higher education institutions, and the private sector. Through pre-engineering courses in high schools and an integrated math, science, and technology curriculum in middle schools, the program seeks to increase the quantity and quality of engineers graduating at the university level.

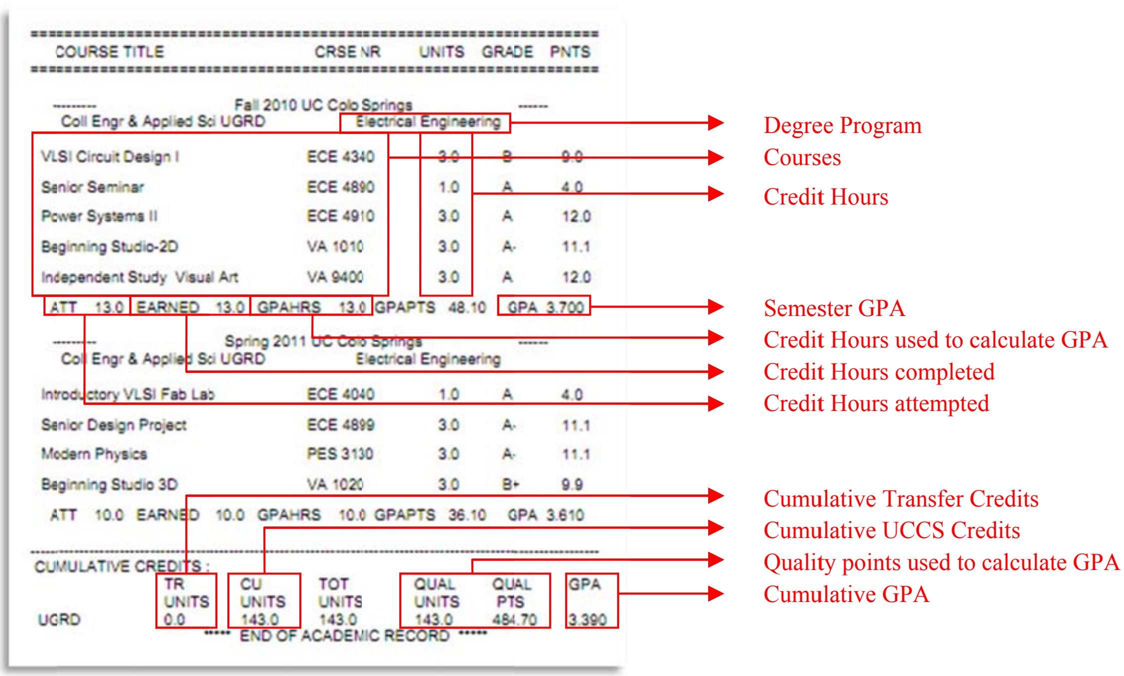
UCCS is the Colorado Affiliate University for PLTW. UCCS provides quality PLTW summer teacher training and ongoing training and networking opportunities throughout the school year. The program offers engineering graduate credit for middle and high school teachers completing the training program. Faculty from UCCS partner with PLTW master teachers to hold a two-week summer training institute for PLTW teachers. Secondary school students enrolled in the PLTW-certified programs can also earn undergraduate engineering credits upon successful completion of the national PLTW exam. PLTW courses are then transferred into the BSEE program as ECE 1411, Logic Circuits I and ECE 2411, Logic Circuits II, as it appears on the high school transcript. Students can earn up to four credits of undergraduate coursework in the BSEE program at UCCS.

F. Graduation Requirements:

Students are advised prior to each enrollment semester to ensure the planned course schedule will meet all graduation requirements for the BSEE program. If there are any deficiencies in courses the students are advised to complete the missing courses. During the second-to-last semester, each student also completes a pre-graduation check with the EA. BSEE graduating students must complete at least 128 hours of course work and must have both an overall grade point average of 2.0 and an average grade point average of 2.0 in all ECE, CS and UCCS courses. BSEE graduating students must also have a minimum of 2.0 in the following courses: ECE 1411, ECE 2610 and ECE 2411. Finally, graduating students must participate in an exit interview conducted by the ECE Chair.

G. Transcripts of Recent Graduates

Official student transcripts of the most recent graduates will be provided to the visiting team. The figure below highlights the items on a transcript for one semester, including the degree program, courses, credit hours attempted and earned, credit hours used to calculation the GPA, and the semester GPA. There are no program options for the BSEE.



<u>**GENERAL CRITERIA**</u>

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement:

UCCS Vision Statement
UCCS will provide unsurpassed, student-centered teaching and learning, and outstanding research and creative work that serve our community, state, and nation, and result in our recognition as the premier comprehensive, regional research university in the United States.

UCCS Mission Statement
The Colorado Springs campus of the University of Colorado shall be a comprehensive baccalaureate university with selective admission standards. The Colorado Springs campus shall offer liberal arts and sciences, business, engineering, health sciences, and teacher preparation undergraduate degree programs, and a selected number of masters and doctoral degree programs.

College of Engineering and Applied Science Vision Statement
The college of Engineering and Applied Science aspires to improve health, welfare and prosperity through technical learning, research, professional practice and invention.

College of Engineering and Applied Science Mission Statement
In partnership with the community and our alumni, the mission of the College of Engineering and Applied Science is to the engineering educational objectives listed in the section B, and described below.

Illuminate: Inspiring a passion in our students for lifelong learning, and graduating engineers and scientists who are knowledgeable and competitive in the global market place throughout their careers.

Investigate: Conducting recognized and relevant research that has both local and global impact.

Innovate: Engaging in leadership, service, economic and technology development that improves health, welfare and prosperity through engineering.

GENERAL CRITERIA

B. Electrical Engineering Educational Objectives:

The following educational objects are specific to the BSEE program and can be found in the UCCS Catalog as well as on the ECE website[5].

1. **Illuminate:** *lifelong learning in electrical engineering*
   Alumni are expected to learn new and emerging engineering technologies and pursue graduate school or technology careers, including but not limited to technical development, project management, and technical sales.
2. **Investigate:** *demonstration of electrical engineering principles*
   Alumni should have the ability to find and access information relevant to an application under development and have the ability to understand and approach various engineering problems and convert their solutions into engineering products.
3. **Innovate:** *creative application of electrical engineering principles*
   Alumni should be able to apply the theory and techniques of electrical engineering to innovative real-world solutions.

C. Consistency of the Program Educational Objectives with the Mission of the Institution

The BSEE program's educational objectives were designed to fit the three categories of the College's mission: Illuminate, Investigate and Innovate. The College's mission was also designed to be compatible with the campus mission.

The BSEE program educational objectives emphasize lifelong learning in electrical engineering, demonstration of electrical engineering principles and creative application of engineering principles. These emphases are consistent with the UCCS mission of a comprehensive baccalaureate university with selective admission standards. The students admitted to EE program usually have admission standards compared to other programs in the campus.

Incoming students to the EAS College are well-prepared for the rigors of the BSEE program. The following table shows the quality of new EAS students through the selective admission requirements of the College as listed in the Catalog.

Table 1: Assured Admission Criteria for EAS Students**

Class Rank	Top 30%
ACT	25 Composite
SAT	1120 Verbal + Math

*** Students not meeting criteria for assured admission will be considered for admission based on a combination of class rank, test scores, and high school units. An Engineering*

[5] The UCCS Catalog is attached as Supplemental Information.

Preparatory Program is available for students having deficiencies in their math/science backgrounds. Higher standards apply for EAS majors.

D. Program Constituencies

The ECE Department serves the following constituencies: students, alumni, faculty, advisory committee, industry, College and University. The BSEE program is designed to meet the needs of the constituencies and is evaluated on a regular basis by the Department Chair and DAC.

Students: Student needs have been assessed each semester, for the past nine years, after their completion of a required exit questionnaire shortly before graduation. Each student provides responses describing concerns and accomplishments relating to the preparation and quality of the BSEE program provided by faculty and staff. The ECE Chair compiles written and oral surveys to gauge each student's response as well as the cohort as a whole. The students also have an opportunity to discuss their immediate and life-long career plans and concerns during the interview.

Advisory Committee: The ECE Advisory Committee (AC) represents a number of industry-related regional companies and organizations which consistently recruit UCCS BSEE graduates. As employers of the *students*, the AC constituency's needs are assessed through a yearly survey of managers who work directly with the graduates. The AC also assists in the evaluation of the survey results from the industry stakeholders, alumni, and graduating students.

Alumni: The BSEE program alumni are surveyed each year and are asked questions that relate to their current activities to find out how they currently meet the educational objectives of the program. The assessment helps to determine if any changes are required to help the future BSEE alumni perform better in their chosen profession. Alumni records are collected at the time of graduation and updated regularly so that as many alumni as possible are invited to participate in the online survey each year.

Faculty: The AC and ECE Chair provide the results of the surveys with their recommendations for the Faculty who then meet to discuss the results as a part of their additional assessment and program improvement. Their actions, in regard to the program's educational objectives, may include leaving the objectives as they are, making slight adjustments or additions (as occurred with the 1999 to 2003 versions of the objectives), or replacing one or more of the objectives (as occurred in formal adoption of the current version of the objectives).

College and University: The campus leadership team reviews the educational objectives of each department to ensure consistency with the mission and guidelines of the college.

E. Process for Revision of the Program Educational Objectives

After their initial development, review and refinement, the current Program Educational Objectives were formally adopted by ECE in late fall of 2006. Figure 1: The Objective Cycle, below, visualizes the formulation and annual review of objective cycle. In Step 1, the BSEE faculty decides the educational objectives which are in line with the college objectives. In Step 2, these objectives are presented to the AC. These objectives are used to determine the student outcomes (Step 1, Fig. 2) and BSEE program outcomes with mapping to program objectives. In Step 2, ECE receives feedback from Step 6 of the outcome cycle. In Step 3, ECE gets input from students, alumni, ECE faculty, employers and advisory committee, and determine whether the program has met the objectives or any revision is needed to objectives. The Objective Cycle provides useful feedback in the development of the Outcomes Cycle (Fig. 2) discussed in Criterion 3.

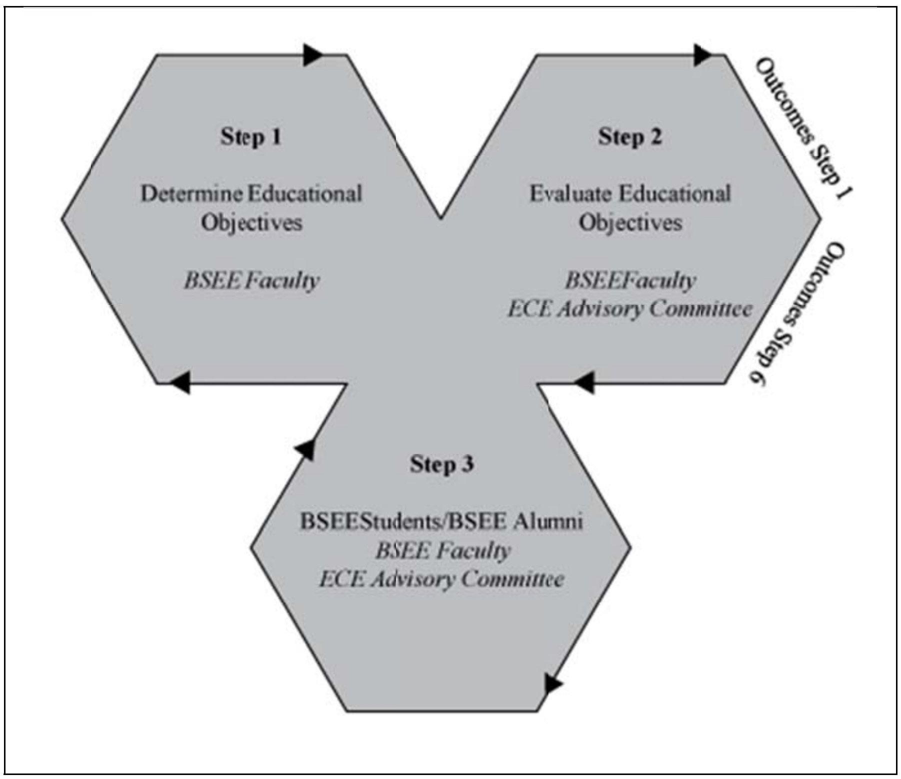


Figure 1: The Objective Cycle

GENERAL CRITERIA

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes:

The UCCS BSEE program outcomes are the same as ABET outcomes (a)-(k). The program educational outcomes are shared by the ECE faculty using specific network storage space. The educational outcomes are also listed on the ECE department website.

Table 2: ABET Outcomes (a)-(k)

ABET Outcomes	
(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 solution in a global, economic, environmental and social 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

B. Relationship of Student Outcomes to Program Educational Objectives

The BSEE Program outcomes are aligned with program objectives as shown in Table 3. For example, to achieve program objectives "illuminate", "investigate" and "innovate", the program outcome (a) – "An ability to apply knowledge of mathematics science and engineering" is very critical. Therefore, the curriculum includes courses in mathematics and engineering. A similar logic is applied to the rest of the table, shown below.

Table 3: BSEE Program Outcomes with Mapping to Program Objectives (OOM)

ABET Outcomes		EE Objectives		
		Illuminate	Investigate	Innovate
(a)	An ability to apply knowledge of mathematics science and engineering	x	x	x
(b)	An ability to design and conduct experiments as well as to analyze and interpret data		x	
(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		x	x
(d)	An ability to function on multi-disciplinary teams	x		
(e)	An ability to identify, formulate, and solve engineering problems		x	x
(f)	An understanding of professional and ethical responsibility	x		
(g)	An ability to communicate effectively	x		x
(h)	The broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context	x		
(i)	A recognition of the need for, and an ability to engage in life-long learning	x		x
(j)	A knowledge of contemporary issues	x		
(k)	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice		x	x

CRITERION 4. CONTINUOUS IMPROVEMENT:

The Objectives Cycle, introduced in Figure 1, is visualized below in Figure 2 as a continuous cycle working in collaboration to assess outcomes and to evaluate objectives. From Figure 1, after objectives are identified, they are evaluated in Educational Objectives Step 2, and then are input to Step 1 of the outcomes cycle shown in Figure 2, below. Feedback from the outcomes cycle, Step 6 from Figure 2, is used in Figure 1 for continued evaluation of the objectives (Step 3, Figure 1).

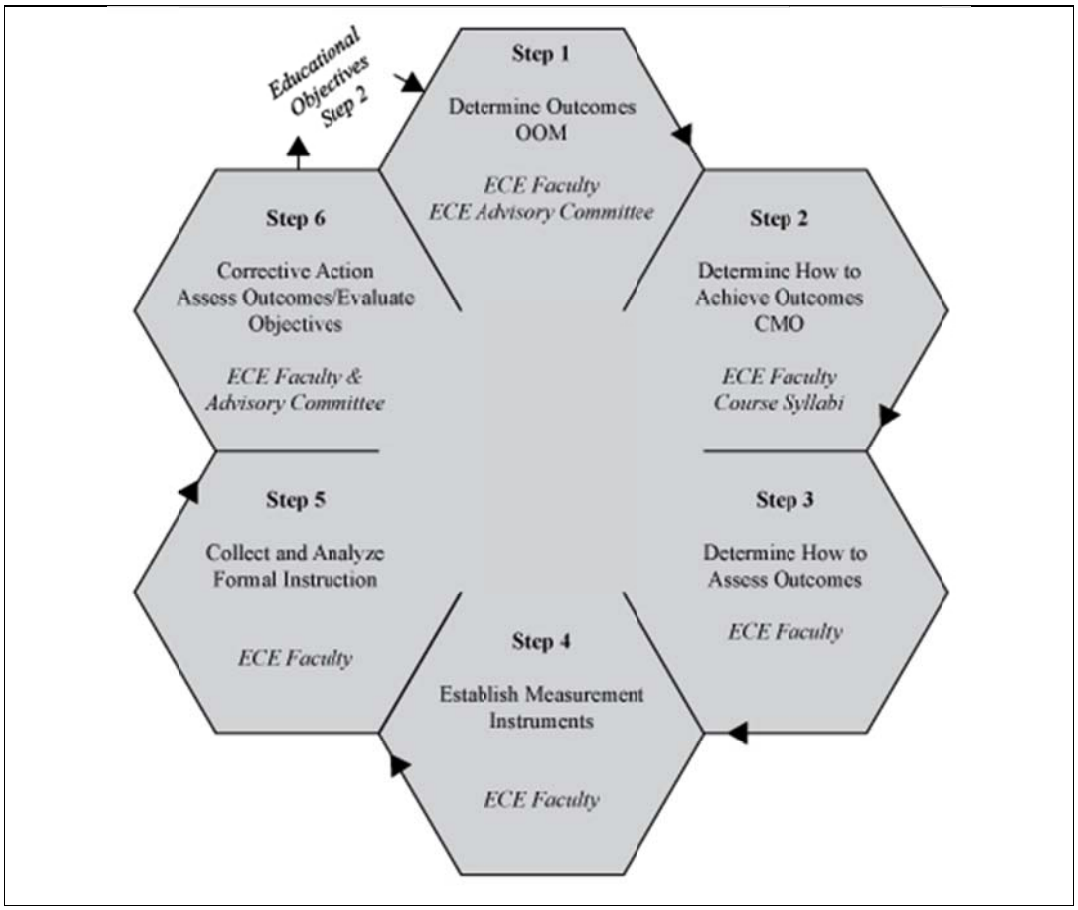


Figure 2: The Outcomes Cycle
Objectives to Outcomes mappings (OOM) & Course Mappings to Outcomes (CMO)

The following methods are used to assure that the BSEE Program outcomes are what our constituency deems that they should be, and that they are evaluated for possible adjustment on an annual basis:

1. Determine or adjust (from input from the objectives cycle) outcomes (Step 1).
2. Determine how to achieve outcomes (Step 2).
3. Determine how to assess outcomes (Step3).
4. Establish/improve measurement instruments (Step 4).
5. Provide formal instruction (Step 5).
6. Collect and analyze measurement data (Step 5)
7. Assess outcomes and evaluate objectives (Step 6)
8. Determine corrective action required (Step 6 of outcomes cycle and Step 2 of objectives cycle)
9. Take corrective action (repeat of cycles)
10. Measure success of corrective action

A. Program Educational Objectives:

1. *A listing and description of the assessment process used to gather data upon which the evaluation of each program educational objective is based*

The BSEE program uses three surveys as a tool to assess and evaluate the achievement of the educational objectives.

a) **Exit Interview**: Each graduating senior undergoes an exit interview at the end of his/her final semester.
b) **The Alumni Survey**: Alumni are surveyed usually once in two years to determine the extent to which the objectives are met.
c) **Stakeholders Survey**: Stakeholder survey is usually taken on a two year basis to ascertain the opinions of employers on our graduates.
d) **Evaluation:** The ECE Faculty and the ECE AC then decide whether changes are merited, either to the course-mapping-to-outcomes (CMO) or the curriculum.

2. *The frequency with which these assessment processes are carried out*

a) **Exit interview:** Fall, spring, and summer (if there are graduates).
b) **Alumni Survey:** Conducted in 2006[6], 2007, 2008, 2010; typically once in two years.
c) **Stakeholder Survey:** Conducted in 2006, 2007, 2008, and 2010; typically once in two years.
d) **Advisory Committee:** Meeting conducted in 2006-2007, 2008-2009, and 2010-2011; typically once in two or three years.

3. *The expected level of attainment for each of the program educational objectives*

[6] Alumni survey used the old survey format in 2006-2007 academic year.

A score 75% is rated as good, 60-75%, OK and less than 60% bad.

4. *Summaries of the results of the evaluation processes and the analysis illustrating the extent to which the educational objectives being achieved*

Table 4: Alumni Survey Results

The table below shows our program is meeting most of the BSEE objectives. The year 2008 survey shows there is need more emphasis on innovation, an area emphasized in senior design projects. The 2010 survey shows that there was an improvement over the 2008 survey in innovation.

Objective	Criteria to meet objective	2007	2008	2010*
		n= 59	n= 46	n = 21
Objective 1: Illuminate (Life Long Learning) Alumni Survey Q2	Creation of Life Long learning through professional development courses, conferences Masters/Ph.D pursuit.	87.5%	88%	83%
Objective 2: (Investigate Demonstration of Electrical Engineering Principles) 2007, 2008 Alumni Survey Q3, 2010 Q4	Practice of Electrical Engineering principles through continued use of Library, Internet, Supplier, Colleague, Other.	100%	100%	100%
Objective 3: Innovate (Creative Application of Electrical Engineering Principles) 2007, 2008 Alumni Survey Q4, 2010 Q5	Use of theory and methodology of electrical engineering learned while in school and applied to current work. Serves well or better.	87.5%	47%	79%

* For 2010, the survey responses for BSEE and the BSCpE programs did not distinguish between programs.

Table 5: Stakeholder Survey Results

The 2008 stakeholder survey, summarized below, also shows the same trend in innovation as the alumni survey (Table 4), but the results significantly improved as demonstrated in the 2010 survey results.

Objective	Criteria to meet objective	2007 n = 4	2008 n = 11	2010* n = 7
Objective 1: Illuminate (Life Long Learning) Q3	Alumni's creation of Life Long Learning through professional development, advanced degrees, conferences, other.	100%	100%	100%
Objective 2: (Investigate Demonstration of Electrical Engineering Principles) Average of Q4a,b,c,f	Alumni practice of Electrical Engineering principles through technical skills, problem solving, team work, evolving technology, etc.	83.5%	60%	87%
Objective 3: Innovate (Creative Application of Electrical Engineering Principles) Average of Q4b,c,d,e	Alumni's use of theory and methodology of electrical engineering learned while in school and applied to current work.	76.6%	57%	75%

* For 2010, the survey responses for BSEE and the BSCpE programs did not distinguish between programs.

5. *How the results are documented and maintained:*

The ECE Chair and the administrative staff gather the data results from each survey. The ECE Chair analyses the data and discusses it with the AC and the faculty, in the faculty meeting. These data are filed in the ECE office.

Mechanisms to Measure Student Outcomes:

Several key courses are identified as measurement courses for assessing the selected components of the ten outcomes, (a)-(k). An assessment process is conducted as each course is taught. This process typically consists of a number of assessment techniques as determined by the instructor and presented to the entire EE faculty during a faculty meeting at the beginning of each semester. During the assessment meeting it will be discussed, revised, and accepted with faculty approval. At the end of semester, an assessment report is generated for each measurement course. These results are discussed at the faculty meeting at the beginning of next semester's faculty meeting held at the beginning of the semester. The faculty discusses the results of the assessment and suggests changes, if needed, to meet the outcomes. Any remedial action needed is also incorporated for implementation in the subsequent offerings.

GENERAL CRITERIA

The following table identifies the BSEE core course and their corresponding ABET outcomes.
Highlighted courses need to use the corresponding EE outcomes as course outcomes and collect data for assessment.

Table 6 BSEE Course Mappings to Program Outcomes (CMO).

EE Outcomes	EE Core Courses ECE1001	ECE1021	ECE1411	ECE2050	ECE2205	ECE2411	ECE2610	ECE3020	ECE3110
(a)	X	x	x	x x		x	x	x	x
(b)		x	x			x	x		
(c)				x					
(d)	X								
(e)	X		x			x	x		
(f)	X								
(g)	X								
(h)	X		x						
(i)						x			
(j)			x	x		x			x
(k)	X	x	x	x x		x	x	x	x

EE Outcomes	EE Core Course EECE3205	ECE3210	ECE3220	ECE3230	ECE3240	ECE3420	ECE3430	ECE3610	ECE4890	ECE4899
(a)	X	x	x x		X	x	x x x			
(b)	X			x	X	x		x	x	
(c)			x		X				x	x
(d)									x	x
(e)			x			x	x	x	x	
(f)									x	x
(g)					X				x	x
(h)		x							x	
(i)				x	X				x	x
(j)				x	X			x	x	x
(k)	X	x	x	x	X	x	x x		x	x

EE core courses

ECE 1001 Introduction to Robotics
ECE 1021 Computer-based Modeling & Methods of Engineering
ECE 1411 Logic Circuits I
ECE 2050 Introduction to Physical Electronics
ECE 2205 Circuits and Systems I
ECE 2411 Logic Circuits II
ECE 2610 Introduction to Signals and Systems
ECE 3020 Semiconductor Devices I
ECE 3110 Electromagnetic Fields I
ECE 3205 Circuits and Systems II
ECE 3210 Electronics I
ECE 3220 Electronics II
ECE 3230 Electronics Lab I
ECE 3240 Electronics Lab II
ECE 3420 Microprocessor Systems Lab
ECE 3430 Introduction to Microcomputer Systems
ECE 3610 Engineering Probability and Statistics
ECE 4890 `Senior Seminar
ECE 4899 Senior Design Project

Updated:11/30/2006

ABET Outcomes

(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 solution in a global, economic, environmental and social 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.

GENERAL CRITERIA

The cycles for objectives (Fig.1) and outcomes (Fig.2) are continually exercised for evaluation of program objectives and outcomes and for revising the process itself. Evaluation of objectives is done by surveying faculty, alumni, students and advisory committee. A copy of surveys is located in the supplemental information.

B. Student Outcomes:

1. Assessment Process

When determining the outcomes (Step 1 in Fig. 2), the mapping of objectives to outcomes (OOM, Step 1 in Fig. 2) ensures adequate coverage of all the objectives and mapping may change as a result of the normal assessment process. A major part in ensuring a student achieves the program outcomes is formal instruction. Therefore, it is important that the curriculum is properly structured and the outcomes of the courses are clearly defined.

The first step is, therefore, developing course syllabi with outcomes that cover the desired BSEE program outcomes.

The second step is to identify courses in which to define measurement instruments for assessing outcome achievement (Table 2). The mapping (CMO in Step 2 of Fig. 2) is shown in detail in Fig. 6. Note: not every core course is used, but each outcome is covered by more than one course.

The third step is to design assessment tools for assessing outcomes in the courses so identified. This is accomplished by course assessment sheets for each of the core courses used to assess a BSEE program outcome. Examples are shown in Supplemental Information for the courses ECE3230 and ECE4890. The following table outlines the course assessment sheets and each assessment purpose it serves.

Table 4: Assessment Sheet Outline

Location	Assessment Purpose
Page 1 (H-12)	Overall assessment of the assessment process itself and of student performance
Page 2 (H-13)	Summary of the catalog description and links to other courses
Page 3 (H-14)	The BSEE program outcome(s) currently being assessed and their links to the BSEE program objectives
Page 4 (H-15)	An assessment of each outcome being measured by that course and the tools by which it is measured, i.e., graded test questions, rubrics, peer evaluations, project cut sheets, homework, graded project or lab report, faculty observations, focus groups, etc.
Page 5 (H-16)	An assessment of the assessment process for the student performance along with identification of problems, recommended actions to be taken, and impact of the action to be assessed in future offerings of the course.

The identified problems, actions, and impacts are shared with the ECE faculty at each start of the next semester. The BSEE program outcomes are assessed along with the assessment process, and continual feedback is supplied to the cycles of Figures 1 and 2 which results in revision and continuous improvement to the process.

Below are several survey instruments are used to gather assessment results from ECE 4899 - Senior Design.

- ECE4899 Exit Questionnaire – Faculty
- ECE4899 Exit Questionnaire – Students
- ECE4899 Final Oral Report Evaluation
- ECE4899 Final Written Report Evaluation

Table 5: Required Program Outcomes Assessment Criteria

The following table describes each of the measured courses in the BSEE program based on the required program outcomes (a)-(k) addressed in the assessment for course improvement.

Course	Program Outcome Assessment and Representative Criteria
ECE 1001: Introduction to Robotics	Outcome (d) 1. Ability to complete directed laboratory exercises as a team, involving hardware, software, and report write up 2. Ability to extend beyond the directed laboratory exercises to create solutions to more complex problems 3. Ability to manage a design project, including design proposal, Gantt charts, and progress reports. 4. Ability to complete a design project. 5. Ability to effectively deal with teamwork interference of “hitchhikers” and “couch potatoes.”
ECE 1021: Computer Based Modeling and Methods of Engineering	Outcome (k) 1. Correctly write all basic C structures (if, for, switch…) for a given simple application 2. Write a moderately complex (challenging) C program 3. Understand how to break a problem down into solvable pieces 4. Learn to implement a small software system (optional class project)
ECE 2050: Introduction to Physical Electronics	Outcome (j) 1. The ability to understand the underlying mathematical and physical principles of materials and semiconductor physics applicable to materials and electronic devices. 2. Understanding of modern physics concepts such as quantum states, energy bands, statistics, etc. 3. Understanding of transport phenomena such as drift,

Course	Program Outcome Assessment and Representative Criteria
	diffusion, photoconductivity, etc. 4. Understanding of the operation of special devices such as photoconductors, special junctions, etc.
ECE 2411: Logic Circuits II	Outcome (k) 1. Use of ASM and FSM charts for design 2. Use of industry standard VHDL software 3. Register Transfer Logic approach for system designs 4. Fundamental knowledge of sequential logic circuits
ECE 2610: Introduction to Signals and Systems	Outcome (a) 1. Complex math 2. Phasor addition 3. Line spectra and Fourier series modeling 4. Sampling and aliasing 5. Convolution sum 6. Frequency response 7. Z-domain methods: LCCDE structures and H(z), pole-zero and frequency response, and partial fraction methods for inverse z-transform
ECE 3110: Electromagnetic Fields I	Outcome (a) 1. Ability to analyze and understand electromagnetic field problems that arise in various branches of engineering 2. Ability to apply electromagnetic field concepts applications 3. Ability to understand the underlying mathematical and physical principles of electromagnetic fields
ECE 3205: Circuits and Systems II	Outcome (a) 1. Ability to use Phasor and Fourier analysis as tools for analyzing circuits 2. Demonstrated understanding of basic power concepts and circuit design for maximum power transfer 3. Students will exhibit an understanding or analog and digital filter design techniques Outcome (b) 1. Ability to effectively evaluate experimental data using analysis and/or simulation as a basis for comparison
ECE 3220: Electronics II	Outcome (c) 1. Design systems with power consumption requirements 2. Design modern multistage transistor circuit to required specifications 3. Understand global impacts of inefficient and not-to-specification based systems Outcome (e) 1. Solve specific design problems 2. Design at the transistor level from system specifications Outcome (k)

Course	Program Outcome Assessment and Representative Criteria
	1. Analyze equivalent impedance circuits 2. Learn and use industry standard design tools and design simulators
ECE 3230: Electronics Laboratory I	Outcome (i) 1. Build on skills and knowledge from prior courses 2. Create design solutions based on modern electrical system complexity and challenges 3. Ability to research data sheets and creation of life-long learning methods
ECE 3240: Electronics Laboratory II	Outcome (b) 1. Design and complete transistor level projects using hand calculations, simulations, and hardware result analysis Outcome (c) 1. Design projects constrained by power consumption, available technology and safety. Outcome (g) 1. Work as an interchangeable team of two or more to for various projects including oral and visual presentations to a group Outcome (i) 1. Design projects building on the educational foundation of all previous academic courses 2. Ability to research data sheets and creation of life-long learning methods
ECE 3420: Microprocessor System Laboratory	Outcome (b) 1. Application of theory covered in lecture to method in lab assignments 2. Troubleshooting for alternative solutions to challenges 3. Build a simple circuit based on a provided schematic 4. Demonstrated understanding of microcontroller architecture and peripherals to complete lab assignments
ECE 3430: Introduction to Microcomputer Systems	Outcome (e) 1. Ability to research device datasheets to complete laboratory exercises (ECE 3420) and homework assignments 2. Solution generation for general microcontroller problems 3. Solution generation for hypothetical, problematic microcontroller situations and alternative solution speculation
ECE 3610: Engineering Probability and Statistics	Outcome (e) 1. Ability to model engineering problems using random variables 2. Solve problems containing random variables by using concepts related to distribution functions (joint, marginal, and conditional density functions, mean and variance, correlation, etc.)

Course	Program Outcome Assessment and Representative Criteria
	3. Analysis of data using concepts from statistics (sampling, distributions, confidence intervals, hypothesis testing, etc.)
ECE 4890: Senior Seminar	Outcome (c) A. Ability to critique and participate in case study analysis Outcome (d) 1. Work as a randomly assigned team for various projects including oral and visual presentations to a group B. Ability to incorporate two or more distinct electrical engineering disciplines into a capstone design project Outcome (f) 1. Ability to critique and participate in case study analysis Outcome (g) 1. Demonstrated proficiency at speaker delivery of presentation material (voice level, use of pointer, appropriate dress, etc.) 2. Demonstrated ability to present technology-based slideshow presentations Outcome (h) 1. Ability to critique and participate in case study analysis
ECE 4899: Senior Design Project	Outcome (c) 1. Demonstrated ability to prepare and constrain a design project to a fixed budget 2. Ability to develop a working prototype Outcome (d) 3. Ability to incorporate two or more distinct electrical engineering disciplines into a working prototype Outcome (g) 1. Demonstrated proficiency at speaker delivery of presentation material (voice level, use of pointer, appropriate dress, etc.) 2. Demonstrated ability to present technology-based slideshow presentations Outcome (j) 1. Demonstrated use of current hardware and/or software tools in projects 2. Develop contemporary project prototypes for industry partners Outcome (k) 1. Demonstrated use of software design tools, instrumentation, test and debug in projects

2. *The frequency with which these assessment processes are carried out*

Prior to the end of each semester, students in ECE 4899 participate in a survey to determine the scores for achievement of the ABET Outcomes. The summary of scores is listed in Table 9 below. The scores are reviewed at the next ECE faculty meeting.

3. *The expected level of attainment for each of the student outcomes.*

Shown in Supplemental Information, the assessment levels of “Good,” “Okay,” or “Bad” are based on actual student performance and measured by earned grades on assignments and projects, represented by the course student outcomes. The percentages listed on the assessment documents are the measured percentage of students’ grades at a pre-determined performance level. The target performance level is a 75% or better grade percentage. Students who earned grades of 75% or better are given the assessment of “Good.” Students who earned grades between 60% and 74% are given the assessment of “Okay.” Students who earned grades for 59% or below are given the assessment of and Bad.

4. *Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained*

The evaluation process is summarized in a cumulative survey given to students and faculty in the BSEE program using the ECE 4899- Senior Design Project Exit Questionnaire, Final Oral Report, and Final Written Report Evaluation to determine the performance of the students relating to ABET Outcomes (c) – (k). The results of these surveys are listed below in Table 7: ECE 4899 Average Scores for ABET Outcomes.

Table 6: ECE 4899 Average Scores for ABET Outcomes

Outcome	Source	2007-2008		2008-2009		2009-2010		2010-2011		
		N	Score	N	Score	N	Score	N	Score	Av Score
(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	*Question 5 & 14 on ECE 4899 Exit Questionnaire (student & faculty)*	18	87.5%	25	86.0%	12	88.2%	14	85.7%	86.8%
(d) an ability to function on multidisciplinary teams	*Question 8 on ECE 4899 Exit Questionnaire (student & faculty)*	18	88.9%	25	80.7%	12	86%	14	90.5%	86.5%

(g) an ability to communicate effectively	*Question 1,2,& 3 on ECE 4899 Exit Questionnaire (student & faculty)*	18	83.0%	25	85.6%	12	87%	14	85.3%	85.2%
(j) a knowledge of contemporary issues	*Question 10 on ECE 4899 Exit Questionnaire (student & faculty)*	18	88.0%	25	87.3%	12	94.4%	14	89.2%	89.7%
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	*Questions 7 & 13 on ECE 4899 Exit Questionnaire (student & faculty)*	18	91.7%	25	89.2%	12	88.2%	14	89.3%	89.6%

In addition to the student and faculty surveys used in ECE 4899 Senior Design Project, the assessment process in ECE4899 combines multiple measurement tools, which include faculty observation evaluations of students during three oral presentations, and team advisor grade evaluation of both a project report and project demonstration. The resulting evaluation percentage is then translated into a letter grade based on a numerical average of the performance. The performance level target is the same as the assessment value previously stated as 75% or better to be "Good."

Table 4 lists the courses in which course assessment data is collected based on the highlighted cell values. Courses without highlighted "x" values were assessed without additional data collection, such as surveys or additional evaluations outside of assignments and projects. For example, in Table 4, three individual faculty members assessed "Outcome (b)" three courses, ECE 1021, ECE 2411, and ECE 2610, but no additional data collection was used in the assessment process.

The assessment data is both objective and subjective in interpretation. Faculty members use multiple measurement instruments, indicated by the key at the bottom of page 4 of the assessment tool. Half of the instruments are objective (EX, CS, HW, PR), and the other half have a subjective component (R, P, O, FG), depending on how the data is collected. For example, peer evaluations are used in ECE 4890 Senior Seminar, but each student completes an evaluation sheet for all students in the course section, limiting the overall subjectivity of the additional assessment data for that course.

At the beginning of each semester, each course assessment is discussed during a program faculty meeting. During this meeting, each faculty member presents the assessment process for their course to the other faculty. This meeting lasts for several hours as the program faculty discuss and question the assessment methods and results. Revisions are made, if necessary, and if the assessment report is satisfactory, the faculty will vote to approve.

The Outcomes Cycle, shown in Fig. 2, recurs annually. The performance dates were adjusted in the current year to benefit from the newly revised ABET objectives and outcomes.

The following table indicates the analysis results of the assessments from 2007 to 2011 based on the performance levels of "Good," "Okay," and "Bad." The target performance level of the assessment is "Good," or performing at 75% or better.

Table 7: Analysis Results of Course Assessments, 2007 to 2011

Key:

G – Good: Clear and effective; goal achieved. 75% or better performance evaluation.
O – Okay: Average ability; goal partially achieved. 60%-74% performance evaluation.
B – Bad: Minimal or no ability; goal not achieved. 59% or below performance evaluation.
If the course collected additional data, the assessment will have two or more letters.

Outcome (a) – (k)		Corresponding Course and Assessment Outcome	Course assessment results (from course assessment tool)			
			2007-2008	**2008-2009**	**2009-2010**	**2010-2011**
(a)	An ability to apply knowledge of mathematics, science, and engineering	ECE2610	G,G	G,G	G,G	O,G
		ECE3110	G	G	G	G
		ECE3205	O	G	G	G
(b)	An ability to design and conduct experiments as well as to analyze and interpret data	ECE3205	O	G	G	G
		ECE3240	G	G	G	G
		ECE3420	O	G	G	G
(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	ECE3220	G	G	G	G
		ECE3240	G	G	G	G
		ECE4890	G,G	G,G	G,G	G,G
		ECE4899	G,G	G,G	G,G	G,G
(d)	An ability to function on multi-disciplinary teams	ECE1001	G,G	G,G	G,G	G,G
		ECE4890	G,G	G,G	G,G	G,G

Key:

G – Good: Clear and effective; goal achieved. 75% or better performance evaluation.
O – Okay: Average ability; goal partially achieved. 60%-74% performance evaluation.
B – Bad: Minimal or no ability; goal not achieved. 59% or below performance evaluation.
If the course collected additional data, the assessment will have two or more letters.

Outcome (a) – (k)		Corresponding Course and Assessment Outcome	Course assessment results (from course assessment tool)			
			2007-2008	2008-2009	2009-2010	2010-2011
		ECE4899	O,O	G,G	G,G	G,G
(e)	An ability to identify, formulate, and solve engineering problems	ECE3220	G	G	G	G
		ECE3430	O	O	O	G
		ECE3610	O	G	G	G
(f)	An understanding of professional and ethical responsibility	ECE4890	G,G	G,G	G,G	G,G
(g)	An ability to communicate effectively	ECE3240	G	G	G	G
		ECE4890	G,G	O,G	G,G	G,G
		ECE4899	G,O	G,G	G,G	G,G
(h)	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context	ECE4890	G,G	G,G	G,G	G,G
		ECE 1001	G,G	G,G	G,G	G,G
(i)	A recognition of the need for, and an ability to engage, in life-long learning	ECE3230	O	G	G	O
		ECE3240	G	G	G	G

Key:

G – Good: Clear and effective; goal achieved. 75% or better performance evaluation.
O – Okay: Average ability; goal partially achieved. 60%-74% performance evaluation.
B – Bad: Minimal or no ability; goal not achieved. 59% or below performance evaluation.
If the course collected additional data, the assessment will have two or more letters.

Outcome (a) – (k)		Corresponding Course and Assessment Outcome	Course assessment results (from course assessment tool)			
			2007-2008	**2008-2009**	**2009-2010**	**2010-2011**
(j)	A knowledge of contemporary issues	ECE2050	O	G	G	G
		ECE4899	G,G	G,G	G,G	G,G
(k)	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	ECE1021	O,O	G,G	G,G	G,G
		ECE2411	O,G	G,G	G,G	G,G
		ECE3220	G	G	G	G
		ECE4899	G,O	G,G	G,G	G,G

Assessment Process Example

ECE 3205- Circuits and Systems II

Based on two course outcomes, (a) and (b), ECE 3205 used a single assessment method to determine the performance level of the course. The methods are outlined on the Assessment Tool shown in the Supplemental Information.

Outcome (a) used measurement tools of selected problems on the final exam (EX), weekly homework sets (HW) [7], and weekly short-problem quizzes (EX)[8]. Specifically, the first metric, selected problems on the final exam (EX), included three questions evaluating the students' ability to analyze (problem A), design (problem B), and demonstrate relationship knowledge (problem B).

[7] Copies of the evaluations are located in Appendix C
[8] Copies of homework sets, quizzes, etc. will be available during the team visit.

Student earned a percentage score for each problem and the results across the course section were compiled and averaged: Problem A – 93%; Problem B – 80%; and Problem C – 69%. The assessment determined a rating level of "Okay" even though problems A and B scored within the "Good" percentage level. Problem C was considered to be a fundamental-knowledge question for the course and therefore weighted more heavily on the resulting performance than the other two questions.

ECE 3205, Problem C: Disparity in Scores for 19 Students

- 6 students earned 18 or better of 20 points (score > 90%)
- 4 students earned 8 or worse of 20 points (score < 40%)
- Overall average score = 69%

Figure 3: ECE 3205, Problem C: Disparity in Scores for 19 Students

The weekly quiz (EX) average over the whole class was 73% which merited another "Okay" on the assessment form. Weekly homework (HW) averaged 84%, which resulted in a "Good" on the assessment form. Overall, the assessment of Outcome (a) was judged to be "Good" although an argument could be made for "Okay."

Outcome (b) used measurement tools of lab reports and a final project (see Supplemental Information). These tools measured the students' ability to design and construct experiments as well as analyze and interpret data[9]. The students' average score for lab reports was 86%, or "Good." The students' average score for the final project was 89%, also "Good." Therefore, the assessment of Outcome (b) was evaluated as "Good."

ECE 4890- Senior Seminar

Five outcomes were assessed by this course: (c), (d), (f), (g), and (h).

To assess Outcome (c), the instructor used peer evaluations of team topic oral presentations[10] and note/worksheets filled out by individual students (HW). On the

[9] A grading rubric was used for each lab and the project, samples will available during the team visit.

[10] Evaluation form attached in Supplemental Information.

former, the class average was 89% and on the latter the class average was 90% which resulted in an assessment of "good" by the instructor.

To assess (d), the instructor used team assignments and an oral presentation on ABET outcomes (O) along with team selections for the capstone design project (O). This was assessed "okay" by the instructor because, as yet, we have no way of guaranteeing multi-disciplinary team makeup.

To assess (f), oral presentations by teams on professional and ethical responsibility were used (O, P) along with individual notes/worksheets done by students (HW). Average grades of 89% and 90% were achieved, respectively, on these two metrics, which resulted in an assessment of "good".

To assess (g) oral presentations by teams (O), a design requirements document by each team (PR), and a design project pre-proposal presentation (O) were used. The averages for these activities were 89%, 90%, and 82.3%, respectively, giving an overall average assessment of "good".

To assess (h), team oral presentations (O) and individual notes/worksheets on engineering impacts (HW) were used, which resulted in 89% and 90%, respectively, for an assessment of this outcome of "good".

Closing the Loop

Using the Outcomes Cycle (Fig. 2), deficiencies in other courses are also noted and changes are made to the courses to improve the performance. Each Cycle creates an opportunity to recognize deficiencies and to work as a cohesive unit, consisting of the ECE Chair, faculty, and Advisory Committee, to suggest and implement improvements to the course and program.

For example, the results of the preliminary assessments during the 2006-2007 AY identified problems in ECE 2411- Logic Circuits II, with respect to Outcome (k), an ability to use the techniques, skills and modern engineering tools necessary for engineering practice. As a result of this deficiency, the next time the course was offered, the instructor changed the textbook and added a final project. Improvements in Outcome (k), were observed and the improved score is recorded in Table 10.

During an earlier assessment cycle, prior to the Outcomes Cycle of 2006-2007, 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, for ECE 4890-Senior Seminar performed unsatisfactorily and need to be improved. For the fall 2006 semester, a faculty member returned from a sabbatical with local industry and became the new instructor assigned to teach ECE4890 to improve and help resolve the problems. After consultation with the ECE Chair, faculty, and Advisory Committee, major changes were made to the curriculum of the course. These changes included teaching design principles prior to formation of project teams, selecting a contemporary project with guidance from local industry, producing a preliminary document for design and budget specifications, as well as identifying an advisor to support the student team throughout the project creation and function. The course emphasis shifted to constraints of design, professional and ethical responsibility, and oral presentation proficiency. The changes to the course are reflected as improvements in Outcome (c), Table 8, recorded during the Outcome Cycle (Step 6) performed in spring 2007.

A final example of how the Outcomes Cycle created course improvements, both Outcome (i), a recognition of the need for, and an ability to engage, in lifelong learning, and Outcome (j), a knowledge of contemporary issues were reviewed for improvement because they both scored “Okay” in the BSEE program course assessments 2007-2008. For Outcome (i), ECE3230- Electronics Laboratory I and ECE3240- Electronics Laboratory II were assessed. For Outcome (j), ECE2050- Introduction to Physical Electronics and ECE4899- Senior Design Project were assessed. The following actions were taken to raise the assessment scores from “Okay” to “Good”:

1. Faculty were asked to review their assessment process for each course to find possible problems and solutions. Findings were discussed during the next Advisory Committee meeting (Step 6).
2. In collaboration with the Advisory Committee, the ECE Chair discussed the faculty’s assessment findings and offered additional feedback to further develop the courses and increase achievement of the outcomes.
3. Recognizing that students should increase their knowledge of contemporary issues, Outcome (j), the ECE Chair, Faculty, and Advisory Committee are working with the Liberal Arts faculty to help improve outside skills in conjunction with the BSEE program’s outcomes. Students should gain a better insight into the social implications of technology through completion of a limited set of general education courses. Results of this improvement for Outcome (j) will be tracked and measured in the Exit Surveys for ECE 4899– Senior Design.
4. Although current students have a lower percentage score for Outcome (i), resulting in an assessment of “Okay,” during the Outcomes Cycle, our alumni consistently score high for the achievement of lifelong learning. The ECE Chair, faculty and Advisory Committee, made recommendations for improving

this Outcome, based on the idea that students may gain appreciation for lifelong learning after they leave our institution. Supplemental solutions include creation of a “speaker series” for current students to understand industry perspective with contemporary issues and instill the importance of lifelong learning. Results of this improvement for Outcome (i) will be tracked and measured in the Exit Surveys for ECE 4899– Senior Design.

5. *How the results are documented and maintained*

At the beginning of each semester, the Undergraduate Committee Course Assessment Coordinator collects the preliminary course assessment outcomes from the faculty. During the next assessment faculty meeting, each instructor presents their course assessment outcomes and received input from the other faculty as well as the recommendations for revision or improved goals for the course. Over the progression of the semester, the instructor collects the relevant data to support the assessment outcomes , then, at the end of the semester, the instructor completes the assessment and sends it to the Assessment Coordinator. At another assessment faculty meeting at the beginning of the semester, the instructor presents the data to the faculty. The instructor, again with input from faculty, determines the level of success for the course assessment outcomes and any solutions to improve the score. The preliminary course assessment outcomes and the completed assessments are available on the shared faculty network drive, and are attached in Supplemental Information.

The Exit Surveys for ECE 4899 Senior Design data are collected by the Senior Design Course Director. The data is tabulated by ECE Department staff and the data is analyzed by ECE Chair and shared with ECE faculty each semester. The surveys and their tabulated results are shared on the faculty network drive.

At the end of each semester, the Chair conducts exit interviews with the graduating seniors and collects their answers to their experience in the BSEE program, their future career plans, and their plans for lifelong learning. The ECE Chair shares the summary of the graduating senior’s responses with the faculty at the end of each semester. In the first faculty meeting of subsequent semester, the students’ responses are discussed for possible deficiencies and actions to improve the program.

C. Continuous Improvement:

Course Improvement based on assessment:

During the Outcome Cycle, the faculty determined the following courses required course improvement based on the Course Assessment results (2007-2010), feedback from graduating seniors during exit interviews, and/or discussion in faculty meetings:

ECE 1001- Introduction to Robotics
In fall 2010, the following improvements were made for the course:

Recognizing that most students at the entry level have had limited-to-no exposure to basic computer programming skills and the course does not requires students to have any prerequisite programming experience, the first two weeks of the course are devoted to the introduction of the basic programming skills necessary to be successful at developing robotics code. The LEGO Kits, used to teach the robotic concepts, are now deferred and distributed during the third week of class, giving students plenty of time to learn the major programming concepts before having to work with team members on course projects.

Additionally, the program eliminated the older LEGO RCX Mindstorms Kits in favor of the new LEGO NXT Mindstorms Kits. Although it was an expensive transition, more modern concepts are now introduced to the students, including more modern sensor technology, such as concepts in ultrasonics, as well as wireless communication[11].

ECE 1411- Logic Circuits I
In fall 2008, the following improvements were made for the course:

Two major improvements made to this course based on the need for more understanding of the equipment for the course.

Because most students in ECE 1411 have had no exposure to basic Test and Measurement equipment, and these instruments are vital for students to use throughout the semester and their entire engineering careers, the students learn the basic uses of a voltmeter, a breadboard, an oscilloscope, a power supply, and a function generator in the laboratory. Students also learn how to trigger the oscilloscope to measure more subtle effects, such as relay bouncing.

The second improvement to the course is the addition of two labs which require the students to convert a written digital logic problem into a working solution. Students

[11] Bluetooth is now introduced to the students as a form of wireless communication.

learn to organize and design the logic necessary to solve the problem, choose components, and write a lab report to describe their design approach and results.

ECE 2411 – Logic Circuits II

In fall 2008, the following improvements were made for the course:

In order to sharpen students' ability to convert a spoken problem into a working solution, students are now required to construct a sequential logic circuit using nothing but flip-flops and develop a working bread-boarded circuit using ten to twelve integrated circuits. Students also document their design process through a formal lab report.

In preparation for more advanced sequential courses, such as ECE 4200 Advanced Digital Design, students now study the Verilog Hardware Description Language during 16 of the total 32 course lectures. Students also learn basic hardware concepts using the industry-standard Xilinx Spartan 3 FPGA.

Students are required to use their Verilog knowledge in creation of their first FPGA-based sequential logic circuit, applying industry standard tools such as Modelsim and Xilinx ISE, to immediately prepare them for internship opportunities.

ECE 2205 – Circuits and Systems I

In spring 2006, the following improvements were made for the course:

This course is the first course for students to learn fundamental electrical circuits. To enhance students learning through hands-on laboratory work, lecture material is one to two weeks ahead of lab material. As such, students can learn difficult circuit concepts through lab performance. Lab material includes how to use mulitmeters, functional generators, oscilloscopes, power suppliers and instructions for designing advanced operational amplifiers using LM741, LM411, LM311, resistors, and capacitors.

ECE 2610 – Introduction to Signals and Systems

In fall 2005, the following improvements were made for the course:

As a new course in Fall 2005, ECE 2610 Introduction to Signals and Systems now includes "balance" in the Kolb/4MAT sense, which consist of demonstrations, lectures, integrated labs, and a final project. This course is challenging to students in two ways: 1) learning mathematical modeling of signals and systems; and 2) learning new software tools, such as MATLAB, to conduct signals and systems experiments.

Several course improvements have been made address these challenges. After 2007, all lectures have been recorded using screen-casting software. The lecture and demonstration videos are posted to the course website within 48 hours of recording, for students to review. The course website was designed to give students access to current materials including lecture notes, special handouts, animation programs using Mathematica, MATLAB, or standalone software, homework assignments, hints pages, quiz and homework solutions, lecture videos, and practice exams.

In addition to the weekly quizzes and to keep the students engaged and proficient with the key mathematical concepts of the course, “active learning” assignments have been added to the course lectures in which worksheets are handed out weekly, for students to work in small groups to discuss and present as solution to the class. The worksheets cover concepts of the weekly quizzes and help improve students’ retention of the material concepts.

Since 2008, software-based animations of signal processing mathematics have been incorporated into the course. The students maintain their engagement with the mathematics concepts by performing the software animations or watching and listening to them again in the posted lecture videos.

The latest improvement for this course has been the inclusion of laboratory hardware demonstrations of signals and systems concepts, using measurement equipment often used in more advanced undergraduate courses. The sight-and-sound aspects of these demonstrations have reinforced the MATLAB-concept assignments using simulated signals and systems, as well as more advanced concepts used in upper-level courses in signals and systems. The main objective is to show to the students that signals and systems modeling, although very mathematical in nature, leads to the development of real hardware systems which deal with real input and output signals.

A small team final project is also incorporated into the course to increase awareness of the practical applications of signals and systems modeling and the role of tools, such as MATLAB, which enable engineers to explore computer architecture and mathematical algorithm concepts before committing to hardware prototypes. Students investigate small portions of bigger systems models, without requiring advanced course backgrounds through the use of a MATLAB-code-base project. Recent project topics have been “baseband digital communications” and “high-quality audio signal processing.”

ECE 3205 – Circuits and Systems II
In 2010, the following improvements were made for the course:

In an attempt to engage students, the instructor created a course packet, available at the beginning of the semester, in both online and in print form. This packet is divided into corresponding textbook chapters and sections containing important formulas, example problems, etc. The majority of the packet is blank for the students to fill-in derivations, solutions to the example problems, and their own notes. In this way students are actively participating in the class, but have an idea where the lecture is headed and what concepts may be particularly important. In addition, supplementary coverage on the Fourier Transform was introduced. In order to cover discrete-time circuits and systems, a second book was added since the primary text book covered only continuous-time circuits and systems.

ECE 3220, Electronics II
In Spring 2011, the following improvements were made for the course:

An opamp design project, based on industry standard TSMC .35µm CMOS process model was incorporated into the course. Using this model, student designed a two-stage operational amplifier and simulated their design using LT spice from Linear Technology in order to obtain practical design experience.

ECE 3610, Engineering Probability and Statistics
In 2010, the following improvements were made for the course:

Although the textbook previously used for ECE 3610 gave an excellent overview of probability and statistics for engineers, it lacked in two major areas. First, it did not include much coverage of the theoretical background and motivation for probability and statistics. The focus of this text was almost entirely on solving problems by using formulas, and gave very little attention to the derivation of those formulas. Second, it did not include material on how to simulate random variables. After two iterations, a new textbook has been chosen that addresses both of these issues.

In this course, students are assigned a final project in which they must use their knowledge of probability and statistics to create a computer simulation of a real-world problem involving random events. For example, students could be asked to simulate the length of a buffer in a network where arrivals and departures are controlled by real network protocols involving random events. However, students had difficulty when asked, not only to model real-world events, but also to generate random variables and extract statistics from their simulations. As a result, an additional project was introduced earlier in the semester. The goal of this prior first project was to familiarize students with simulating random variables and extracting statistics, without having to worry about modeling real-world scenarios. The students then use their knowledge from this first project to be able to model real-world scenarios in their second project.

ECE 4890, Senior Seminar & ECE 4899, Senior Design Project
In 2008, the following improvements were made for the courses:

Significant changes in the capstone design sequence, ECE4890 and ECE4899, were driven by the assessment process and a desire to improve the course sequence with a more meaningful design project experience.

ECE 4890

The first change was to require oral presentations and discussions to be given by the students as improvement to Outcome (c), Outcome (f), Outcome (g), and Outcome (h). While Outcome (g) creates a direct improvement through requiring presentations and leading discussions, Outcomes (c), (f), and (h) are also indirectly improved. Teams are assigned to minimize the chance of close-acquaintance teams, analogous to the model of industry practice.

The oral presentations and discussions include case-study contemporary topics, which have engaged students in meaningful and serious dialogue. During a presentation, students are required to take notes and turn them into the instructor for review and grade assignment. Student teams are also evaluated on their presentation skills. Students evaluate each other and the Instructor evaluates each student using a survey evaluation form.

In the first course, ECE 4890, students begin working on their design project, which is ultimately completed to design specification in second course, ECE4899. New to the course curriculum is the requirement of each design team to respond to a project from a list of requests for proposals (RFPs). The RFPs are sponsored by local industry, faculty, and staff and provide a buffer that guides the students to work on real-life contemporary projects rather than student-initiated projects. The sponsor's name is not revealed to the student team until chose their project from the RFP list. The team meets with the sponsor/customer to assess what the project goals and requirements. The team formulates a design requirements document, one of the course improvements implemented in 2007, and reviews this information with the sponsor to stay on task. The design project is similar to an industry design project and helps prepare students for comparable tasks in the real-world.

The design document is reviewed by the instructor, faculty, industry sponsors and other industry partners who have shown an interest in critiquing the capstone design projects. The teams are given feedback on the document and an opportunity to make changes. Once the design document is approved, the team delivers a pre-proposal presentation to the same constituency.

The student teams are then given feedback on their requirements documents, and move on to the final course change. The teams prepare and deliver a pre-proposal presentation to an audience composed faculty, projects sponsors, and other industry partners who have shown an interest critiquing capstone design projects. The teams are critiqued orally and evaluation forms are completed by the reviewers. At the close of the semester the teams receive copies of their pre-proposal evaluation forms. The team members remain the same during the second capstone course, ECE 4899, as they complete the build-out of their project. The team commitment is also a new improvement in capstone design course sequence.

Since Fall 2006, the improvements to the course have been very well received by students, faculty, staff, and industry sponsors. While the use of real-world projects commissioned by industry sponsors has created some student anxiety, the benefit to the student is measured by their success in the capstone course and often shows during the exit interviews that they've learned from the quality of the program.

ECE 4890 outcomes have improved with three other small additions to the course. An industry speaker is invited each semester to give a lecture on a product design cycle experience. The lecture is recorded and past lectures are available for students to review as case-studies. The speaker also answers career questions and other questions from the students related to the industry. A librarian visits the class to discuss special resources available when conducting engineering research and development. In particular, students learn about on-line resources such as books and journals, and also advanced search engines tailored for engineering work. In fall 2009, custom printed circuit board (PCB) design was introduced as an important design tool in the program. One year later the need for this instruction diminished in the capstone course because PCB design is now introduced in ECE 3240 Electronics Lab II, a junior-level electronics.

ECE4899

ECE 4899 is the second semester of the capstone design sequence. From the above discussion of changes made to the first semester course, ECE 4890, much is already known about how these two courses work together to form the capstone experience.

The ECE 4899 course website continues to keep students, industry sponsors, and others informed of the various team presentations given throughout the semester.

In fall 2009, when changes were made in ECE 4890, similar changes were made in ECE 4899, along with some new improvements to the course. At the start of the semester the teams are already selected and students finalize their faculty advisor for the duration of the capstone sequence. The selection of faculty advisor is based on the previous semester's review by the faculty during the presentation of the design requirements document and pre-proposal. The teams each sign an agreement to meet with their faculty advisor each week for a project status update. A summary of each meeting and the project status is also recorded by the instructor.

As in the past, three times during the semester the ECE 4899 teams give oral presentations to the faculty, and ECE 4890 students, who observe and learn more about what is expected in ECE 4899. Prior to each presentation a schedule is posted on the course website which provides the abstract of each project and scheduled time for each talk. The first presentation is the project proposal. As a result of the pre-proposal feedback given at the end of the ECE 4890 semester, the overall quality of the proposal presentation is much improved. The second presentation is the design review and the third is the final presentation and project demonstration. All three of these student presentations now include the audience of project sponsors from local industry, as well as industry supporters who enjoy serving as project reviewers. Evaluation forms are filled out by each reviewer, with paper copies of the reviews being returned to the teams for continuous feedback. Having industry reviewers has increased the overall quality of the projects and the public speaking aptitude for the course.

GENERAL CRITERIA

CRITERION 5. CURRICULUM

A. Program Curriculum

1. *Program of Study*

   Table 5-1, at the end of this section, describes the plan of study for students in the BSEE program including information on course offerings in the form of a recommended schedule by year and term along with average section enrollments for all courses in the program over two years prior to the 2011 visit. The program is offered over semesters fall and spring.

2. *Describe how the curriculum aligns with the program educational objectives.*

   The BSEE program requirements are consistent with its educational objectives and are designed so that each program outcome can be achieved. The curriculum combines breadth and depth in electrical engineering, general education requirements, including the basic sciences, mathematics, humanities, and elective to prepare students for a professional career and further study in the electrical engineering field. In addition, the program includes a senior seminar which covers ethics, globalization, etc. In addition, the course concludes with a capstone design project sponsored by industry.

3. *Describe how the curriculum and its associated prerequisite structure support the attainment of the student outcomes.*

   The curriculum has the prerequisite structure which gives students the required background to achieve student outcomes. Any change in course prerequisites must be discussed in undergraduate studies committee and approved by faculty vote before change. The prerequisite structure is set such that the students can achieve the required outcomes in a course with required background in electrical engineering, basic sciences and mathematics. For example, the course, ECE 2610, Introduction to Signals and Systems, requires a background in programming which is first learned in course ECE 1021, Computer-Based Modeling and Methods of Engineering, and supplemented by the logic provided in and MATH 1360, Calculus II. By completing these two pre-requisites, the students will have the background knowledge to be successful in ECE 2610.

4. *Attach a flowchart or worksheet that illustrates the prerequisite structure of the program's required courses.*

The flowchart in Figure 4, below, illustrates the prerequisite structure of the program's required courses.

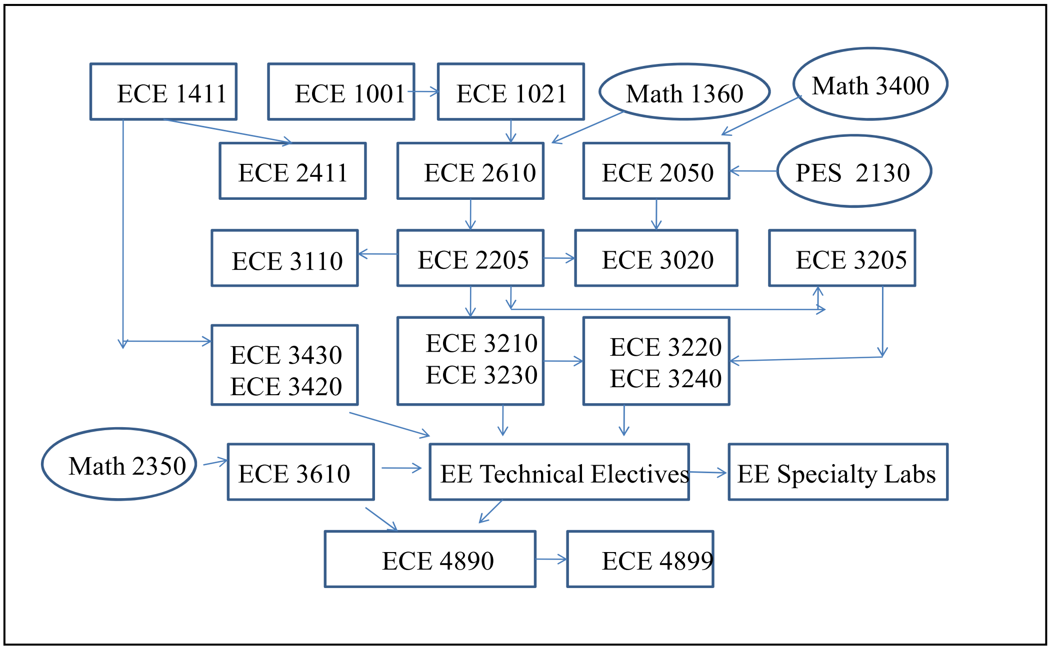


Figure 4: Prerequisite Flow Chart

5. *For each curricular area specifically addressed by either the general criteria or the program criteria as shown in Table 5-1, describe how your program meets the specific requirements for this program area in terms of hours and depth of study.*

The following list describes how the curriculum is used to satisfy requirements of the program criteria:

A total of 34 hours of mathematics and basic sciences courses are required in the BSEE program.

The required college-level mathematics courses are:

- 12 semesters hours of calculus – MATH 1350, MATH 1360, MATH 2305
- 3 semester hours of differential equations – MATH 3400
- 3 semester hours of upper-division mathematics electives

The required basic science courses are:

- 11 semester hours of calculus-based physics – PES 1110, PES 1120, PES 2130
- 5 semester hours of science with lab – Biology, Chemistry, Geology, or Physics

The BSEE program requires that students take 73 semester hours of electrical engineering and other advanced-level courses. The 73 semester hours are broken down as 64 hours of specified courses offered by the ECE department and 9 hours of technical electives from Biology, Chemistry, Computer Science, Electrical and Computer Engineering, Mechanical and Aerospace Engineering, Mathematics, and Physics departments. The specified courses ensure that the student understands the fundamentals of electrical engineering science and design. The technical electives provide choice, breadth, and depth of topics in the different areas where electrical engineering can be applied.

The BSEE program educational objectives prepare the graduates to be productive members of society. As such, students are required to complete 15 semester hours of humanities and social science courses. Approximately an equal mix of humanities and social science courses and at least two (2) upper-division courses are also required for breadth and depth of knowledge.

The BSEE program educational objects also require that the students have good oral and written communication skills. The BSEE program requires the following course in order to meet this objective:

- ENGL 1310, Rhetoric and Writing I, or ENGL 1410, Rhetoric and Writing II
- ENGL 2090, Technical Writing and Presentation

The BSEE program educational objectives also require that students be able to formulate, analyze and design electrical engineering circuits, devices, and systems in the modern engineering environment. The sequence of two capstone courses, ECE 4890, Senior Seminar and ECE 4899, Senior Design Project, are designed to help students attain these skills. The basic knowledge gained in the required BSEE courses form the basis for the students to take advanced courses from the list of restricted electives. The students are then prepared for the design experience in the capstone design course, ECE 4899, in their area of interest. The students are advised by faculty, in some cases by faculty and industry personnel, to work in teams as preparation for engineering practice. Student design project reports will be available for inspection by the ABET visiting team.

6. *Describe the major design experience that prepares students for engineering practice. Describe how this experience is based upon the knowledge and skills acquired in earlier coursework and incorporates appropriate engineering standards and multiple design constraints.*

Senior Design is a two semester course: ECE 4890 Senior Seminar and ECE 4899 Senior Design Project. Students complete the core courses in ECE before the end of the junior year. Students take senior seminar in the first semester of their senior year followed by Senior Design Project in the final semester. In Senior Seminar, students learn design principles and realistic constraints such as economic factors, globalization issues, ethics, safety, reliability, aesthetics and social impact. Some of these topics will be presented by local industry experts. Most of the design projects are sponsored by industries, faculty and staff. Students also learn techniques for oral presentations and organizing written reports. The request for proposals, solicited by faculty staff and local industries, are posted on the ECE course website. Before finalizing their selection, students meet the project sponsors. In the later part of the semester, students prepare design requirement documents which will be reviewed, with feedback, by the course instructor, faculty, industry sponsors and industry partners as a part of the project. The student teams also present pre-proposal oral demonstrations for evaluation by faculty, sponsors and industry partners. In Senior Design Project, students build their proposed project and demonstrate it to students, faculty, sponsors, and industry partners. Throughout the final capstone semester, student teams present three times to this group for evaluation and feedback.

7. *If your program allows cooperative education to satisfy curricular requirements specifically addressed by either the general or program criteria, describe the academic component of this experience and how it is evaluated by the faculty.*

The BSEE program does not include a cooperative education component to satisfy curricular requirements.

8. *Describe the materials (course syllabi, textbooks, sample student work, etc.), that will be available for review during the visit to demonstrate achievement related to this criterion. (See the 2011-2012 APPM Section II.G.6.b.(2) regarding display materials.)*

The following materials will be available during the team visit to demonstrate achievement related to this criterion:

- Course syllabi
- Textbooks
- Sample student work
- Assessment materials
- Surveys
- Senior Design reports and presentations
- Recent graduate transcripts
- and other materials, as requested

B. Course Syllabi

The following BSEE ECE core courses formatted syllabi are included in Appendix A-Course Syllabi. All of the course section syllabi will be available during the team visit.

- ECE 1001 – Introduction to Robotics
- ECE 1021 – Computer-Based Modeling and Methods of Engineering
- ECE 2050 – Introduction to Physical Electronics
- ECE 2205 – Circuits and Systems I
- ECE 2411 – Logic Circuits II
- ECE 2610 – Introduction to Signals and Systems
- ECE 3020 – Semiconductor Devices I
- ECE 3110 – Electromagnetic Fields I
- ECE 3205 – Circuits and Systems II
- ECE 3210 – Electronics I
- ECE 3220 – Electronics II
- ECE 3230 – Electronics Laboratory I
- ECE 3240 – Electronics Laboratory II
- ECE 3420 – Microprocessor Systems Laboratory
- ECE 3430 – Introduction to Microcomputer Systems
- ECE 3610 – Engineering Probability and Statistics
- ECE 4890 – Senior Seminar
- ECE 4899 – Senior Design Project

Table 5-1 Curriculum

BSEE

Course (Department, Number, Title) List all courses in the program by term starting with first term of first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.[2]	Curricular Area (Credit Hours) Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1]
Freshman Year / **1st semester** / **Fall**							
ECE 1001 – Intro to Robotics **OR** ID 1010 – Freshman Seminar (only offered in fall semesters)	R		3			2010 Fa; 2011 Spg	36
ECE 1411 – Logic Circuits I	R		2			2010 Fa; 2011 Spg	29
ENGL 1310 – Rhetoric and Writing I	SE			3		2010 Fa; 2011 Spg	20/44
MATH 1350 – Calculus I	R	4				2010 Fa; 2011 Spg	49
PES 1110 – General Physics I	R	4				2010 Fa; 2011 Spg	81

Freshman Year	2nd semester	Spring					
ECE 1021 – Computer-Based Modeling and Methods of Engineering	R		3			2010 Fa; 2011 Spg	43
MATH 1360 – Calculus II	R	4				2010 Fa; 2011 Spg	53
PES 1120 – General Physics II	R	4				2010 Fa; 2011 Spg	72
ENGL 1310 – Rhetoric and Writing I **OR** Social Science/Humanities elective	SE			3		2010 Fa; 2011 Spg	20/varies
Sophomore Year	**3rd semester**	**Fall**					
ECE 2610 – Introduction to Signals and Systems	R		4			2010 Fa; 2011 Spg	25
MATH 2350 – Calculus III	R	4				2010 Fa; 2011 Spg	36
Basic Science course with Laboratory	SE	5				2010 Fa; 2011 Spg	varies
Social Science/Humanities elective	E			3		2010 Fa; 2011 Spg	varies

Sophomore Year	**4th semester**	**Spring**					
ECE 2050 – Introduction to Physical Electronics	R		3			2010 Spg; 2011 Spg	27
ECE 2205 – Circuits and Systems I	R		4			2010 Spg; 2011 Spg	24
ECE 2411 – Logic Circuits II	R		2			2010 Fa; 2011 Spg	35
ENGL 2090 – Technical Writing and Presentation	R			3		2010 Fa; 2011 Spg	19
MATH 3400 – Intro to Differential Equations	R	3				2010 Fa; 2011 Spg	40
PES 2130 – General Physics	R	3				2010 Fa; 2011 Spg	37
Junior Year	**5th Semester**	**Fall**					
ECE 3020 – Semiconductor Devices I	R		3			2009 Fa; 2010 Fa	13
ECE 3205 – Circuits and Systems II	R		4			2009 Fa; 2010 Fa	18
ECE 3210 – Electronics I	R		3			2009 Fa; 2010 Fa	24
ECE 3230 – Electronics Laboratory I	R		1			2009 Fa; 2010 Fa	18
ECE 3420 – Microprocessor Systems Laboratory	R		1			2009 Fa; 2010 Fa	13
ECE 3430 – Intro to Microcomputer Systems	R		3			2011 Fa; 2010 Fa	31

Junior Year	**6th Semester**	**Spring**						
ECE 3110 – Electromagnetic Fields I	R		3			2010 Spg; 2011 Spg	15	
ECE 3220 – Electronics II	R		3			2010 Spg; 2011 Spg	15	
ECE 3240 – Electronics Laboratory II	R		1			2010 Spg; 2011 Spg	14	
ECE 3610 – Engineering Probability & Statistics	R	3				2010 Spg; 2011 Spg	36	
Technical electives	SE		4			Fa 2010; Spg 2011	varies	
Social Science/Humanities elective	SE			3		Fa 2010; Spg 2011	varies	
Senior Year	**7th semester**	**Fall**						
ECE 4890 – Senior Seminar	R		1			Fa 2010; Spg 2011	8	
Technical electives	SE		9			Fa 2010; Spg 2011	varies	
Mathematics elective	E	3				Fa 2010; Spg 2011	varies	
Social Science/Humanities elective	E			3		Fa 2010; Spg 2011	varies	

<u>**GENERAL CRITERIA**</u>

Senior Year	**8th semester**	**Spring**					
ECE 4899 – Senior Design Project	R		3			Fa 2010; Spg 2011	8
Technical Electives (10cr)	SE		10			Fa 2010; Spg 2011	varies
Social Science/Humanities elective (3cr)	E			3		Fa 2010; Spg 2011	varies
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS							
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128	37	*70*	*21*			
PERCENT OF TOTAL		28.9%	*54.7%*	*16.4%*			
Total must satisfy either credit hours or percentage: Minimum Semester Credit Hours		32	48	-			
Total must satisfy either credit hours or percentage: Minimum Percentage		25%	37%	-			

1. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the average enrollment in each element.
2. Required courses are required of all students in the program, elective courses are optional for students, and selected electives are courses where students must take one or more courses from a specified group.

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be provided during the campus visit.

GENERAL CRITERIA

CRITERION 6. FACULTY

A. Faculty Qualifications

Table 6-1, at the end of this section, describes faculty qualifications and their coverages of all the curricular areas of the BSEE program. There are six tenure-track faculty, two instructors, and the program Dean serving as ECE Faculty. Seven members are full-time and one is part-time. Each faculty member holds a PhD terminal degree except one instructor, but all faculty members are educated in engineering. There is a good mixture of senior and junior experienced faculty. Four faculty members have over 20 years of teaching experience each. In addition, most faculty are active in consulting in their areas of expertise. Faculty are also active in research and publish significantly in their research areas. The latest five publications for each faculty member are listed on each résumé in Appendix B.

B. Faculty Workload

The College of Engineering and Applied Science (EAS), which oversees the Electrical and Computer Engineering (ECE) Department for the BSEE program, has specified several workload models ranging from intensive teaching (six courses per year) to a research emphasis (four courses per year). Table 6-2, at the end of this section, tabulates the workload assigned to the BSEE faculty. The average course load is five courses per year. The faculty workload includes an expectation of 50% teaching, 30% research and 20% service. Special workload assignments, based on intensive service, have occasionally been arranged with approval of the ECE Chair and the EAS Dean. The faculty workload policy and summary for the 2010-2011 academic year is included in Supplementary Information

C. Faculty Size

The faculty consists of six tenure-track faculty members and two instructors, which is large enough to provide instruction and guidance for all students in all areas of electrical engineering. The faculty and their areas of expertise are listed in Figure 5, below.

Core Faculty	Areas of Expertise
Drs. Araujo and Kalkur	Microelectronics and Circuit Design
Dr. Wickert	Communications and Signal Processing
Drs. Tumbush, Wang, Dandapani and Mr. Kressin	Circuit Design and Computers
Dr. Song	Electromagnetics
Dr. Plett	Controls

Figure 5: Faculty Areas of Expertise

In addition to these faculty members, there are a number of part-time lecturers who work in local industry and teach for the BSEE program. These part-time lecturers bring their rich industrial experience to the classroom and generally have a Ph.D. in the areas in which they teach.

All faculty members have extensive research publications in their areas of expertise and have considerable industry experience. Many of the faculty members are involved in professional activities with the Institute of Electrical and Electronics Engineers (IEEE), National Science Foundation (NSF), and other related organizations and industry conferences around the world.

Each core faculty member in the department also advises students in the BSEE program every semester. Faculty members are also involved in student advising and sponsorship of the student branches of IEEE and Society of Women Engineers (SWE).

During AY 2010-2011, the ECE Department began a search process to replace a faculty member in the area of Communications. Additionally, in order to continue to provide excellence in teaching and support for the BSEE program, the ECE Department will be adding a tenure-track faculty position in energy and control systems. ECE is currently undergoing a search for these faculty members to continue the BSEE program growth and faculty availability for students pursuing these topics. The program is growing and this increase in staff will help the program to continue to develop without an increase in stress to slow the progress of the BSEE program.

D. Professional Development

Each faculty member is provisioned $1,000 per year to attend technical conferences and workshops of their own choosing within their area of expertise. Additional travel support may be obtained by faculty through a formal request to the ECE Chair and EAS Dean. In addition, faculty use indirect cost return (ICR) funds to attend conferences and other professional workshops. Funds are available to attend ABET workshops to develop and improve assessment activities. Faculty are expected to share their ABET workshop experience with other faculty in the College through a college-wide forum.

E. Authority and Responsibility of Faculty

The faculty play and important role in the guidance, development and implementation of the processes for evaluation, assessment and continuous improvement. The ECE Department has an undergraduate committee to help guide policy and implementation of the processes. The undergraduate committee consists of three core faculty members, who report at each monthly faculty any updates, changes, or concerns about the BSEE curriculum and program. During the faculty meeting, the faculty discuss these issues and vote regarding implementation in the BSEE program. The faculty also play an important role in the evaluation and assessment by discussing the completed course assessments at the beginning of each semester and the assessment results at the end of each semester as well as actions for program and course improvements. Any issues, such as resource or material requirements are also discussed with the EAS Dean by the ECE Chair during monthly one-on-one meetings.

Table 8-1: Faculty Qualifications

BSEE

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[4] (FT* administrative Dean)	Years of Experience: Govt./Ind. Practice	Years of Experience: Teaching	Years of Experience: This Institution	Professional Registration/ Certification	Level of Activity High, Medium, or Low: Professional Organizations	Level of Activity: Professional Development	Level of Activity: Consulting/Summer work in industry
Ramaswami Dandapani	PhD, CS, 1974	Dean & Prof.	T	FT*	-	37	25	-	M	H	M
Thottam S Kalkur	PhD, EE, 1986	Prof.	T	FT	4	27	25	-	M	M	M
Mark Wickert	PhD, EE, 1984	Prof.	T	FT	-	26	26	-	M	M	M
Gregory Plett	PhD, EE, 1998	Prof.	T	FT	2	13	13	-	M	M	M
Chia Jiu Wang	PhD, EE, 1988	Prof.	T	FT	-	23	23	-	M	M	M
Carlos Araujo	PhD, EE, 1983	Prof.	T	FT	-	27	27	-	M	M	H
Heather Song	PhD, EE, 2004	Assoc. Prof.	TT	FT	-	5	5	-	L	H	M
Robert Kressin	MS, EE, 2000	Instructor	NTT	FT	-	3	3	-	L	L	H
Greg Tumbush	PhD, EE, 1998	Instructor	NTT	PT	-	3	3	P.E.	L	L	H

Instructions: Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.
4. At the institution

Table 6-2: Faculty Workload Summary

BSEE

Faculty Member (name)	PT or FT[1] FT* = admin Dean	Classes Taught		Program Activity Distribution[3]			% of Time Devoted to the Program[5]
		Course No.-Credit Hrs.	Term and Year[2]	Teaching	Research or Scholarship	Other[4]	
Ramaswami Dandapani	FT*	-	-	0%	0%	100%	0%
Thottam S Kalkur	FT	ECE 4260/5260-3; ECE 4040-1	Spg 2011	25%	25%	50%	100%
		ECE 4340-3	Fall 2010				
Mark Wickert	FT	ECE 4670-1; ECE 4615/5615-3; ECE 2610-4; ECE 4655/5655-3; ECE 4890-1; ECE 4899-1	Spg 2011	60%	20%	20%	100%
		ECE 4680-1; ECE 4650/5650-3; ECE 4630/5630-3; ECE 4890-1; ECE 4899-1	Fall 2010				
Gregory Plett	FT	ECE 5560-3; ECE 5540-3	Spg 2011	20%	60%	20%	100%
		ECE 4510/5510-3; ECE 4530-1	Fall 2010				
Chia Jiu Wang	FT	ECE 4480/5480-3; ECE 2205-4; ECE 3220-3	Spg 2011	60%	20%	20%	100%
		ECE 4330/5330-3, ECE 3210-3, ECE 4990/5990-3	Fall 2010				
Carlos Araujo	FT	ECE 4020/5020-3; ECE 5990/6990-3	Spg 2011	20%	30%	50%	100%
		ECE 5990/6990-3	Fall 2010				
Heather Song	FT	ECE 3110-3; ECE 4110/5110-3	Spg 2011	40%	40%	20%	100%
		ECE 3120-3; ECE 4250/5250-3	Fall 2010				
Robert Kressin	FT	ECE 1001-3; ECE 1411-2; ECE 2411-2; ECE 3240-1	Spg 2011	80%	0%	20%	100%
		ECE 1001-3; ECE1411-2; ECE 2411-2; ECE 3220-1	Fall 2010				
Greg Tumbush	PT	ECE 4200-1; ECE 4211/5211-3	Spg 2011	80%	0%	20%	50%
		ECE 4242/5242-3; ECE 4280/5280-3	Fall 2010				

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the self-study is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.

GENERAL CRITERIA

CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

Summarize each of the program's facilities in terms of their ability to support the attainment of the program educational objectives and student outcomes and to provide an atmosphere conducive to learning.

1. *Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment that is typically available there.*

   The ECE Department office includes an office for the ECE Chair as well as for the program assistant and other temporary assistants. The ECE Chair's office has a conference table and chairs with a whiteboard for illustrative discussions. The ECE office is equipped with a facsimile machine, phones, printers, computers with internet access, a copy machine, and office supplies. In addition, the ECE Department has tablet and laptop computers and a projector available for use by faculty and students.

   Each faculty member is supplied and office equipped with phones, white board, computers with internet access, and storage bookshelves and cabinets. Teaching assistants and lecturers share office space which are also equipped with phones, white board, computers with internet access, and storage bookshelves and cabinets.

   The EAS College has a three-year cycle computer replacement/upgrade program.

2. *Classrooms and associated equipment that is typically available where the program courses are taught.*

   Most of the BSEE program core courses are taught in the Engineering Building, the Science and Engineering Building, or in Centennial Hall on campus. All the classrooms are equipped with a white board and markers. The majority of classrooms on campus are "smart rooms," which are equipped with computers with internet access and overhead projectors. Each room has internet access through wireless or network connections and portable device drive applications.

3. *Laboratory facilities including those containing computers (describe available hardware and software) and the associated tools and equipment that support instruction. Include those facilities used by students in the program even if they are not dedicated to the program, and state the times they are available to students. Complete Appendix C containing a listing the major pieces of equipment used by the program in support of instruction.*

   The laboratory facilities and equipment available in the Engineering Building (ENG) are adequate for the EE program to meet its educational objectives.

Electronic Systems Laboratories, ENG 229 & ENG 230

The Electronic Systems Laboratories house equipment and supplies for digital and analog design: personal computers networked to the campus and college servers and internet, electronic breadboards, digital oscilloscopes, logic analyzers, function generators, multimeters, power supplies, electronic circuit boards, and parts and supplies to complete laboratory assignments. These laboratories are used for the following BSEE assessment courses. Courses with an "*" are not BSEE assessment courses.

- ECE 1001 – Introduction to Robotics
- ECE 1411 – Logic Circuits I*
- ECE 2205 – Circuits and Systems I*
- ECE 2411 – Logic Circuits II
- ECE 2610 – Introduction to Signals and Systems
- ECE 3205 – Circuits and Systems II
- ECE 3230 – Electronics Laboratory I
- ECE 3240 – Electronics Laboratory II
- ECE 3420 – Microprocessor Systems Laboratory
- ECE 3430 – Introduction to Microcomputer Systems
- ECE 3440 – Microcomputer Systems Laboratory*
- ECE 4200 – Advanced Digital Design Laboratory*
- ECE 4890 – Senior Seminar
- ECE 4899 – Senior Design Project

The electronic breadboards, parts, and supplies are used in ECE 1411 and ECE 2411. In courses ECE 3420, ECE 3430, and ECE 3440, students develop the hardware and software needed for a single-board Motorola HC11 microcomputer-based system. The objective is for student groups to design, implement, and test a system. The implementation involves the use of logic analyzers, oscilloscopes, soldering tools, and software tools like assemblers, linkers, layout tools, etc. The students in courses ECE 3230 and ECE 3240, design, implement, and test analog circuits, such as operational amplifiers. PSpice and Multisim are used as the simulation tools in the design process. ECE 4200 focuses on the design of digital systems using modern programmable devices, including field programmable gate arrays (FPGAs). Students in ECE 4890 and ECE 4899 also used the equipment and parts available in the laboratory and build upon their foundational courses to complete their prototype and final design projects.

VLSI Circuit Design Laboratory, ENG 231

The VLSI Circuit Design Laboratory houses equipment for VLSI design, including SUN Solaris workstations, which are networked to a SUN Solaris Enterprise 250 server. The following software is also available: Cadence tools for VLSI circuit design and Synopsis tools for VLSI circuit synthesis. Additionally Silvaco tools are available for process simulation. This laboratory is used for the following BSEE assessment courses. Courses with an "*" are not BSEE assessment courses.

- ECE 4211 – Rapid Prototyping with FPGAs*
- ECE 4242 – Advanced Digital Design Methodology*
- ECE 4320 – Fault Detection and Design for Testability*
- ECE 4330 – Embedded Systems Design*
- ECE 4362 – Synthesis with the Verilog Hardware Description Language*

The workstations in the VSLI Circuit Design Laboratory are used with the Cadence Design systems tools suite and Synopsys tool suite in the courses ECE 4211, ECE 4242, ECE 4320, and ECE 4362. In these courses, students use the laboratory hardware and software to complete VLSI circuit design and synthesis assignments. The students in ECE 4330 use the ATMEL STK500 controller boards to develop hardware and software for embedded systems.

ECE PC Laboratory, ENG 233

This laboratory consists of 34 personal computer workstations networked to the campus and College servers. The following software is installed on the computers, but not limited to, Windows 7 operating system, Borland C^{++} 4.52, LogicWorks, MATLAB, Multisim, Microsoft Visual Studio, Silos 2003, Xilinx ISE 7.2i, Rendezvous, and Microsoft Office 2010 Professional. This laboratory is used for the following BSEE assessment courses. Courses with an "*" are not BSEE assessment courses.

- ECE 1021 – Computer-Based Modeling and Methods of Engineering
- ECE 1411 – Logic Circuits I*
- ECE 2411 – Logic Circuits II
- ECE 3210 – Electronics I*
- ECE 3220 – Electronics II
- ECE 4211 – Rapid Prototyping with FPGAs*
- ECE 4362 – Synthesis with Verilog HDL*
- ECE 4890 – Senior Seminar
- ECE 4899 – Senior Design Project

Students in ECE 1021 use the C^{++} programming environment to model and test engineering problem solutions. Multisim and Verilog software are used in ECE 1411 and

ECE 2411 to design and simulate combinational and sequential logic circuits. Rendezvous is used in ECE 3210 and ECE 3220. Silos III design simulation software and Xilinx ISE 7.2i is used in ECE 4211 and ECE 4362 to design VLSI and FPGA circuits. Microsoft PowerPoint and other visual presentation software are used in ECE 4890 and ECE 4899 to make design project presentations. In addition to these classes, the workstations are available to any student within the University. In particular, students use this laboratory for internet access and to complete assignments from all University programs.

EAS Laboratories
The College also has other laboratories for students in the Computer Science and Mechanical and Aerospace Engineering programs which students in the BSEE program are available to use for elective courses throughout their academic career.

Communications and Signal Processing Laboratory, ENG 242
The Communications and Signal Processing Laboratory houses equipment and supplies for communications and signal processing systems design. Workstations are networked to the ECE network server, spectrum analyzers, function generators, pulse generators, and other equipment, parts and supplies. The following software is also available in this laboratory: Windows 7 operating system, MATLAB, PSpice, Code Composer, Wave file manipulation software, and TI Microprocessor Development Tools. This laboratory is used for the following BSEE assessment courses. Courses with an "*" are not BSEE assessment courses.

- ECE 4655 – Real-Time DSP*
- ECE 4670 – Communication Laboratory*
- ECE 4680 – Signal Processing Laboratory*

MATLAB and PSpice are used in ECE 4670 to design communication systems. MATLAB, Wave file manipulation software, and TI Microprocessor Development Tools are used in ECE 4670 and ECE 4680 to design digital signal processing systems.

Control-Systems, ENG 130, & High Capacity Battery Testing Laboratory, ENG 136
The control-systems laboratory (CSL) is housed within the College of Engineering and Applied Science at the University of Colorado at Colorado Springs. Its mission is to support teaching and research in control-system theory within the Electrical and Computer Engineering (ECE) and Mechanical and Aerospace Engineering (MAE) programs. The lab comprises a number of student and research work centers. Each work center has at least one device to control, which includes Educational Control Products' (ECP) Magnetic Levitation and Control-Moment Gyroscope systems and a Rhino Robotics six-degree-of-freedom robotic arm. Each center has a full complement of test-and-measurement equipment.

The dynamic devices may be configured to study identification and control of linear or nonlinear, stable or unstable, SISO, collocated SIMO, noncollocated SIMO and full MIMO control. Control is accomplished using Comdyna GP-6 analog computers or a digital computer via MathWorks' Matlab/ Simulink/ the Real Time Workshop and Quanser QUARC.

The laboratory provides opportunities for undergraduate and graduate student research in all aspects of control systems. The lab supports undergraduate analog and digital control-systems lab courses, and projects in both undergraduate and graduate control-systems courses. Funding sources for the CSL have included substantial discounts from ECP, as well as a grant from the National Science Foundation.

This laboratory is used for the following BSEE assessment courses as well as Senior Design Students. Courses with an "*" are not BSEE assessment courses.

- ECE 4510 – Feedback Control Systems*
- ECE 4530 – Control-Systems Laboratory*
- ECE 4540 – Digital Control Systems*
- ECE 4560 – Digital Control Laboratory*

The High Capacity Battery Testing Laboratory was established in 2010 with major support from the National Science Foundation (NSF) under the Major Research Instrumentation Program[12] and with additional support from the College of Engineering and Applied Science at the University of Colorado Colorado Springs. It is not considered an undergraduate laboratory, but students with advanced understanding and knowledge may use this lab, with permission, to perform research or projects within the Senior Seminar or Design courses.

The laboratory has facilities to perform tests on high-capacity cells, such as those used in hybrid and electric vehicle technology, modules of such cells, and full-size battery packs. The laboratory has cell testing, module testing, and pack testing capabilities.

Electromagnetics Laboratory, ENG 168

This is an anechoic chamber used for preforming microwave measurements. The equipment available includes an EMI receiver, network analyzer, infrared imaging system, microwave exposure meter, and houses other equipment, parts, and supplies for use in the laboratory. This laboratory is used for the following BSEE assessment course. Courses with an "*" are not BSEE assessment courses.

- ECE 4150 – Microwave Measurements Laboratory*

[12] MRI: Acquisition of High-Power Energy Storage System Test Equipment

Microelectronics Research Laboratory, ENG 156

This and a Class-100 clean room, used to fabricate, characterize, and analyze integrated circuits. This laboratory is used for the following BSEE assessment course. Courses with an "*" are not BSEE assessment courses.

- ECE 4040 – Introduction to VLSI Fabrication Laboratory*
- ECE 4050 – Microelectronics IC Fabrication Laboratory*

Students use this laboratory to learn the hands-on processes involved in fabricating modern integrated circuits. All students are prepared in safety handling guidelines specific to a Class-100 clean room laboratory. More detail is described in section C, below.

B. Computing Resources

UCCS Campus Computing Resources
The UCCS Information Technology Department operates over 500 Windows and 45 Macintosh computers in Student Classrooms and Open Labs throughout the campus. Open labs are open to all students, staff and faculty, while computerized classrooms are reserved for classrooms, conferences, and other sponsored programs.

PC Hardware Specifications:
- 22" Dell Optiplex 780
- Core 2 Quad 2.83 GHz Processor
- 4 GB RAM
- 320 GB Hard Disk Drive
- Windows 7 64-bit Operating System

Macintosh Hardware Specifications:
- 27" Macintosh computer
- Core 2 Duo 3.06 GHz Processor
- 4 GB RAM
- 1 TB Hard Disk Drive
- iMac 10.1 Operating System

Printer Specifications:
- HP LaserJet 9050dn Printer

Campus Open Labs
Open Labs are located on the second floor of the El Pomar Center in the Library Commons area, and in Columbine Hall room 231. Included in the El Pomar Center Open Lab are several computerized rooms designated for group study (two or more persons) These Group

Study Rooms are located in EPC Rooms 212, 213, 214, 216, 217, 226, 227, 228, and 230 contain 2 PC's each. The Multimedia Lab is an additional Open Lab located in the El Pomar Center for the purpose of video editing and graphic design.

El Pomar Center Open Lab:

- 205 PCs
- 4 Macs
- 2 Flatbed Scanners
- 9 High-Capacity B&W Laser Printers

El Pomar Center Multimedia Lab:

- 7 PC's
- 2 Macs
- 2 Flatbed Scanners
- 1 High-Capacity B&W Laser Printer
- 6 Digital Video Recording Devices

COH 231:

- 42 PC's
- 8 Macs
- 2 Flatbed Scanners
- 4 High-Capacity B&W Laser Printers

Computerized Classrooms

Computerized Classrooms are located throughout Columbine Hall, with an additional overflow classroom in the El Pomar Center and in Centennial Hall. PC hardware is used in all classrooms except for COH 209 which uses Mac's. A single High-Capacity B&W Laser Printer is also available in each classroom.

- EPC 239 – 36 PC's
- COH 209 – 31 Mac's
- COH 220, 221, 223, 224 – 22 PC's each
- COH 229 – 24 PC's
- COH 230, 329 – 28 PC's each
- CENT 245 – 32 PC's

In addition, there are several Computerized Classrooms that utilize a single Instructor Podium Computer. These systems are identical to the PC's in the open labs and computer classroom.

- Centennial Hall – 7 Podiums
  (CENT 102, 106, 186, 188, 191, 192, 203)

- Columbine Hall – 19 Podiums
  (COH 103, 114, 115, 116, 117, 127, 128, 132, 135, 136, 214, 216, 317, 322, 323, 324, 325, 333, 334)
- Dwire Hall – 9 Podiums
  (DWIRE 101, 103, 104, 106, 112, 114, 121, 201, 303)
- Science-Engineering – 8 Podiums
  (SENG-B134, B136, B138, B211, B213, B215, B216, B217)
- University Hall – 9 Podiums
  (UHALL 109, 132, 133, 140, 141, 165, 168, 216, 317)

Public Access Computers are available in the El Pomar Center on the 2nd floor near the west entrance, located along either side of the Library Reference Desk. A total of 10 PC's are available for public access.

Also note that there are additional computerized resources available and operated by individual departments here at UCCS. This includes the Colleges and Departments of Business, Chemistry, Engineering, Physics, Math, Oral Communications, Language Technology Center, The Writing Center, and Assistive Technology.

PC Software List:

- PC Software List
- Microsoft Windows 7 - (64-bit)
- Microsoft Office Professional Plus 2010 - (Access, Excel, InfoPath, OneNote, PowerPoint, Publisher, Word)
- Microsoft .NET Framework 4
- Microsoft Silverlight
- Microsoft Internet Explorer 9
- Microsoft Forefront Endpoint Protection 2010
- Equitrac Plugin 4.2.1
- Google Chrome
- FireFox 4
- Skype 5.3
- Respondus Lockdown Browser
- SSH Secure Shell (and File Transfer) Client
- BlueZone Web-to-Host
- WebCT shortcut
- Putty.exe
- Java 6
- iTunes 10.2.2
- QuickTime 7.6.9

- RealPlayer 14
- VideoLAN VLC Player
- Audacity 1.3
- Cam Studio
- Media Player Classic
- Windows Media Player
- Windows Movie Maker 2.6
- Windows Live Essentials 2011 (PhotoGallery, MovieMaker, Writer)
- Windows DVD Maker
- WinRAR
- SDP-850 Document Camera Software
- Epson V600 Scanner Software + ABBYY FineReader 6.0
- Adobe Reader 10
- Adobe Creative Suite 4 Design Premium - (Acrobat 9 Professional, Dreamweaver CS4, Fireworks CS4, Flash CS4 Professional, Illustrator CS4, InDesign CS4, Photoshop CS4)
- Adobe CS4 Camera Raw Plugins
- Adobe Flash Player 10
- Adobe Shockwave Player 11
- Adobe FrameMaker v7.2
- Sophie Author 2.0.11
- Sophie Reader 2.0.11
- iClicker.exe 5.5.2
- Excel Plugins (shortcut)
- Notepad++
- ACD Labs 12
- RasWin 2.7.5
- Jmol 12
- Logger Pro 3.8.4
- Spartan '10 v1.1.0
- Marvin Beans 5.4.0.1
- Microsoft Mathematics 4.0
- ALEKS (Plugin) 3.14
- MATLAB R2011a
- Pcspim.exe
- CYGWIN 1.7.7-1
- Google Earth 6
- ArcGIS 10
- IDRISI Taiga
- MicroDEM 12

- PASW (SPSS) 19
- AMOS 19
- NORM 2.03
- R v2.13.0 (with MatchIt2.4-18)
- HLM 7
- JAWS 12
- ZoomText 9.1
- FS Font Pack
- FileOpen DRM Plugin

MAC Software List:

- OS X 10.6.x Snow Leopard updated weekly
- Microsoft Office 2011 (Includes Word, PowerPoint, Excel, and Messenger)
- Adobe Design Premium CS4 (includes Acrobat 9 Pro, Bridge, Dreamweaver, Drive, Fireworks, Flash, Illustrator, InDesign, Media Encoder, and Photoshop)
- Adobe Reader 9
- FireFox 4
- iTunes and Quicktime updated weekly
- Divix player 7.1.0
- DVD Player
- iLife 11 (includes iDVD, iMovie, iPhoto, iWeb, and Garageband)
- Final Cut (includes Final Cut Pro 6.0.6, Motion 3.0.2, Soundtrack Pro 2.0.2, Color 1.0.4, Compressor 3.0.5, and DVD Studio Pro 4.2.1)
- Komplete 7 (Absynth 5, Guitar Rig, Kontact 4, Massive, Reaktor 5, Traktors 12)
- Audacity 1.2.5 and 1.3.13
- Pro Tools 7.4.2
- FM8 1.0.4
- MaxMSP 4.6
- Reason 3.0.5
- Cyberduck
- Epson Scan
- Firstclass 8.3
- Fugu 1.2.0
- HP Scanner
- Labanwriter 4.6 and 4.7
- Scratch 1.3.1 and 1.4

- SimplyBurns
- Google Earth
- Respondus Lockdown Browser
- Microsoft Remote Desktop client
- Silverlight plugin
- Windows Media Player

Campus Computing Facilities

- 2 Redundant Datacenter: 30 kW UPS
  - Cisco Nexus 5010, 4 x Nexus 2010 in each center with 10GbE uplinks to Nexus 7000 cores.
  - VMware Infrastructure
    - 3 x Dell M 600 Blades in 1000E Chassis.
- Microsoft Hyper-V Infrastructure in each data center
    - 4 x Dell M 600 Blades in 1000E Chassis.
- 5 Node HP/Lefthand iSCSI SAN in each Data Center.
    - 2 x Brocade Edge Iron switches with dual 10GbE to redundant storage network.

Campus Network Facilities

- Dual Campus Routing Cores
  - Cisco Nexus 7000, Cisco 6513 in each routing center with dual 10GbE uplinks to all major buildings.
- Wireless network covering all campus buildings.
  - 350 Aruba access points providing B/G wireless with B/G/N in 3 newest building installations.
- Internet access via 2 x 1 GbE connect to Southern Colorado Optic Network (Scone)
  - Connection to Front Range Gig Pop (FRGP) for commodity internet, access to NLR Transit Rail and Internet2 Packet service.
  - Peer routing to CU Campuses, Colorado State U, Colorado School of Mines, Denver University, U of Wyoming via FRGP
- Cisco ASR 1006/1002 routers, Cisco ASA 5580 firewalls at network edge
- Southern Colorado Educational Consortium Network
  - Network connections via Scone and private peering to 2 Southern Colorado Community Colleges with connections planned to a total of 10 members.

- Cisco Telepresence environment including: Redundant Call Managers, Telepresence management server, TP Multipoint Switch, Video conference server, Recording server.
- Cisco Telepresence CTS1100 systems installed at 3 Locations for remote instruction. Supports classes currently offered by College of Engineering and Bethel School of Nursing.

NISSSC Computing Facilities

The National Institute of Science, Space and Security Centers (NISSSC) at UCCS was established 2005 to better focus on developing and implementing sound academic and research deliverables in the science, space and security disciplines, for meeting the nation's challenges. Through an AFOSR grant, a data center with state of art network/blade server/storage equipment and an innovation security lab were created to foster development of educational and research programs in Cyber Security, Physical Security, and Homeland Security. UCCS faculty/students can request accesses to the NISSSC data center for the computation and storage needs on related research projects.

- Datacenter: 40 kW UPS w/auto switch to backup generator for protection against long-term power outages, shared with the EAS Computing Facilities.
  - Blade Server/Storage Infrastructure: Consist of 3 racks of HP Blade Servers and SAN storage systems.
    - Production rack with HP C7000 blade server chassis containing
      - VMware vSphere - 6 HP ProLiant 460 G7 Blades. Each blade consists of two 6-core Intel XEON X5650 (2.66GHz) w/128GB RAM
      - VMware vSphere - 4 HP ProLiant BL460C G6 Blades. Each blade consists of 2 Quad-core Intel Xeon E5530 (2.66GHz) w/32 GB RAM.
      - Tier 1 storage - HP Fiber Channel EVA SAN with 40 TB RAW.
      - Tier 1 and 2 storage – 5 x HP DL180 10TB SAS NAS
    - Two security research racks. Each with HP C3000 blade server chassis containing
      - VMware vSphere 4 HP ProLiant BL460C G6 Blades. Each blade consists of 2 Quad-core Intel Xeon E5530 (2.66GHz) w/32 GB RAM.
      - HP Lefthand SAN iSCSI with 10 TB storage capacity.
    - Multiple HP Procurve router/switches with 64 ports @ 10 GbE server/storage edge port capacity – shared with EAS.
    - Redundant 10 GbE uplinks to campus routing core.
    - VMware Software: vCenter, vSphere, and Lab Manager.

EAS College Computing Facilities

- Datacenter: 40 kW UPS w/auto switch to backup generator for long-term power outages, shared with NISSSC.
    - VMware Infrastructure
        - Redundant 10 GbE uplinks to campus routing core.
        - Multiple HP Procurve router/switches with 64 ports @ 10 GbE server/storage edge port capacity – shared with NISSSC.
        - VMware vCenter – Dell 2950
        - VMware vSphere - 2 x Dell PowerEdge R810: 4 x 6-core (24 CPU's) Intel Xeon w/196GB RAM each, clustered as 48 CPU cores (96 logical cores) and 384GB RAM.
        - Tier 1 storage - 2 x Dell PowerEdge R710, 48GB RAM 12TB NAS storage
        - Tier 1 and 2 storage – 1 x HP DL180 10TB SAS NAS
    - 2x Windows Remote Desktop Servers (24/7 remote access for students) w/software as EN233.

Departmental computing facilities:

EN138 (SOFTWARE DEV. LAB):
27 x Dell Optiplex 990, Intel Core i7-2600 CPU @ 3.40 GHz, 8GB RAM, 465GB HDD, 64-bit Windows 7, 1 GbE

Operating Hours:
Sunday – Thursday: 8:00am - 12:00am
Friday: 8:00am – 5:00pm
Saturday: 12:00pm – 5:00pm

PC Software List in EN138 Lab

- ActiveState - ActivePerl Build 1204 [294330]
- ADA
- Adobe CS4 Service Manager Version 4.0.1
- Adobe Reader Version 10.0.1.434
- Alias - Maya Thu 07/20/2006, 200607200010
- Alice
- Apple Inc. - Bonjour Version 2.0.5.0
- Apple Inc. - iTunes Version 10.2.2.14
- Apple Inc. - QuickTime QuickTime 7.6.9 (1680.9)
- Blender Version 2.57

- Don HO don.h@free.fr - Notepad++ Version 5.9
- dotPDN LLC - Paint.NET Version 3.58.4081.24586
- DrRacket
- Epic Games, Inc. - UDK Game Version 1, 0, 8364, 0
- Epic Games, Inc. - UDK Mobile Game Version 1, 0, 8364, 0
- Epic Games, Inc. - UDKLift Version 1.0.3911.19448
- Epic Games, Inc. - UnrealEngine3 Version 1.0.4142.22186
- FlashDevelop 3.2.2 RTM for Microsoft.NET 2.0 Runtime Version 3.0.0.0
- Ghostscript 9.02
- GNU Visual Debugger
- GRacket
- GSview 4.9
- jGRASP
- jGRASP Startup Settings
- Larus-Stone pcspim Version 8, 0, 0, 0
- LATS
- Microsoft (R) Visual Studio (R) 2010 Version 10.0.30319.1
- Microsoft Corporation - .NET Compact Framework Version 3.7
- Microsoft Corporation - Internet Explorer Version 9.00.8112.16421
- Microsoft Corporation - Office Source Engine Version 14.0.4730.1010
- Microsoft Corporation - Silverlight Plug-In Version 4.0.60310.0
- Microsoft Lync 2010 Version 4.0.7577.275
- Microsoft Office 2010 Version 14.0.5130.5003
- Microsoft OneNote Version 14.0.5128.5000
- Microsoft Outlook Version 14.0.4760.1000
- Microsoft XNA Game Studio 4.0 Version 4.0.20823.0
- Microsoft® .NET Framework Version 4.0.31106.0
- Microsoft® DirectX for Windows® Version 9.29.1962.0
- Microsoft® Games for Windows® - LIVE Version 3.5.0050.0
- Microsoft® Windows® Operating System Version 12.0.7600.16385
- Mozilla Corporation - Firefox Version 4.0.1
- Mozilla, Linspire Inc. - Nvu Personal Debug
- MzScheme
- NUnit Version 2.5.10.11092
- OpenOffice.org 3.3 Version 3.03.9556
- openwatcom.org - Open Watcom Version 1.90
- PLT Scheme Version 4, 2, 5, 0
- Prolog
- Python Interactive Shell
- Racket

- RealNetworks, Inc. - RealPlayer (32-bit) Version 12.0.1.652
- SlowAndSteadyAlice
- SSH Secure Shell Version 3.2.9
- Sun Microsystems, Inc. - Java(TM) Platform SE 6 U25 Version 6.0.250.6
- The Document Foundation - LibreOffice 3.3 Version 3.03.202
- The MathWorks Inc. - MATLAB Version 7.12.0.384
- TightVNC Win32 Viewer Version 1.5.3.0
- Vim Version 7, 2, 269, 0
- VMware Converter Hosted Version 3.0.3 build-132753
- VMware vCenter Converter Standalone Version 4.0.1 build-161434
- VMware Workstation Version 6.5.4 build-246459
- VMware, Inc. - vSphere Client Version 4.1.0.12319
- YoYo Games Ltd - Game Maker Version 8.1

EN233 (COMPUTATIONAL LAB):

35 x Dell Optiplex 780, Intel Core 2 Quad CPU Q9550 @ 28.83GHz, 4GB RAM, 300GB HDD, 64-bit Windows 7, 1 GbE

Operating Hours:

Sunday – Thursday: 8:00am - 12:00am
Friday: 8:00am – 5:00pm
Saturday: 12:00pm – 5:00pm

PC Software List in EN233 Lab:

- (Classkit License) COMSOL Multiphysics 4.1
- Acresso Software Inc. - FLEXnet Publisher (32 bit) Version 11.7.0.0 build 76260
- AdaGide
- Adobe Reader Version 10.0.0.407
- Advanced Micro Devices Inc. - Catalyst Control Centre Version 2.0.0.0
- Alexander Roshal - WinRAR archiver Version 3.71.0.0
- Apple Inc. - Bonjour Version 2.0.4.0
- Apple Inc. - iTunes Version 10.1.1.4
- Apple Inc. - QuickTime QuickTime 7.6.9 (1680.9)
- Autodesk - AutoCAD Version 18.1.49.0.0
- Autodesk Design Assistant 2011 Version 15, 0, 0, 1
- Autodesk DWF Application Version 11.0.0.86
- Autodesk Inventor Project Editor 2011 Version 14, 0, 0, 1
- Autodesk Moldflow Inventor Tool Suite Integration 2011 Job Manager
- Autodesk, Inc. - AutoCAD Mechanical Version 2011
- Autodesk, Inc. AddInMgr Version 1, 0, 0, 1

- Autodesk, Inc. FEAFilesHandler Autodesk Inventor 2011
- Blender
- CACE Technologies, Inc. - WinPcap Version 4.1.0.1753
- COMSOL 4.1 with MATLAB
- Dept. of Civil & Mechanical Engineering, USMA - WPBD2010 Version 12.00.0005
- Digilent Inc. - Adept Application Version 2.4.2
- Don HO don.h@free.fr - Notepad++ Version 5.86
- dotPDN LLC - Paint.NET Version 3.56.3972.42626
- EAGLE 5.10.0
- FlashDevelop 3.3.2 RTM for Microsoft.NET 2.0 Runtime (R1574) Version 3.0.0.0
- GNU Visual Debugger
- IDLE (Python GUI)
- jGRASP
- JoCar Consulting - Bricx Command Center Version 3.3
- Launch NX session
- LEGO MINDSTORMS NXT Version 2.0
- Licensing Wizard
- LTspice IV Version 4.08o
- Macrovision Corporation - LMTOOLS Utility Version 10, 8, 5, 0
- MDSolids Version 3.05
- Mentor Graphics - PCLS_OK MFC Application Version 2, 0, 0, 0
- Mentor Graphics Corporation - Precision Synthesis Version 2010a_Update1.228
- Microsoft (R) Visual Studio (R) 2010 Version 10.0.30319.1
- Microsoft Corporation - .NET Compact Framework Version 3.5
- Microsoft Corporation - Internet Explorer Version 9.00.8112.16421
- Microsoft Corporation - Silverlight Plug-In Version 4.0.60310.0
- Microsoft FxCop 1.36 Version 9.0.30729.17
- Microsoft Lync 2010 Version 4.0.7577.0
- Microsoft Malware Protection Version 3.0.8107.0
- Microsoft Office 2010 Version 14.0.5130.5003
- Microsoft Office InfoPath Version 14.0.4763.1000
- Microsoft OneNote Version 14.0.4763.1000
- Microsoft Outlook Version 14.0.4760.1000
- Microsoft XNA Game Studio 3.1 Version 3.1.10527.0
- Microsoft® .NET Framework Version 4.0.31106.0
- Microsoft® DirectX for Windows® Version 9.28.1886.0
- Microsoft® Games for Windows® - LIVE Version 3.4.0054.0
- Microsoft® Windows® Operating System Version 12.0.7600.16385

- MicroVision Development, Inc. - Express Labeler Version 1.0
- Model Technology - QuestaSim Version 5, 2, 2, 0
- ModelSim EE/NT Version 5, 2, 2, 0
- Mozilla Corporation - Firefox Version 3.6.13
- openwatcom.org - Open Watcom Version 1.80
- Parallax, Inc. - BASIC Stamp Editor Version 2.4
- PLT Scheme Inc. - Racket Version 5, 0, 2, 0
- PreEmptive Solutions, LLC - Dotfuscator Community Edition Version 5.0.2300.0
- Process Design GmbH - Named-Server for LLWin Version 1, 0, 0, 5
- Prolog
- ProSign GmbH - Lucky Logik für Windows Version 1.0.0.0
- Python (command line)
- Racket
- RealNetworks, Inc. - RealPlayer (32-bit) Version 12.0.1.609
- RecordNow Version 7.0.0
- ROBO Pro graphical programming language Version 2,1,3,14
- SSH Secure Shell Version 3.2.9
- Sun Microsystems, Inc. - Java(TM) Platform SE 6 U23 Version 6.0.230.5
- The MathWorks Inc. - MATLAB Version 7.11.0.584
- the VideoLAN Team - VLC media player Version 1,1,5,0
- TightVNC Win32 Viewer Version 1.5.2.0
- VMware Converter Hosted Version 3.0.3 build-132753
- VMware vCenter Converter Standalone Version 4.0.1 build-161434
- VMware Workstation Version 6.5.4 build-246459
- VMware, Inc. - vSphere Client Version 4.1.0.12319
- Wolfram Research, Inc. - Mathematica Kernel Version 7, 0, 17, 34024
- Wolfram Research, Inc. - Mathematica Version 7, 0, 17, 34023
- Xilinx Bash shell
- Xilinx Software Development Kit
- YoYo Games Ltd - Game Maker Version 8.0

SENG 208 (MAE LAB):
21 x HP DC7700, Intel Core 2 Quad CPU @ 2.33 GHz, 4GB RAM, 160GB HDD, 64-bit Windows 7, 1 GbE

Operating Hours:
Sunday – Thursday: 8:00am - 12:00am
Friday: 8:00am – 5:00pm
Saturday: 12:00pm – 5:00pm

PC Software List in EN208 Lab:

- (Classkit License) COMSOL Multiphysics 4.1
- Acresso Software Inc. - FLEXnet Publisher (32 bit) Version 11.7.0.0 build 76260
- AdaGide
- Adobe Reader Version 10.0.0.407
- Alexander Roshal - WinRAR archiver Version 3.71.0.0
- Apple Inc. - Bonjour Version 2.0.4.0
- Apple Inc. - iTunes Version 10.1.1.4
- Apple Inc. - QuickTime QuickTime 7.6.9 (1680.9)
- Autodesk - AutoCAD Version 18.1.49.0.0
- Autodesk Design Assistant 2011 Version 15, 0, 0, 1
- Autodesk DWF Application Version 11.0.0.86
- Autodesk Inventor Project Editor 2011 Version 14, 0, 0, 1
- Autodesk Moldflow Inventor Tool Suite Integration 2011 Job Manager
- Autodesk, Inc. - AutoCAD Mechanical Version 2011
- Autodesk, Inc. - DWG TrueView R18.1.49.0.0
- Autodesk, Inc. AddInMgr Version 1, 0, 0, 1
- Autodesk, Inc. FEAFilesHandler Autodesk Inventor 2011
- Autodesk, Inc. MSP Autodesk Inventor 2011
- Autodesk, Inc. TaskScheduler Autodesk Inventor 2011
- Autodesk® Inventor® 2011 Autodesk® Inventor® 2011
- Blender
- CACE Technologies, Inc. - WinPcap Version 4.1.0.1753
- COMSOL 4.1 with MATLAB
- Dept. of Civil & Mechanical Engineering, USMA - WPBD2010 Version 12.00.0005
- Digilent Inc. - Adept Application Version 2.4.2
- Don HO don.h@free.fr - Notepad++ Version 5.86
- dotPDN LLC - Paint.NET Version 3.56.3972.42626
- EAGLE 5.10.0
- Equitrac Express Version 4.1.1.3567
- Equitrac Platform Component Version 4.1.1.3567
- FlashDevelop.org - ASDocGen Version 1.0.0.0
- GNU Visual Debugger
- IDLE (Python GUI)
- Indigo Rose Corporation - Setup Factory 6.0 Runtime Module Version 6.0.0.2
- INTEST Application Version 1, 0, 0, 1
- jGRASP
- jGRASP Startup Settings

- JoCar Consulting - Bricx Command Center Version 3.3
- Larus-Stone pcspim Version 8, 0, 0, 0
- Launch NX session
- LEGO MINDSTORMS NXT Version 2.0
- LTspice IV Version 4.08o
- Macrovision Corporation - LMTOOLS Utility Version 10, 8, 5, 0
- MDSolids Version 3.05
- Mentor Graphics - PCLS_OK MFC Application Version 2, 0, 0, 0
- Mentor Graphics Corporation - Precision Synthesis Version 2010a_Update1.228
- Microsoft (R) Visual Studio (R) 2010 Version 10.0.30319.1
- Microsoft Corporation - .NET Compact Framework Version 3.5
- Microsoft Corporation - Internet Explorer Version 8.00.7600.16385
- Microsoft Corporation - Silverlight Plug-In Version 4.0.60310.0
- Microsoft Corporation - Windows® Search Version 7.00.7600.16385
- Microsoft Lync 2010 Version 4.0.7577.275
- Microsoft Office 2010 Version 14.0.5130.5003
- Microsoft Office InfoPath Version 14.0.4763.1000
- Microsoft OneNote Version 14.0.4763.1000
- Microsoft Outlook Version 14.0.4760.1000
- Microsoft XNA Game Studio 3.1 Version 3.1.10527.0
- Microsoft® .NET Framework Version 4.0.31106.0
- Microsoft® DirectX for Windows® Version 9.28.1886.0
- Microsoft® Games for Windows® - LIVE Version 3.4.0054.0
- Microsoft® Windows® Operating System Version 12.0.7600.16385
- MicroVision Development, Inc. - Express Labeler Version 2.1
- MindVision Software - Installer VISE Version 3.1.1
- Model Technology - QuestaSim Version 5, 2, 2, 0
- ModelSim EE/NT Version 5, 2, 2, 0
- Mozilla Corporation - Firefox Version 3.6.13
- openwatcom.org - Open Watcom Version 1.80
- Parallax, Inc. - BASIC Stamp Editor Version 2.4
- PLT Scheme Inc. - Racket Version 5, 0, 2, 0
- PreEmptive Solutions, LLC - Dotfuscator Community Edition Version 5.0.2300.0
- Prolog
- ProSign GmbH - Lucky Logik für Windows Version 1.0.0.0
- Python (command line)
- Racket
- RealNetworks, Inc. - RealPlayer (32-bit) Version 12.0.0.879
- ROBO Pro graphical programming language Version 2,1,3,14
- SPACE.com, Canada, Inc. - Starry Night Version 3.1.2

- SRS Premium Sound Version 1.10.1.0
- SSH Secure Shell Version 3.2.9
- Sun Microsystems, Inc. - Java(TM) Platform SE 6 U23 Version 6.0.230.5
- The MathWorks Inc. - MATLAB Version 7.11.0.584
- the VideoLAN Team - VLC media player Version 1,1,5,0
- TightVNC Win32 Viewer Version 1.5.2.0
- VMware Converter Hosted Version 3.0.3 build-132753
- VMware vCenter Converter Standalone Version 4.0.1 build-161434
- VMware Workstation Version 6.5.4 build-246459
- VMware, Inc. - vSphere Client Version 4.1.0.12319
- Wolfram Research, Inc. - Mathematica Kernel Version 7, 0, 17, 34024
- Wolfram Research, Inc. - Mathematica Version 7, 0, 17, 34023
- Xilinx Bash shell
- Xilinx Software Development Kit
- YoYo Games Ltd - Game Maker Version 8.0

Linux Remote Access Terminal Server

Dell PowerEdge 2950, Intel Xeon Dual Quad Core @ 3.0 GHz, 64GB RAM, 300GB HDD, 1 GbE, running Suse Linux 10.x. OS and the following software packages:

- Cadence Design Tools
- Synopsys Design Tools
- Mentor Graphics Design Tools

Wireless access available in most buildings on campus

IT Support

The University has an instructional technology department. This department provides Campus wide open labs, technology in classrooms and supports IT access for most of the campus. Their technology is replaced on a three year cycle and that equipment is paid for out of a campus wide technology fee of $5.00 per credit hour. They support primarily Windows 7 Enterprise. While this equipment supports the needs of most departments, those within EAS have greater needs for specialized equipment.

Owing to their greater need, EAS maintains its own IT department. That department is funded by instructional fees. The fee structure for academic year 2008-09 is $15 per EAS credit hour with a maximum of $180 per student per semester. This applies to all courses offered in the EAS with the exception of graduate thesis courses. There are no additional fees levied within the College. The purpose of the fee is to assist the College in providing exceptionally high-quality instruction, including but not limited to, support for all instructional labs managed by EAS, support for faculty office equipment used in instruction, support for the College IT network and servers, college or departmental help centers or instructional supplements provided by students for students, and students run mentoring programs. Departments and programs are invited to submit proposals for new equipment (not replacement equipment) or other legitimate uses of the Program Fees.

The computer equipment in the laboratories of the College is maintained by one full-time staff and Student-Assistantship positions. They are responsible for the equipment owned by the college and departments. The IT Department also has a small annual budget for equipment maintenance that is spent on maintenance contracts, software licenses, computer parts, computer system replacement and new equipment used for research purposes.

Student Access
24/7 hours Remote Access to Windows and Linux Servers

EAS IT provides students and faculty with Remote Access Terminal Service (RATS) to two Window 2008 R2 Server and a SuSE Linux Server with licensed software packages used in various classes. It allows students to access remotely these software packages and computing facilities at home anytime via UCCS Virtual Private Network.

One server runs Windows 2003 R2 operating system and contains software packages such as MATLAB R2008b, Mathematica, Ansoft including Ansoft Designer, HFSS, Q3D Extractor, ePhysics 3 and Optimetrics, Comsol, Mathworks/Matlab, Agilent Advanced Design Systems. It can be accessed using Windows Remote Desktop Client, Mac Remote Desktop Client, or Linux RDESKOP client to connect to host rats.eas.uccs.edu.

The other server runs SuSE Linux Enterprise Desktop 11 64 bit operating system with OpenMPI and NoMahine NX Enterprise Terminal server and contains Mathworks/Matlab, Mentor Graphics, Synopsys, VORPAL 3.0.2, Agilent Advanced Design Systems, Cadence Design Systems. It can be access using using NoMachine NXclient(graphical remote desktop client) or ssh (shell environment) to host lats2.eas.uccs.edu
Faculty and students can access the EAS-NISSSC data center facilities via UCCS VPN 24x7. Most of the virtual machines and servers are behind the UCCS firewall for protection.

Columbine Hall Lab Hours

- Monday – Friday 8:00 am – 10:00 pm
- Saturday 8:00 am – 5:00 pm
- Sunday: Closed

EL Pomar Labs (Kraemer Family Library) Computer Assistance Desk Hours

- Fall / Spring Hours
- 7:30 am – 12:00 am (MON- THU)
- 7:30 am - 8:00 pm (FRI)
- 10:00 am – 8:00 pm (SAT)
- 11:00 am - 12 am (SUN)

Engineering Building Labs

- Monday – Thursday 8:00am – 12:00am
- Friday 8:00 am – 5:00 pm
- Saturday 12:00 pm – 5:00 pm
- Sunday 12:00 pm – 12:00 am

C. Guidance

Faculty members are experts in the use of tools, equipment, computing resources and laboratories. The guidance starts at the entry-level courses on robotics, logic circuits, and circuits and systems courses. During the first four weeks of these laboratory courses, faculty train the students in using basic equipment, such as oscilloscopes, signal generators, power supplies, multimeters, and logic analyzers. For example, in ECE 2205, Circuits and Systems I, during the first lab assignment, students learn how to use a digital multimeter to measure resistance, current, and voltage. In the third lab assignment, students learn how to use function generators and oscilloscopes. In addition, every lab course has pre-lab assignments. The faculty play an important role in appropriate guidance of tools, equipment, and computing sources by training the laboratory instructors and graduate students who may assist or lead the laboratory sessions. Personnel from EAS-IT support the laboratories with hardware and software maintenance and upgrades.

D. Maintenance and Upgrading of Facilities

Instructional software, laboratory equipment, and maintenance are funded by college-wide instructional fees. Additionally, private and corporate contributions, indirect cost recovery from funded research, other general fund monies, and auxiliary funds are used to equip laboratories. Resources are primarily pooled at the college level, for distribution to departments based on a five-year plan and subject to approval of the dean and available funding. The five-year plan will be available for review at the time of the visit.

E. Library Services

The Kraemer Family Library (Library), located in the El Pomar Center services the faculty, staff and students in all programs at UCCS and is the sole library facility at UCCS. The Library's staff includes nine professional librarians with master's degrees, eleven library technicians in classified staff positions and numerous student employees[13], who serve the entire UCCS campus community comprised of over 370 faculty and more than 9,000 students. One librarian is assigned to serve as liaison to the ECE Department and works with faculty to support collection needs, library instruction, and research assistance.

The Library occupies a total of 108,000 assignable square feet (ASF) in the El Pomar Center with seating space for 1,300 users. In addition, the Library offers 27 group study rooms including a part/child study room and nine computer-equipped study rooms. The Library's "information commons" area includes a computer lab containing nearly 200 personal computers surrounding the Library's reference section. In addition, the area holds a multimedia development lab and an assistive technology lab for students with disabilities. The Library also has an enclosed computer lab/classroom that is frequently used for instructional sessions with classes.

The Library offers a wide range of services to faculty and students including reference assistance in person or via email, telephone or online chat, classroom and one-on-one instruction in the use of Library resources, interlibrary loan including electronic delivery of articles, and campus and remote access to the Library's catalog and numerous electronic databases and journals.

Library Collections

The Library houses a growing collection of over one million physical volumes – books, print journals, microform, videos, DVDs, maps, and government documents – and provides access to an extensive array of electronic resources. The book collection includes over 32,000 volumes in electrical engineering, computer science, and related fields in both print and electronic format. In terms of journal collections, the Library now has a small collection of print journal titles and almost all electrical engineering titles have been converted from print to electronic format. All faculty and students have direct access to the physical holding of all the large research libraries in the states of Colorado and Wyoming through the use of "Prospector," a unified online catalog that allows for identification of and requests for materials available from those libraries with delivery within 3-4 days.

Electrical engineering faculty members are encouraged to submit requests to their Library liaison for purchase of materials and resources to support their teaching or research needs, regardless of format. The Library makes every effort to honor those requests within the constraints of the existing budget; almost all materials requested are acquired. While it is not feasible to own every resource a faculty member or student may need, the Library strives to provide access to the universe of resources available through services such as "Prospector" or other interlibrary loan (ILL) methods.

[13] Library staff comprise of 26.5 FTE positions.

Electronic Access

Most of the Library's electronic resources are purchased through cooperative agreements, many at the statewide or University-wide levels. The Library actively seeks such cooperative purchases to reduce its per-resource costs and at the same time increase the number of resources available to its users.

The Library's online resources include journal collections and e-books from the following major publishers: IEEE, ACM, ScienceDirect (Elsevier), Wiley, Springer, SPIE, American Institute of Physics, American Physical Society, ASME, Optical Society (OpticsInfobase), Cambridge University Press, Sage, Institute of Physics, Oxford University Press, nature, and Taylor and Francis. Several of these resources (IEEExplore, ACM Digital Library, SPIE, ASME, etc.) include access to the conference proceedings literature in electrical engineering and computer science as well. The Library subscribes to a number of major indexing and abstracting resources that cover the electrical engineering literature including Engineering Village 2 (INSPEC and Compendex), MathSciNet, and Scopus. In addition, the Library offers e-book collections from NetLibrary, Knovel, Sprign, SPIE, IEEE and Books 24x7 that include numerous titles in electrical engineering and related fields.

All electronic resources are available through links on the Library's website. Electrical engineering faculty and students can access the resources 24/7 from any computer on campus or from anywhere off-campus by establishing a VPN connection to the campus network. The Library uses a link resolver, SerialSolution, to provide an A-Z listing of available journal titles and links from various resources to the available full-text of articles. This includes links to many free or open-access recourses. Links can also be added to search engines such as Google Scholar and Scirus.

The Library facilities are adequate for the BSEE program. ECE Department has a faculty member as a liaison to Library. The Liaison collects and makes requests for books or articles for Library procurement.

F. Overall Comments on Facilities

Safety guidelines to ensure the facilities, tools, and equipment used in the BSEE program are safe for their intended purposes are posted in each laboratory. At the beginning of the semester, laboratory faculty review the safety guidelines with students during class time. The faculty also hand out safety guideline documentation with each course syllabus. During the laboratory coursework, faculty and lab assistants also ensure that safety protocols are followed. A copy of the safety guidelines is located in Supplemental Information.

GENERAL CRITERIA

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

Describe the leadership of the program and discuss its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the program.

The ECE Chair provides leadership to the program. The ECE Chair meets with the faculty regularly during faculty meetings as well as one-on-one discussions. The Department has an undergraduate committee to discuss and present undergraduate course and program issues to the faculty and ECE Chair. These issues and concerns are discussed in the faculty meetings. In addition, the executive committee of the department is chaired by the ECE Chair and discusses challenges and resource allocation for the BSEE program with the faculty and the EAS Dean. The ECE Chair also regularly meets with the EAS Leadership committee, consisting of the other department chairs, assistant dean, etc. the EAS Leadership committee meets twice a month to make decisions which affect the BSEE program, among the other EAS programs. A faculty member meets with lecturers in a leadership role to see that quality is maintained in the course including course content, textbook selection and other needed guidance. The ECE annual professional development budget of $6,000 is inadequate to have an aggressive program for faculty development, yet, the ECE Department has allocated funds efficiently and cost effectively to regularly send faculty to present papers at conferences and to attend contemporary industry-focused workshops. The ECE Chair is determined to support the faculty in their professional development opportunities.

B. Program Budget and Financial Support

1. *Describe the process used to establish the program's budget and provide evidence of continuity of institutional support for the program. Include the sources of financial support including both permanent (recurring) and temporary (one-time) funds.*

   Campus leadership provides an annual fiscal year recurring budget to the College from state monies with line items for Operating, Travel, Student Hourly, Instructional Assistant Salaries, Lecturer Salaries, and Faculty salaries. The Dean of the College distributes from the recurring Operating budget an equal amount to the three departments for operations. The Travel, Student Hourly, and Lecturer Salaries budget from campus are supplemented by the recurring and temporary Faculty Salary savings, indirect cost recovery funds from research expenditure, and external gift money to address College and Department needs in instruction, operations, and research.

   The College maintains a plan for instructional needs that is updated on a periodic basis with input from Department chairs. The College Dean ensures that the instructional needs are met from Faculty Salary savings. The Dean, working with the College Financial Assistant, prepares a budget for the upcoming fiscal year in early spring of each year. The budget also includes approximate budgeting for the four fiscal years following the upcoming year. The budget is presented and discussed at one or more College Executive Committee meetings during the spring semester. Once consensus is reached, the budget is adopted for the upcoming year.

Student fees are collected for classes taken in the College of Engineering and Applied Science. These fees are used for maintenance and purchase of equipment for all teaching laboratories within the College.

2. *Describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc.*

The EAS instructional budget is provided by the Campus on a continuing basis to support part-time instruction, course assistants, and graders, as organized above in Part 1. The College uses temporary funds to support graduate assistantships with teaching assignments. Instructional resources are pooled at the College level, and allocated to the Departments based on factors including enrollment, faculty workload policy, and personnel changes (e.g. retirements, new hires, and sabbatical assignments).

3. *To the extent not described above, describe how resources are provided to acquire, maintain and upgrade the infrastructures, facilities and equipment used in the program.*

No additional comment.

4. *Assess the adequacy of the resources described in this section with respect to the students in the program being able to attain the student outcomes.*

The program budget and financial support resources described above are very adequate to maintain the achievement of the student outcomes. Office and grader support for faculty is sufficient for faculty to achieve excellence in delivering courses. The year-to-year budget and budget process allows for stability and multi-year planning. The revenue stream from student fees allows the laboratory equipment to be maintained adequately, and to be upgraded or adapted, as needed, for continuous improvement as technology advances.

C. Staffing

Describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the program. Discuss methods used to retain and train staff.

The staff (administrative, instructional and technical) for ECE is adequate to support the BSEE program to meet the Program Educational Objectives and to support the students in achieving student outcomes.

There is one full-time administrative staff member assigned solely to the department. ECE Laboratories are overseen by a full-time technician, who shares duties in support of the laboratory equipment for both the ECE and MAE Departments. For the 2011-2012 academic year, the ECE Department will have a full-time technician devoted to the ECE Laboratories. The search is currently underway to fill this position. The ECE Department is also supported by additional shared college staff, including a full-time college financial assistant and a grants administrator. In addition, the department is supported by a full-time undergraduate Engineering Advisor (EA) who advises all freshmen, undecided engineering students, and transfer students. The EA also conducts senior audits for graduating seniors. Additionally the ECE Department is supported by a part-time Internship Coordinator for the EAS College and a full-time Director of Student Support for the college. Further, the College of EAS has an IT department (separate from campus IT) with a full-time IT professional and several part-time aides.

D. Faculty Hiring and Retention

1. *Describe the process for hiring of new faculty.*

The need for new faculty and the area of expertise are discussed in faculty meetings. The ECE Chair makes the case for the requirement of faculty positions to the EAS Dean. The Dean receives similar requests from other College Departments. After the Dean's approval of the faculty position, the ECE Chair, in consultation with the faculty, develops the requisition for the faculty position for approval by Dean. The faculty chooses the search committee which is also approved by the Dean. The position is advertised for national and international search through solicitations satisfying the University's Equal Opportunity Employment Policy.[14] The search committee screens the applications and decides the candidates to be interviewed. The faculty candidates are interviewed by faculty, Dean, and Provost. The search committee recommends a candidate based on input from faculty to the Dean. With the approval of the Dean the ECE Chair makes an initial offer. If the negotiations are not fruitful then a second candidate approved by the faculty is forwarded to the Dean for consideration.

2. *Describe strategies used to retain current qualified faculty.*

There are various strategies to retain current qualified faculty. One of the strategies is the faculty are given options to teach a majority of courses in which they have passion to teach. Each member of the faculty has options to teach graduate courses so that they can

[14] See Supplemental Information for a copy of the EOE Policy.

identify graduate students to assist their own research activities. The faculty are encouraged to develop new under graduate/graduate courses in new emerging areas. There are significant number of local industries. The graduate students coming from these local industries are matured and motivated which excites faculty to be current and innovative. The ECE Department and the College strive hard to fund the state-of-the-art tools for instruction and research. Although resources are limited, the ECE Chair works with the EAS Dean to meet the instruction and research needs of the faculty. The campus emphasizes diversity so that faculty can work effectively in a cross-cultural environment. The Department has invested significantly in developing laboratories in the area of microelectronics, electromagnetics, control systems, and communications and signal processing to facilitate new research and innovative instruction. Faculty are allowed to professionally consult for $1/6^{th}$ of their workload time. Faculty are encouraged to become involved in entrepreneurial activities for the progression of local economic development as well as support local industry sponsors. Faculty are offered workload activities which not only meets their fulfillment requirements, but also the needs of the College.

E. Support of Faculty Professional Development

Describe the adequacy of support for faculty professional development and how such activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.

All EAS faculty have automatic access to limited travel funds to attend professional conferences and workshops. Participation in conferences and professional organizations is encouraged. Other opportunities for participation in professional development or professional organizations is supported via funded research projects, campus research support such as industry-sponsored support and federally-funded grants, as well as the EAS Research Development Committee (RDC). The University of Colorado system offers a sabbatical program for which all faculty become eligible after six years of full-time service. The sabbatical program is heavily focused on faculty professional development and requires a sabbatical plan as part of the application, and a report describing accomplishments and fulfillment of the plan upon completion of the sabbatical. Altogether, these various avenues for faculty development support provide adequate resources. While it would certainly be desirable to have greater resources in this area, the support necessary for maintaining professional competence, maintaining and improving classroom teaching and learning, and progressing toward rank advancement and tenure are in place.

GENERAL CRITERIA

PROGRAM CRITERIA

Describe how the program satisfies any applicable program criteria. If already covered elsewhere in the self-study report, provide appropriate references.

The structure of BSEE program is described in detail in Criterion 5, affirming that the structure of the curriculum provides both breadth and depth across the range of engineering topics related to electrical engineering.

The curriculum includes probability and statistics (ECE 3610, Engineering Probability and Statistics) and the following core courses appropriate to the BSEE program: ECE 1001, Introduction to Robotics; ECE 1411, Logic Circuits I; ECE 2411, Logic Circuits II; ECE 2610, Introduction to Signals and Systems; ECE 2205, Circuits and Systems I; ECE 3205, Circuits and Systems II; ECE 3210, Electronics I; 3220 Electronics II; ECE 3050, Physical Electronics; ECE 3110, Electromagnetics I; and ECE 3430, Microprocessor Systems.

Students also complete high-level mathematics courses, including differential equations, linear algebra, complex variables, and discrete mathematics topics, and high-level sciences courses, such as biological, chemical, or physical science). BSEE students are exposed to engineering topics necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components throughout their academic plan.

As upper-level undergraduate engineering students, the opportunity to learn an electrical engineering specialty such as VLSI Design, Communications and Signal Processing, Physical Electronics and Controls is available through technical electives and interaction with other students and industry professionals during the two-semester capstone, ECE 4890 & ECE 4899, Senior Design Seminar and Project.

A. Course Syllabi

B. Faculty Vitae

C. Equipment

D. Institutional Summary

E. Advisory Board

F. Exit Interview Surveys

G. Alumni Surveys

H. Course Assessment Materials

A- Course Syllabi

1. ECE 1001, Introduction to Robotics

2. 3 credits, 40 contact hours

3. Instructor: Robert Kressin

4. Textbook: "Lego Mindstorms NXT Power Programming," John C. Hansen, 2009
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      An introductory course presenting foundational material in the design of robots. Topics include basic properties of sensors, motors, gears, drive mechanisms, control schemes and processors to guide and control robots. Lego kits will be used to implement student designs
   b. *Prerequisites or co-requisites:*
      None.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Ability to complete directed laboratory exercises as a team, involving hardware, software, and report write up
      - Ability to extend beyond the directed laboratory exercises to create solutions to more complex problems
      - Ability to manage a design project, including design proposal, Gantt charts, and progress reports.
      - Ability to complete a design project.
      - Ability to effectively deal with teamwork interference of "hitchhikers" and "couch potatoes."
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics science and engineering
      (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 solution in a global, economic, environmental and social context
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Introduction to RCX and NQC
   - Construction
   - Basic control, electronics, and sensors
   - Microprocessor designs

- Cybernetics
- Competition trial run
- Assembly, test and debug
- Project and competition

1. ECE 1021, Computer-Based Modeling and Methods of Engineering

2. 3 credits, 40 contact hours

3. Instructor: Ankur Chattopadhyay

4. Textbook: "C How to Program," P.J. Deitel, 2006
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Methodology for solving engineering problems is introduced. Fundamental features of the C programming language are presented and integrated with a variety of engineering examples and applications. Pointer variables and structures will be used in the applications.
   b. *Prerequisites or co-requisites:*
      ECE 1001 and MATH 1350.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Correctly write all basic C structures (if, for(switch…) for a give simple application
      - Write a moderately complex C program
      - Understand how to break a problem down into solvable pieces
      - Learn to implement a small software system (optional class project)
   b. *Criterion 3 student Outcomes:*
      (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
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Introduction to C programming language: history, printing, calculations, memory, components and operators
   - Structured Development: algorithms, pseudocode, flowcharts, control structures, selection statements, repetition, nested control structures
   - C Program Control: for, switches, do…while, break and continue structures; logical operators and assignments
   - C Functions: modules, library functions, call stack and activation records, random number generation, classes, scope, recursion and iteration.
   - C Arrays: defining, passing arrays to functions, sorting and searching, multiple scripted arrays

- C Pointers: definitions and initialization, operators, passing arguments to functions by reference, bubble sort, relationship between pointers and arrays and vice versa, pointers to functions
- C Characters and Strings: character libraries, passing to functions by reference, string-conversion functions, standard Input/Output library functions, memory and search
- C Formatted Input/Output: streams, printf, integers, floating-point numbers, strings and characters, conversion specifiers, field widths and precision, scanf and escapes
- C Structures, Unions, Bit Manipulations and Enumerations
- C File Processing: hierarchy, file and streams, sequential-access files, random-access files, reading data
- C Data Structures: self-referential structures, dynamic memory allocation, linked lists, stacks, queues, trees.

1. ECE 2050, Introduction to Physical Electronics

2. 3 credits, 40 contact hours

3. Instructor: Ricardo Unglaub (staff)

4. Textbook: "Principles of Electronic Materials and Devices," S.O. Kasap, 2006
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      An introductory course on the fundamental properties of materials and semiconductors in preparation for a background in modern device physics and technology. Topics include: Crystal Structure, Quantum Theory of Solids, and Transport and Excess Carriers in Semiconductors.
   b. *Prerequisites or co-requisites:*
      MATH 3400 and PES 2130.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - The ability to understand the underlying mathematical and physical principles of materials and semiconductor physics applicable to materials and electronic devices
      - Understanding of modern physics concepts such as quantum states, energy bands, statistics, etc.
      - Understanding of transport phenomena such as drift, diffusion, photoconductivity, etc.
      - Understanding of the operation of special devices such as photoconductors, special junctions, etc.
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science, and engineering
      (j) a knowledge of contemporary issues
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Bonding, Crystal Structure, Thermodynamics.
   - Conduction in Metals
   - Wave-Particle Concepts
   - Schrodinger equation, Bound Electron, H-Atom
   - Quantum Theory of Solids, Band Theory, and Effective Mass
   - Semiconductor Fundamentals
   - Band Diagrams, Charge Carriers, Conductivity
   - Equilibrium Carrier Concentrations and Fermi Statistics

- Excess Carriers in Semiconductors
- PN-Junction
- Band Diagrams and Built-In Potential
- Abrupt Junctions
- Current Flow and Biasing
- Transient Conditions

1. ECE 2205, Circuits and Systems I

2. 4 credits, 80 contact hours

3. Instructor: Chi-Jiu Wang

4. Textbook: "Circuit Analysis: A Systems Approach," R. Mersereau, J. Jackson, 2005
    a. Other supplemental materials:
       None.

5. Specific Course Information
    a. *Catalog description:*
       Modeling and analysis of analog circuits and linear systems. Kirchoff's current and voltage laws. Uses time-domain methods and s-domain transfer functions to solve differential equations of first and second order RLC circuits with op amps. Transient and steady-state response to steps and complex exponentials. Zero-input, zero-state, and initial-state response. Introduction to circuit simulation.
    b. *Prerequisites or co-requisites:*
       ECE 2610.
    c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
       Required

6. Specific goals for the course
    a. *Outcomes of Instruction:*
       - Read, interpret and critically access electrical circuits
       - Analyze electrical circuits using time domain techniques
    b. *Criterion 3 student Outcomes:*
       (a) an ability to apply knowledge of mathematics, science, and engineering
       (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7. Brief list of topics to be covered:
    - Circuit Elements and Models
    - Writing Circuit Equations
    - Sub-networks
    - Operational Amplifiers
    - Capacitors and Inductors
    - Series RC and RL Time-Domain Solutions
    - Laplace Transforms
    - Circuits in the Laplace Domain
    - Second-Order RLC Circuit Analysis
    - System Functions

1. ECE 2411, Logic Circuits II

2. 2 credits, 40 contact hours

3. Instructor: Robert Kressin

4. Textbook: "Digital Design," M. Morris Mano and Michael D. Ciletti, 2006
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Covers sequential circuits design and implementation. Topics include Mealy/Moore machine design, State encoding, states minimization, Verilog HDL modeling of logic circuits, Register Transfer Level Modeling of digital systems, and memory.
   b. *Prerequisites or co-requisites:*
      ECE 1411.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Use of ASM and FSM charts for design
      - Use of industry standard VHDL software
      - Register Transfer Logic approach for system designs
      - Fundamental knowledge of sequential logic circuits
   b. *Criterion 3 student Outcomes:*
      (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
      (e) an ability to identify, formulate, and solve engineering problems
      (i) a recognition of the need for, and 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
7. Brief list of topics to be covered:
   - Sequential Logic Analysis and Design
   - Sequential Logic Implementation Using Verilog, Modelsim, and ISE
   - Complex Sequential Logic Circuits: Registers, Counters, Pattern Detectors
   - ASMD Charting for Complex Sequential Logic Design
   - Introduction to Verilog
   - Introduction to Field Programmable Gate Arrays

1. ECE 2610, Introduction to Signals and Systems

2. 4 credits, 80 contact hours

3. Instructor: Mark Wickert

4. Textbook: "Signal Processing First," James H. McClellan, Ronald W. Schafer, Mark A. Yoder, 2003
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Mathematical representation of signals and systems; spectrum representation; representation of signals by sample values; discrete-time filter characterization and response; the z-transform; continuous-time signals and linear, time-invariant systems; frequency response; continuous-time Fourier transform and application to system analysis. Matlab basics with application to signals and systems. Includes lectures, demonstrations, and laboratory assignments.
   b. *Prerequisites or co-requisites:*
      ECE 1021 and MATH 1360.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Complex math
      - Phasor addition
      - Line spectra and Fourier series modeling
      - Sampling and aliasing
      - Convolution sum
      - Frequency response
      - Z-domain methods: LCCDE structures and H(z), pole-zero and frequency response, and partial faction methods for inverse z-transform
   b. *Criterion 3 student Outcomes:*
      (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
      (e) an ability to identify, formulate, and solve engineering problems
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Sinusoids
   - Spectrum Representation
   - Sampling and Aliasing
   - FIR filters

- Frequency response of FIR filters
- z-Transforms
- IIR Filters
- Continuous-time Signals and Systesm
- Frequency Response
- Continuous-time Fourier Transform
- Filtering, Modulation, and Sampling

1. ECE 3020, Semiconductor Devices I

2. 3 credits, 40 contact hours

3. Instructor: Kanhao Xue (staff)

4. Textbook: “Semiconductor Physics And Devices,” Donald Neamen, 2002
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      An introduction to semiconductor devices used in modern microelectronic technologies. The course objective is to provide an understanding of the fundamental physical principles and concepts underlying the operation and use of the most important semiconductor devices.
   b. *Prerequisites or co-requisites:*
      ECE 2050 and ECE 2210 or ECE 2205.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Understanding of physical principles in modern microelectronic technologies
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Crystal structure and Miller indices
   - Basic concepts in quantum mechanics and 1-D Schrödinger equation
   - Band theory and Fermi level
   - Boltzmann distribution and Fermi distribution
   - Holes in semiconductors
   - Extrinsic semiconductor
   - Calculation of carrier concentration
   - Transport equations, Drift and Diffusion
   - Excess carriers
   - The pn junction

1. ECE 3110, Electromagnetic Fields I

2. 3 credits, 40 contact hours

3. Instructor: Heather Song

4. Textbook: "Fundamentals of Applied Electromagnetics," Fawwaz T. Ulaby, 2010
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Static electric and magnetic field analysis, Poisson's and Laplace's equations, steady electric current, fields of steady electric currents, ferromagnetic materials, boundary-value problems for static fields, time-varying electric and magnetic fields, and Maxwell's equations and wave equations. Relationship between field and circuit theory.
   b. *Prerequisites or co-requisites:*
      ECE 2210 or ECE 2205.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Ability to analyze and understand electromagnetic field problems that arise in various branches of engineering
      - Ability to apply electromagnetic field concepts applications
      - Ability to understand the underlying mathematical and physical principles of electromagnetic fields
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (j) a knowledge of contemporary issues
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7. Brief list of topics to be covered:
   - Waves and Phasors
   - Transmission Lines
   - Vector Analysis
   - Electrostatics
   - Magnetostatics

1. ECE 3205, Circuits and Systems II

2. 4 credits, 80 contact hours

3. Instructor: Chia-Jui Wang

4. Textbook: "Circuit Analysis: A Systems Approach," R. Mersereau, J. Jackson, 2006 and "Fundamentals of Signals and Systems," E.W. Kamen and B.S. Heck, 2007
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      A continuation of topics introduced in ECE 2205. Also, phasors, sinusoidal steady-state response, impedance models, Fourier series and Laplace transforms. Computer-aided design of active and passive analog filters. Includes lectures, demonstrations, and laboratory assignments.
   b. *Prerequisites or co-requisites:*
      ECE 2205.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Ability to use Phasor and Fourier analysis as tools for analyzing circuits
      - Demonstrated understanding of basic power concepts and circuit design for maximum power transfer
      - Students will exhibit an understanding or analog and digital filter design techniques
      - Ability to effectively evaluate experimental data using analysis and/or simulation as a basis for comparison
   b. *Criterion 3 student Outcomes:*
      (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
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Phasors
   - Sinusoidal steady-state response
   - Impedance models
   - Fourier series and laplace transforms
   - Computer-aided design of active and passive analog filters

1. ECE 3210, Electronics I

2. 3 credits, 40 contact hours

3. Instructor: Chi-Jui Wang

4. Textbook: "Microelectronic Circuits," Adel S. Sedra and Kenneth C. Smith, 2009
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      The application of semiconductor devices to the design of electronic circuits. Topics include diode circuits and applications, low frequency transistor amplifier design and switching theory.
   b. *Prerequisites or co-requisites:*
      ECE 2210 or ECE 2205.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Read, interpret and critically access analog circuit design methods.
      - Write technical project reports on transistor designs
      - Analyze and synthesize real-world analog transistor
      - Design analog transistor circuits using engineering knowledge and software tools.
      - Function as a design engineer
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (h) the broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Semiconductor devices for design of electronic circuits
   - Diode circuits and applications
   - Low frequency transistor amplifier design
   - Switching theory

1. ECE 3220, Electronics II

2. 3 credits, 40 contact hours

3. Instructor: Chi-Jui Wang

4. Textbook: "Microelectronic Circuits," Adel S. Sedra and Kenneth C. Smith, 2009
    a. Other supplemental materials:
    None.

5. Specific Course Information
    a. *Catalog description:*
    Transistor models used in circuit design at high frequencies: multistage amplifier design, frequency response of amplifiers, feedback, operational amplifiers, and distortion.
    b. *Prerequisites or co-requisites:*
    ECE 2220 or ECE 3205 and ECE 3210.
    c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
    Required

6. Specific goals for the course
    a. *Outcomes of Instruction:*
        - Design systems with power consumption requirements
        - Design modern multistage transistor circuit to required specifications
        - Understand global impacts of inefficient and not-to-specification based systems
        - Solve specific design problems
        - Design at the transistor level from system specifications
        - Analyze equivalent impedance circuits
        - Learn and use industry standard design tools and design simulators
    b. *Criterion 3 student Outcomes:*
    (a) an ability to apply knowledge of mathematics, science and engineering
    (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
    (e) an ability to identify, formulate, and solve engineering problems
    (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
    - Bipolar Junction Transistors
    - Integrated Circuit Amplifiers
    - Differential and Multistage Amplifiers
    - Frequency Response
    - Feedback
    - Output stages
    - Operational Amplifier Circuits

1. ECE 3230, Electronics Laboratory I

2. 1 credits, 27 contact hours

3. Instructor: Bob Kressin

4. Textbook: "Microelectronic Circuits," Adel S. Sedra and Kenneth C. Smith, 2009
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Design and implementation of power supplies, amplifiers with bipolar junction transistors, junction field effect transistors and MOSFETS. In addition, basic circuit design with operational amplifiers will also be performed.
   b. *Prerequisites or co-requisites:*
      Co-req: ECE 3210.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Build on skills and knowledge from prior courses
      - Create design solutions based on modern electrical system complexity and challenges
      - Ability to research data sheets and creation of life-long learning methods
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (b) an ability to design and conduct experiments a well as to analyze and interpret data
      (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
7. Brief list of topics to be covered:
   - Using test and measurement equipment effectively
   - Design, Build, and Simulation of Operational Amplifier Circuit
   - Design, Build, and Simulation of Diode Circuit
   - Design, Build, and Simulation of an Oscillator

1. ECE 3240, Electronics Laboratory II

2. 1 credits, 27 contact hours

3. Instructor: Robert Kressin

4. Textbook: "Microelectronic Circuits," Adel S. Sedra and Kenneth C. Smith, 2009
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Continuation of ECE 3230. Design of differential amplifiers with discrete components, analysis of frequency response, frequency compensation techniques, feedback amplifier design, power amplifiers, oscillator and simple subsystem design.
   b. *Prerequisites or co-requisites:*
      Pre-req: ECE 3230; Co-req: ECE 3220.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Design and complete transistor level projects using hand calculations, simulations, and hardware result analysis
      - Design projects constrained by power consumption, available technology and safety
      - Work as interchangeable team of two or more for various projects including oral and visual presentations to a group
      - Design projects building on the educational foundation of all previous academic courses
      - Ability to research data sheets and creation of life-long learning methods
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (b) an ability to design and conduct experiments a 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
      (g) an ability to communicate effectively
      (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
7. Brief list of topics to be covered:
   - n-Channel MOSFET Characterization
   - Single-Stage FET Amplifier Design

- Differential BJT Amplifier Design
- SPICE Simulation Using LTSpice
- Printed Circuit Board Design
- Basic Soldering Skills

1. ECE 3420, Microprocessor Systems Laboratory

2. 1 credits, 27 contact hours

3. Instructor: John Carlin (staff)

4. Textbook: "MSP430 Microcontroller Basics," John H. Davies, 2008
    a. Other supplemental materials:
    None.

5. Specific Course Information
    a. *Catalog description:*
    Introduction to microprocessor development systems and foundations of system design. Assembly language will be used in the development. Use of high-level languages will also be discussed.
    b. *Prerequisites or co-requisites:*
    Pre-req: ECE 1411; Co-req: ECE 3430.
    c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
    Required

6. Specific goals for the course
    a. *Outcomes of Instruction:*
        - Application of theory covered in lecture to method in lab assignments
        - Troubleshooting for alternative solutions to challenges
        - Build a simple circuit based on a provided schematic
        - Demonstrated understanding of microcontroller architecture and peripherals to complete lab assignments
    b. *Criterion 3 student Outcomes:*
    (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
    (e) an ability to identify, formulate, and solve engineering problems
    (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
    - Bread Boarding
    - LED Manipulation
    - Addressing and Arithmetic
    - Branch/Jump Instructions and Conditional Execution
    - Subroutines and Drivers
    - Interrupt Handling
    - Timers

1. ECE 3430, Introduction to Microcomputer Systems

2. 3 credits, 40 contact hours

3. Instructor: Matt Laubhan (staff)

4. Textbook: "MSP430 Microcontroller Basics," John H. Davies, 2008
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Design of microcomputer systems including assembly language programming and interfacing techniques. Emphasis is on the practical application of microcomputers as solutions to engineering problems.
   b. *Prerequisites or co-requisites:*
      ECE 1411, co-req. ECE 3420.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Ability to model engineering problems using random variables
      - Solution generation for general microcontroller problems
      - Solution generation for hypothetical, problematic microcontroller situations and alternative solution speculation
   b. *Criterion 3 student Outcomes:*
      (a) an ability to apply knowledge of mathematics, science and engineering
      (e) an ability to identify, formulate, and solve engineering problems
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Peripheral interfacing techniques
   - CPU internals
   - Addressing modes, CPU instructions, and programming model
   - Assembly language (assembler fields and directives)
   - Embedded C programming
   - Flow charting
   - Subroutines (parameter passing techniques)
   - Internally and externally generated interrupts
   - Timers (real-time interrupts, PWM, …)
   - Analog-to-digital and digital-to-analog conversion
   - Input capture/Output compare
   - Serial Peripheral Interface (SPI) and Inter-Integrated Circuit Bus (I2C)

1. ECE 3610, Engineering Probability & Statistics

2. 3 credits, 40 contact hours

3. Instructor: Jennifer Price

4. Textbook: "Introduction to Probability and Statistics for Engineers and Scientists," Sheldon M. Ross, 2009
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      An introduction to probability and statistics with application to solving engineering problems. Includes the axioms of probability, random variables, density functions, distributions functions, expectations. Gaussian random variables, bivariate random variables, sums of independent random variables. Estimation of sample mean and variance. Monte Carlo simulation, binomial, hypergeometric, Poisson counting processes, confidence intervals, reliability, failure rates, the Weibull model, the log-normal model, estimation using regression. Introduction to random processes. Involves a project making use of simulation of random variables on a computer.
   b. *Prerequisites or co-requisites:*
      MATH 2350.
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Ability to model engineering problems using random variables
      - Solve problems containing random variables by using concepts related to distribution functions (joint, marginal, and conditional density functions, mean and variance, correlation, etc.)
      - Analysis of data using concepts from statistics (sampling, distributions, intervals, hypothesis testing, etc.)
   b. *Criterion 3 student Outcomes:*
      (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
      (e) an ability to identify, formulate, and solve engineering problems
      (j) a knowledge of contemporary issues
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   - Data collection and statistics
   - Data sets, graphing to show frequency, histograms, ogives, stem and leaf plots

- Sample mean, median, mode; variance and standard deviation
- Normal vs. Paired Data sets
- Probability: Venn Diagrams and Axioms of Probability
- Random Variable types, jointly distributed random variables, conditional distributions, independent random variables, covariance and variance, law of large numbers
- Special Random Variables: Bernoulli and binomial random variables, the poisson random variable, hypergeometric random variables, uniform vs. normal random variables, Distributions arising from the normal (t- and f-Distributions)
- Distributions of Sampling Statistics: central limit theorem, sample mean, etc.
- Parameter estimation
- Hypothesis testing, non-parametric hypothesis testing
- Regression
- Analysis of Variance
- Quality Control

1. ECE 4890, Senior Seminar

2. 1 credits, 27 contact hours

3. Instructor: Mark Wickert

4. Textbook: "Design for Electrical and Computer Engineers," Salt and Rothery, 2002
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      Design principles and a variety of realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, and social impact; design project organization and design goals; techniques for making oral presentations and organizing written reports; interviewing and resume writing skills along with the art of making a favorable first impression.
   b. *Prerequisites or co-requisites:*
      This course must be taken before ECE 4899
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - To become proficient in the use of library resources and the search for technical information
      - To learn the skills and techniques of oral project presentation
      - To learn good written project report procedures
      - To learn the basics of engineering design
      - To learn the ethical practices in engineering
      - To prepare for the Senior Design project course
   b. *Criterion 3 student Outcomes:*
      (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
      (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 solution in a global, economic, environmental and social context
      (i) a recognition of the need for and 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
7. Brief list of topics to be covered:
   - Proposal presentations

- Library resources and technical research
- Oral and visual presentations
- Team grouping and structure determination
- Presentations and discussions on ethical practices in engineering and the workplace

1. ECE 4899, Senior Design Project

2. 3 credits, 40 contact hours

3. Instructor: Mark Wickert

4. Textbook: None.
   a. Other supplemental materials:
      None.

5. Specific Course Information
   a. *Catalog description:*
      A project lab taken during the last semester of the senior year for the design of system components and systems in the areas of communications, computer engineering, controls, digital signal processing, electromagnetics, microelectronic fabrication processes, or CMOS integrated circuits. Students will identify, select, and complete a design project. Design specification, analysis, design, simulation and/or construction of a successful project is required for completion of the course.
   b. *Prerequisites or co-requisites:*
      ECE 4890 and last semester of the degree
   c. *Type of course, from Table 5-1: Required (R), Elective (E), or Selected elective (SE):*
      Required

6. Specific goals for the course
   a. *Outcomes of Instruction:*
      - Read and interpret literature in electrical engineering
      - Write technical reports and other documentation, and to present oral reports of a technical nature
      - Use basic knowledge in science and mathematics as well as knowledge and tools in engineering disciplines to analyze and synthesize real-world engineering problems
      - Design processes, devices, circuits or systems using engineering knowledge and tolls while considering economics safety, ethics ergonomics and aesthetics
      - Function in an effective manner along or as part of a team, in an engineering capacity.
      - Appreciate the importance of keeping up with the engineering field.
   b. *Criterion 3 student Outcomes:*
      (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
(i) a recognition of the need for and 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

7. Brief list of topics to be covered:
   - Proposal presentations
   - Library resources and technical research
   - Oral and visual presentations
   - Team grouping and structure determination

     Presentations and discussions on ethical practices in engineering and the workplace

B- Faculty Vitae

1. **Name**
   Dr. Thottam S. Kalkur

2. **Education**
   - 1985, Ph.D, Electrical and Electronic Engineering, University of Western Australia.
   - 1973, B.Sc Physics and Electronics, University of Mysore, India
   - 1979, M.Tech, Electronics and Instrumentation, Indian Institute of Science, India
   - 1975, M.Sc Solid State Physics, University of Mysore, India

3. **Academic experience – *institution, rank, title, when, full time or part time***
   - 2007-present Chair, Dept. of Electrical and Computer Engineering, UCCS
   - 1997- present Professor, Dept. of Electrical and Computer Engineering, UCCS
   - 1991-1997 Associate Professor (tenured), UCCS
   - 1987-1991 Assistant Professor, UCCS
   - 1985-1987 Visiting Asst. Professor, UCCS.
   - 1983 Post Graduate Research, University of Western Australia.
   - 1975 Lecturer, St. Agnes College, Mangalore, India

4. **Non-academic experience – *company or entity, title, brief description of position, when (ex. 1993-1999), full time or part time***
   - 2006-2009 Chief Editor, Journal on Active and Passive Components.
   - 2000-2004 Atmel Corporation, Visiting Faculty Researcher.
   - 2000-2001 Vitesse Semiconductor, Visiting Faculty Researcher
   - 1992-1993 Visiting Faculty Researcher, Hewlett-Packard Laboratories, Palo Alto, CA
   - 1979-1982 Assistant Executive Engineer, Integrated Circuit Laboratory, Indian Telephone Industries.

5. **Professional memberships**
   - IEEE, member
   - Material Research Society, member
   - ECEDHA, member

6. **Honors and awards**
   - National Science Foundation Research Initiation Award.
   - 1997 - UCCS College of Engineering and Applied Science, Outstanding Teacher Award
   - 2002 - UCCS College of Engineering and Applied Science, Outstanding Researcher Award
   - 2004 - UCCS Faculty Excellence in Research Award

7. **Service activities**
   - IEEE Pikes Peak Chapter CAS/ED chairman, NSF review panel, EAS Executive committee, Ph.D. Governance Committee Chair, NCA committee chair on Discovery,
   - Consultant to various local companies on Circuit Design and Devices.

8. **Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation**
   - Y. Zhang and T.S. Kalkur, “Analysis of distortion in tunable ferroelectric capacitors”, IEEE Transactions on Ultrasonics and Ferroelectrics, vol. 57, 6, 1263-1266, 2010.
   - C. Lin and T.S. Kalkur, “Modeling of current crowding foron-chip multi turn differential differential-spiral inductors,”, Eurocon 2009, St. Petersburg, Russia, pp.178-182, 2009.
   - Y. Zhang , T.S. Kalkur and T. Mulcahy, “Ferroelectric varactor based adaptive matching network for RF Amplifier”, Integrated Ferroelectrics, vol. 112, 60-66, 2009.
   - T.S. Kalkur, N. Sbrockey, G.S. Tompa, M. Cole, Jon Spanier and P. Alpay, “Low voltage Tunable Band Pass Filters using BST parallel Plate Capacitors”, vol.112, 4-11, 2009.
   - T.S. Kalkur, N. Sbrockey, G.S. Tompa and P. Alpay, “Design and simulation of Ka band filters with graded BST Varactors,” Integrated Ferroelectrics, vol. 111, 86-93, 2009.
   - A. Kabir, A. Jamil, Y. Zhang and T.S. Kalkur, “Voltage Controlled Oscillators with ferroelectric capacitors”, IEEE Frequency Control Symposium, Honolulu, 414-417, 2008.
   - G. Pauls, T.S. Kalkur, PLL jitter reduction by utilizing a ferroelectric capacitor as a VCO timing element”, Ultrasonics, Ferroelectrics and Frequency Control, IEEE Transactions on , Volume 54, Issue 6, June 2007 Page(s):1096 – 1102
   - Ali Muhhamad, T.S. Kalkur and N. Cramer, “1 GHz Active Phase Shifter Based on Tunable High-Dielectric Constant BST Thin Films”, IEEE Microwave and guided letters, vol.16, 261-263, 2006.
   - Nasheed Afreen and T.S. Kalkur, “Matching networks Implemented with High-K Capacitors for high frequency amplifiers,” Integrated Ferroelectrics, Volume 93, Number 1, pp. 3-9(7), 2007.
   - Greg Pauls and T.S. Kalkur, “Jitter Analysis in PLLs Implemented with Ferroelectric Capacitors” Integrated Ferroelectrics: An International Journal, 1607-8489, Volume 93, Issue 1, 2007, Pages 10 – 20.
   - Asad Jamil, T.S. Kalkur and N. Cramer, “Tunable Ferroelectric Capacitor based Voltage Controlled Oscillator”, IEEE Transactions on Ultrasonics and Ferroelectrics, vol. 54, 222-226, 2007.
   - Greg Pauls and T.S. Kalkur “Parameterized Ferroelectric Capacitor Macromodel Suitable For Mixed Signal Applications”, Integrated Ferroelectrics, vol. 81, 165-179, 2006. D. Dalton, David Killingensmith, Fred Gnadinger, M. Rahman, Ali Mahmud and T.S. Kalkur, “Ferroelectric Charge Transfer Device Using Polarization assisted tunneling for single transistor memories”, Integrated Ferroelectrics, vol.81, 187-196, 2006. Asad Jamil, T.S. Kalkur and N. Cramer, “Voltage Controlled Oscillator Design Using Ferroelectric Varactors”, Integrated Ferroelectrics, volume 81, 157-163, 2006.
   - T.S. Kalkur, A. Jamil and N. Cramer, “Characteristics of Voltage Controlled Oscillators implemented with Tunable Ferroelectric high-K capacitors,” presented at IEEE ISAF, 364-367, 2006.
   - Ali Mahmud, T.S. Kalkur, Asad Jamil, and N. Cramer, “Design, Modeling and Characterization of an Active Phase Shifter Using A Ferroelectric Capacitor”, Integrated Ferroelectrics, vol.81, 197-205, 2006.

1. **Name**
   Dr. Carlos A. Paz de Araujo

2. **Education**
   - 1982, Ph.D, Electrical Engineering, University of Notre Dame
   - 1979, MS, Electrical Engineering, University of Notre Dame
   - 1977, BS, Electrical Engineering, University of Notre Dame

3. **Academic experience**
   - 2007 – Present Symetrix Chair for Device Science Technology, University of Colorado at Colorado Springs
   - 1998 – 2002 Assistant Dean of Research, University of Colorado at Colorado Springs College of Engineering and Applied Science.
   - 1991 – Present Professor, University of Colorado at Colorado Springs Department of Electrical and Computer Engineering
   - 1988 – 1991 Associate Professor, University of Colorado at Colorado Springs Department of Electrical and Computer Engineering
   - 1983 – 1995 Director, Department of Electrical and Computer Engineering Microelectronics Research Laboratories (MRL) University of Colorado at Colorado Springs
   - 1983 – 1988 Assistant Professor, University of Colorado at Colorado Springs Department of Electrical and Computer Engineering

4. **Non-academic experience**
   - 2001 – Present Advisor to Governor of Hiroshima, Hiroshima Science Park
   - 2000 – Present Commissioner, Colorado Governor's Commission on Science and Technology
   - 1995 Member of the Board of Directors, Ramtron Corporation
   - 1992 – Present Senior Associate Editor and Co-Founder, Journal of Integrated Ferroelectrics (Gordon and Breach Pub. -Switzerland) / At present – Taylor and Francis Publishers
   - 1992 – 1994 Consultant, Concord Services, Inc.
   - 1989 – 1990 Staff Consultant, General Motors Research Laboratories
   - 1986 – Present Corporate Co-Founder, Chairman of the Board, Symetrix Corporation
   - 1986 – Present Member of the Board of Directors, Symetrix Corporation
   - 1984 Corporate Co-Founder, Ramtron Corporation

5. **Professional memberships**
   Institute of Electrical and Electronics Engineers, Electrochemical Society, Materials Research Society, American Physical Society, Electron Device Society, American Ceramics Society, and American Vacuum Society.

6. Honors and awards

- 2006 IEEE Daniel E. Noble Award, “For Fundamental Contributions and Commercialization in the Field of Ferroelectric Random Access Memory (FeRAM)”
- 1998 Fudan University, Shanghai, PRC – Advisory Professor
- 1998 Kochi University of Technology (KUT), Kyoto, Japan – Advisory Professor
- 1991 Outstanding Faculty Member, University of Colorado
- 1986 American Electronics Association, Outstanding Educator/ Researcher of the Year
- 1985 IEEE Outstanding Branch Counselor (National Award)
- 1985 IEEE Outstanding Service Award (Student Chapter)

7. Publications

Prof. Araujo has published over 250 papers in international journals and conferences, with over 200 patents.

- Ricardo Medeiros Valentim, Higor Morais, Hélio Araújo, Heitor Bezerra, Gláucio Brandão, Ana Maria Guerreiro, Carlos Araújo., PH-AH: Protocolo Multiciclos para Automação Hospitalar, XVII Congresso Brasileiro de Automática 2008
- Ricardo A. M. Valentim, Glaúcio B. Brandão, Ana M. G. Guerreiro, Antonio H. F. Morais, Marcelo A. Xavier, Heitor U. Bezerra., MP-HA: Multicycles Protocol for Hospital Automation over Multicast Addressing, 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2008)
- Florentino, Gustavo H. P. ; Paz de Araujo, Carlos A. ; Bezerra, Heitor U. ; Junior, Helio B. de A. ; Xavier, Marcelo Araujo ; de Souza, Vinicius S. V. ; de M. Valentim, Ricardo A. ; Morais, Antonio H. F. ; Guerreiro, Ana M. G. ; Brandão, Glaucio B., Hospital automation system RFID-based: Technology embedded in smart devices (cards, tags and bracelets), 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2008)
- Gustavo H. P. Florentino, Hélio B. de A. Júnior, Heitor U. Bezerra, Marcelo A. Xavier, Ricardo Alexsandro de Medeiros Valentim, Antônio Higor Freire de Morais, Ana Maria Guimarães Guerreiro, Gláucio Bezerra Brandão, Carlos Paz de Aráujo, Hospital Automation RFID-Based, IEEE INDIN 2008 - 6th International Conference on Industrial Informatics, 2008
- Ricardo A. M. Valentim, Gláucio B. Brandão, Ana M. G. Guerreiro, Antonio H. F. Morais, Carlos P. Araújo, MP-HA: Multicycles Protocol for Hospital Automation over Multicast with IEEE 802.3, IEEE INDIN 2008 - 6th International Conference on Industrial Informatics, 2008

1. **Name**
   Dr. Mark Wickert

2. **Education**
   - 1983, Ph.D, Electrical Engineering, Missouri S&T
   - 1978, MS, Electrical Engineering, Michigan Technological University, Houghton
   - 1977, BS, Electrical Engineering, Michigan Technological University, Houghton

3. **Academic experience**
   - 1997 – present Professor of Electrical and Computer Engineering (ECE), University of Colorado Colorado Springs (UCCS)
   - 1990-1997 Associate Professor, ECE, UCCS
   - 1984-1990 Assistant Professor, ECE, UCCS
   - 1983-1984 Graduate Teaching Fellow, Electrical Engineering, Missouri S&T
   - 1992-1983 Graduate Research Assistant, Electrical Engineering, Missouri S&T
   - 1981-1982 Graduate Teaching Assistant, Electrical Engineering, Missouri S&T

4. **Non-academic experience**
   - May 2011-present Amergint Technologies, Colorado Springs, CO
   - August 2005–present Real-Time Logic Inc., Colorado Springs, CO
   - June 1998–August 1999 Pericle Communications, R&D, Colorado Springs, CO
   - May 2008–June 2008 Smart Mountain Technologies Inc., Colorado Springs, CO

5. **Professional memberships**
   - Institute of Electrical and Electronics Engineers—
     - Communications Society
     - Acoustics, Speech, and Signal Processing Society
     - Microwave Theory and Techniques Society

6. **Service activities**
   - 2006–present ECE Undergraduate Studies Committee
   - 2006–present ECE Faculty Grievance Committee
   - 2006-present ECE Executive Committee
   - 2006–2007 EAS Engineering Resources Advisory Committee
   - 2003-2004 ECE Graduate Studies Committee
   - 1996–1998 ECE Faculty Grievance Committee
   - 1996 ECE Computer Network Technician Search Committee
   - 1994–1998 Faculty Advisor for Eta Kappa Nu
   - 1992-1995 ECE Executive Committee
   - 1988-2005 ECE Graduate Studies Committee, chair
   - 1988–1995 ECE Computer Resources Committee
   - 1989-1991 ECE Information Committee, chair
   - 1986–1991 Faculty Advisor for Eta Kappa Nu
   - 1985–1988 ECE Undergraduate Studies Committee

7. Publications

Books

Elanix Inc., SystemView Student Edition with Examples by Professor Mark A. Wickert, software book disk package, PWS Publishing, Boston, MA, 1996. Software users manual with detailed applications examples covering communications, signal processing, and controls, theoretical development/ program files. ISBN: 0-534-95028-0.

Publications

J. Malone and M.A. Wickert, *Practical Volterra Equalizers for Wideband Satellite Communications with TWTA Nonlinearities*, Proceedings, IEEE 14th Digital Signal Processing Workshop/6th Signal Processing Education Workshop, WA.P1.9, pp. 48–53, January 2011.

M.A. Wickert, *High Quality Digital Audio Experiments for a Signal Processing First Course, Proceedings*, IEEE 14th Digital Signal Processing Workshop/6th Signal Processing Education Workshop, WP.P3.3, pp. 174–179, January 2011.

M.A. Wickert, *Digital Communication with Jamming Experiments for a Signal Processing First Course*, Proceedings, IEEE 14th Digital Signal Processing Workshop/6th Signal Processing Education Workshop, WA.P3.4, pp. 101–106, January 2011.

M.A. Wickert, *Mutlirate Digital Phase Locked Loops with Random Processor Latency*, Proceedings, IEEE 13th Digital Signal Processing Workshop/ 5th Signal Processing Education Workshop, pp. 582–587, January 2009.

M.A. Wickert, *Using Software-Based Animations of Signal Processing Mathematics to Enhance Learning*, Proceedings, IEEE 13th Digital Signal Processing Workshop/5th Signal Processing Education Workshop, pp. 244–249, January 2009.

P. Chayratsami and M.A. Wickert, *Channel Estimation and Mitigation Techniques for OFDM in a Doppler Spread Channel*, Proceedings IEEE Global Communications Conference, Session SP09T3 paper 4, December 2008.

Mark Wickert, Shaheen Samad, and Bryan Butler, *An Adaptive Baseband Equalizer for High Data Rate Bandlimited Channels*, Proceedings of the International Telemetering Conference, Links and Applications Session, paper 3, October 2006.

Dahmmaet Bunnjaweht and M.A. Wickert, Capacity Enhancement of a Multi-Beam Technique in a WCDMA Network using Multiple Path Connections, Proceedings, IEE Mobility Conference 2006, Resource Management Session, paper 1, October 2006.

M.A. Wickert, A Simulation Framework to Introduce Modern DSP Based Synchronization Techniques in a PLL Course, Proceedings, IEEE 12^{th} Digital Signal Processing Workshop/4^{th} Signal Processing Education Workshop, pp. 291–296, September 2006.

1. **Name**
   Dr. Greg Tumbush

2. **Education**
   1998, Ph.D, Computer Engineering, University of Cincinnati
   1993, MS, Electrical Engineering, The Ohio State University
   1991, BS, Electrical Engineering, Wright State University

3. **Academic Experience**
   - 2008- present Instructor, UCCS Electrical and Computer Engineering Department

4. **Non-academic experience**
   - 2008- present Owner, Tumbush Enterprises, LLC
   - 2008 Digital Design Engineer, ON Semiconductor
   - 2006-2008 Digital Design Engineer, AMI Semiconductor
   - 2003-2006 Digital Design Engineer, Starkey Labs
   - 2000-2002 Lead ASIC Design Engineer, Astek Corporation
   - 1998-1999 Computer Engineer, Air Force Research Laboratory
   - 1993-1994 Electrical Engineer, Air Force Research Laboratory

5. **Professional memberships**
   - DVCON, 2005-2007, 2009-2011, Technical Program Committee
   - NASCUG, 2005/2006, Spring 2006, Co-Chair

6. **Publications**
   - "Get to ASICs Faster - A Novel Mixed Signal Design Methodology", 2009 Design and Verification Conference (DVCon)
   - "SystemVerilog Tutorial", 2008 AMI Semiconductor Technical Forum
   - "A 2mW 400MHz RF Transceiver SoC in 0.18um CMOS Technology for Wireless Medical Applications", 2008 IEEE Radio Frequency Integrated Circuits Symposium (RFIC)

   "Dramatically Increase the Performance of SystemC Simulations", 2007 Design and Verification Conference (DVCon).

1. **Name**
   Dr. Chia-Jiu "Charlie" Wang

2. **Education**
   - 1988, Ph.D, Electrical Engineering, Auburn University, Alabama
   - 1979, MS, Electrical Engineering, Tatung Inst. Of Tech., Taiwan, R.O.C
   - 1974, BS, Physics, National Central University, Taiwan, R.O.C

3. **Academic experience**
   - 2006 - present UCCS, Professor, Electrical and Computer Engineering
   - 1994 - 2006 UCCS, Associate Professor, Electrical and Computer Engineering
   - 1988 -1994 UCCS, Assistant Professor, Electrical and Computer Engineering
   - 1984 - 1988 Auburn University, Graduate Teaching/Research Assistant
   - 1983 -1984 Instructor, Chung-Yung University, Taiwan, R.O.C.
   - 1979 - 1980 Instructor, Ming-Chi Institute of Technology, Taiwan, R.O.C.

4. **Non-academic experience**
   - 1995 Fall semester on sabbatical leave and worked at Agilent Technologies test and measurement division, Colorado Springs, CO
   - 1980 - 1984 Assistant Scientist/Project Leader, Electronics Research Division, Chung-Shan Institute of Science and Technology, Taiwan, R.O.C.
   - 1976 - 1977 Electronics Engineer, Arvin Industrial Company, Taiwan, R.O.C.

5. **Professional memberships**
   - IEEE
   - IEEE Computer Society

6. **Honors and awards**
   - 2004 Ledger Award
   - 1994-1995 Outstanding Faculty Member, UCCS Department of Electrical and Computer Engineering
   - 1994-1995 Outstanding Teaching Award, UCCS College of Engineering and Applied Science.
   - 1989-1990 Instructor of the Year, IEEE/Eta Kappa Nu Student Chapter, UCCS Department of Electrical and Computer Engineering

7. **Service activities**
   - ECE undergraduate study committee
   - ECE graduate study committee
   - ECE executive committee
   - EAS award committee
   - EAS graduate fellowship committee
   - Faculty volunteer for freshmen orientation
   - Faculty volunteer to recruit students from China and Taiwan
   - Faculty advisor for international students from CYU, participating 3+2 program

8. Patents and Publications

US Pat. No.7,623,685, "Biometric signatures and identification through the use of projective invariants" with G. Zheng and Terry Boult of UCCS.

Patent Application
Title of Invention: Apparatus and Method for Estimating Battery State of Charge; Inventors: Terry Hansen, Chia-Jiu Wang; filed January 2005. Publication Number EPO: EP1859523

Publications
H.T. Tran, Chia-Jiu Wang, "Increase Productivity in Circuit Board Manufacturing Through Support Vectors," Springer Science, The 2nd ICCN 2009 Conference Proceedings.

Vikramjit Mitra and Chia-Jiu Wang, "Content Based Audio Classification: A Neural Network Approach," Soft Computing, Vol. 12, No. 7: 639 - 646. (2008)

G. Zheng, C-J Wang, and T.E. Boult, "Application of Projective Invariants I Hand Geometry Biometrics," IEEE Transactions on Information Forensics and Security, Vol. 2, No. 4 pp. 758-768 December 2007.

Mitra, V., Wang, C.-J., Banerjee, S. "Text classification: A least square support vector machine approach" Applied Soft Computing Journal volume 7, issue 3, 2007, pp. 908 – 914.

T.S. Liu and Chia-Jiu Wang, "CMOS Amplifier using Chopper Stabilization and Sample-and-Hold Techniques," IEEE Proceedings, TENCON 2007, Taipei, R.O.C.

Vikramjit Mitra, Chia-Jiu Wang, Satarupa Banerjee, "Lidar Detection of Underwater Objects using a Neuro-SVM based Architecture," IEEE Transactions on Neural Networks, Vol. 17, No. 4, pp 717- 731, May 2006.

Gang Zheng, Terrance E. Boult, Chia-Jiu Wang, "Personal Identification by Projective Invariant Hand Geometry," Proceedings of Biometrics Symposium 2005, Sep. 19 - 21, 2005.

Vikramjit Mitra, Chia-Jiu Wang, Satarupa Banerjee, "A Neuro-SVM Model for Text Classification using Latent Semantic Indexing," Proceedings of IEEE International Joint Conference on Neural Networks, 2005.

Vikramjit Mitra, Chia-Jiu Wang, Satarupa Banerjee, "Lidar Signal Processing for Under-water Object Detection," Lecture Notes in Computer Sciences LNCS 3497, pp. 556 - 561, Springer-Verlag 2005.

Terry Hansen, Chia-Jiu Wang, "Support Vector based Battery State of Charge Estimator" Journal of Power Sources Vol. 141, pp. 351-358, 2005.

1. **Name**
   Ramaswami Dandapani

2. **Education**
   - 1974, Ph.D, Computer Science, University of Iowa
   - 1969, MS, Electrical Engineering, University of Iowa
   - 1967, BE, Electrical Engineering Technology, Indian Institute of Science
   - 1964, B.Sc, Nagpur University

3. **Academic experience**
   - 2009-present Dean, University of Colorado Colorado Springs,
   - 2008-09 Interim Dean, University of Colorado Colorado Springs,
   - 2006-09 Associate Dean, University of Colorado Colorado Springs,
   - 1998-2007 Chair, University of Colorado Colorado Springs
   - 1986-present Professor, University of Colorado Colorado Springs
   - 1985-1986 Professor, Youngstown State University, Youngstown, Ohio
   - 1979-1985 Associate Professor, Youngstown State University, Youngstown, Ohio
   - 1974-1979 Assistant Professor, Youngstown State University, Youngstown, Ohio
   - 1997 Visiting Academic, Royal Melbourne Institute of Technology, Melbourne, Australia
   - 1986 Visiting Professor, University of Iowa, Iowa City, Iowa
   - 1986 Visiting Professor, Digital Systems Laboratory, Stanford University, Stanford, California
   - 1984, 1985 Visiting Professor, University of Newcastle, Australia
   - 1984 Visiting Professor, University of Illinois at Champaign-Urbana, Illinois

4. **Non-academic experience**
   - 1996-1997 Symbios Logic, Colorado Springs and Fort Collins, Colorado
   - 1994-1995 Ford Motor Company, Dearborn, Michigan
   - 1993 Sun Microsystems Inc., Menlo Park, California
   - 1987, 1991, 1992 Ford Microelectronics Inc., Colorado Springs, Colorado
   - 1990 United Technologies Microelectronics Center, Colorado Springs, Colorado
   - 1987-1988 Digital Equipment Corporation, Colorado Springs, Colorado

5. **Professional memberships**

Institute of Electrical and Electronic Engineers (IEEE)

6. **Honors and awards**
   - 2001 Special Chancellor's Award For directing National Science Olympiad
   - 1997 Patent Incentive Award from Ford Motor Company
   - 1996 For the work "Optimum Test Set Generation for Mixed-Signal Boards"
   - 1996 Outstanding Teacher Award, College of Engineering and Applied Science, Electrical and Computer Engineering Department

•	1993	Motorola Silverkey Award, with Amit Majumder, awarded for paper "Neural Networks as Massively Parallel Automatic Test Pattern Generators"
•	1992	IEEE Region 5 Award, awarded for valued services as the IEEE Student Branch Counselor
•	1990	Department of Electrical and Computer Engineering "Outstanding Among Faculty for Dedication and Teaching"

7. Service activities

•	1999	Panelist, DAC proposal reviews, NSF, Washington, D.C.
•	1997	Panelist, SBIR proposal reviews, NSF, Washington, D.C.
•	1991	IEEE 1149.4 Std. Mixed Signal Testability Bus Working Group, member
•	1993-present	Colorado Science Olympiad, Board of Directors National Science Olympiad 2001, Director
•	1992-2001	Colorado Science Olympiad, Southern Regional Director
•	2003-present	Colorado Science Olympiad, Southern Regional Director
•	1991	Technical Program Committee Member, IEEE VLSI Test Symposium

8. Publications

Dave Stang and R. Dandapani, "An Implementation of IEEE 1149.1 to Avoid Timing Violations and Other Practical In-Compliance Improvements," *Proceedings, IEEE International Test Conference, 2002*

R. Dandapani, "Testing and Testable Design of Circuits and Boards," seminar presented at the School of Computer Science, University of Oklahoma, Oklahoma City, Oklahoma, March 2002

R. Dandapani, " Test and Design for Testability, sponsored by Australian Electronics Development Centre, Melbourne, Australia, May 27-28 and Sydney, Australia, June 2-3, 1997

David Cheek and R. Dandapani, "Integration of IEEE Std. 1149.1 and Mixed-Signal Test Architectures," *Proceedings, IEEE International Test Conference,* 1995

W. Mao, Y. Lu, R. Gulati, R. Dandapani, and D. Goel, "Test Generation for Linear Analog Circuits," *Proceedings, IEEE Custom Integrated Circuits Conference,* 1995

J. Wallack and R. Dandapani, "Coverage Metrics for Functional Tests," *Digest of Papers, 12th IEEE VLSI Test Symposium,* 1994

Y. Lu and R. Dandapani, "Hard Fault Diagnosis in Analog Circuits using Sensitivity Analysis," *Digest of Papers, 11th IEEE VLSI Test Symposium,* 1993

A. Majumder and R. Dandapani, "Neural Networks as Massively Parallel Automatic Test Pattern Generators," *Proceedings IEEE International Conference on Neural Networks,* 1993

1. **Name**
   Robert Kressin

2. **Education**
   - 2000, MS, Electrical Engineering, University of Colorado Colorado Springs
   - 1995, BS, Electrical Engineering, Milwaukee School of Engineering

3. **Academic experience**
   - 2008-present Instructor, UCCS Electrical and Computer Engineering Department

4. **Non-academic experience**
   - 2003-present President & CEO, KS Technologies
   - 2006-2008 Hardware Design Engineer, Agilent Technologies
   - 2005-2006 R&D Operating Manager, Agilent Technologies
   - 1999-2005 Integrated Circuit Design Engineer, Agilent Technologies
   - 1997-1999 Integrated Circuit package Engineer, Hewlett-Packard
   - 1995-1997 Manufacturing Development Engineer, Hewlett-Packard

5. **Patents**
   - United States Patent #6,703,960 - "ANALOG-TO-DIGITAL CONVERTER"
   - United States Patent #7,234,232 - "METHODS FOR DESIGNING AND TUNING ONE OR MORE PACKAGED INTEGRATED CIRCUITS" (numbers 6,854,179 and 7,010,766 are related)

1. **Name**
   Dr. Hoyoung "Heather" Song

2. **Education**
   - 2004, Ph.D, Applied Science, University of California, Davis
   - 1995, MS, Physics, Ewha Woman's University, Seoul, South Korea
   - 1993, BS, Physics, Ewha Woman's University, Seoul, South Korea

3. **Academic experience**
   - 2007-present Assistant Professor, UCCS Electrical and Computer Engineering
   - 2000-2004 Post Graduate Research Engineer, University of California, Davis

4. **Non-academic experience**
   - Senior Microwave Engineer (September 2004 – March 2007)
   - Triton Services, INC. Electron Technology Division
   - Research Engineer (August 1995 – July 2000)
   - Institute for Advanced Engineering, Yongin, South Korea

5. **Professional memberships**
   - AAUW American Fellowship Review Panel
   - Electron Devices Society (EDS) of the IEEE
   - Nuclear and Plasma Sciences Society of the IEEE
   - Woman in Engineering (WIE) Society of the IEEE

6. **Honors and awards**
   - College of Engineering and Applied Science, UCCS, Outstanding Researcher of the Year Award (2008 - 2009)
   - Franklin Research Grant Award (2008)
   - DARPA Young Faculty Award Finalist (one of the 50 selected throughout the country, 2007)
   - Sander Wilson Award – Excellence in Industry (2004)
   - MURI Fellowship Awards (September 2000 – August 2004)
   - Univ. of California, Davis, School of Engineering Summer Research Fellowship Award (June 2002 - September 2002)
   - Block Grant Fellowship Awards (September 2001 – June 2002)
   - Univ. of California, Davis, Deans Commitments Fellowship Awards (September 2001 – June 2002)
   - Univ. of California, Davis, Department of Applied Science Non-resident Tuition Fellowship Awards (September 2000 – June 2001)
   - The International Rotary Foundation Ambassadorial Scholarship (September 2000 – August 2001)
   - The Korean Physical Society, Fall Meeting, Pusan, Korea, Best Poster Presentation Award (October 1999)

7. **Service activities**
   - Received equipment donation from PSM INC. to ECE Dept, UCCS, $150,000 worth plasma surface treatment equipment.
   - Review panel, AAUW (American Association of University Women) fellowship.
   - Reviewer, IEEE Transactions on Electron Devices/ Journal of Active and Passive Electronic Components/ Journal of Electromagnetic Wave and Applications/ Journal of Korean Physical Society
   - Session organizer, The 25th Progress in Electromagnetics Research Symposium, Session: Microwave Generation - Vacuum Beam Devices, Beijing, China, 23 – 27 March 2009.
   - ECE Department, UCCS, Graduate Studies Committee
   - ECE Department, UCCS, Program Assistant Search Committee
   - ECE Department, UCCS, Tenure Track Assistant Professor Search Committee
   - ECE Department, UCCS, Research Associate Professor Search Committee
   - Society of Women Engineers (SWE) Departmental Liaison
   - UCCS, Vice Chancellor for Student Success Search Committee
   - ECE EM lab anechoic chamber refurbish activities: to build collaborative relationships with local industries including SRC computers, Broadcom, TaveTech, Agilent, and PathFinder
   - UCCS public radio guest speaker on topic of Electrical Engineering and EM lab activities

8. **Publications**

T. Mulcahy and H. Song, "Analysis of Frequency Response of Wire Bond Configurations Joining Two 50 Ohm Microstrip Lines," Microwave and Optical Technology Letters, Vol. 52, No. 2, February, 2010.

K. Cantrell and H. Song, “Resonance Shifting and Plane Impedance Calculations for a Rectangular Cavity in Printed Circuit Board Using Closed Form Solutions,” Microwave and Optical Technology Letters, Vol. 51, No. 2, pp. 452-455, February 2009.

T. Mulcahy, H. Song, and F. Francisco, “New Method of Integrating Periodic Permanent Magnet (PPM) Assembly in Traveling Wave Tubes (TWTs),” Progress in Electromagnetics Research C, Vol. 10, pp. 187-199, 2009.

H. Song, F. Francisco, and D. Steidle, “Electron Optical System for a Magnet-less Miniature Klystrode,” Journal of Electromagnetic Waves and Applications, Vol. 22, No. 13, pp. 1757-1763, 2008.

Sun Kim, Seok-Hyun Lee, Jeong-Hyun Seo, and H. Song, “New Rest Waveform for a Large-Sustain-Gap Structure in an Alternating Current Plasma Display,” IEEE Transactions on Electron Devices, Vol. 55, No. 12, pp. 3389 – 3395, December 2008.

1. **Name**
   Dr. Gregory L. Plett

2. **Education**
   - 1998, Ph.D, Electrical Engineering, Stanford University, Stanford CA.
   - 1992, MS, Electrical Engineering, Stanford University, Stanford CA.
   - 1990, B.Eng. (High Distinction), Computer Systems Engineering, Carleton University, Ottawa, ON
3. **Academic experience**
   - 2011-present Professor, UCCS Electrical Engineering
   - 2005-2011 Associate Professor, UCCS Electrical Engineering
   - 2007 Summer Faculty Fellows, USAFA, Colorado Springs, CO
   - 2006-2007 Visiting Research Professor, USAFA
   - 1998-2005 Assistant Professor, UCCS Electrical Engineering
   - 1997 Invited Researcher, Centro de Instrumentos, Universidad Nacional Autónoma de México, México D.F., México
   - 1992-1998 Research Assistant, Information Systems Laboratory, Stanford University, Stanford, CA
   - 1995-1996 Teaching Fellow, Stanford University, Stanford, CA
   - 1992, 1995-96 Teaching Assistant, Sanford University, Stanford, CA

4. **Non-academic experience**
   - 1986-1991 Scientific Staff, Bell North Research, Bells Corners, ON, Canada

5. **Awards and honors**
   - Recipient of EAS college "Outstanding Researcher of the Year" award, 2010.
   - Letter of commendation from Brigadier General Dana H. Born (Dean of Faculty at the United States Air
   - Force Academy) for contributions to the USAFA research efforts in the area of unmanned aerial systems,
   - 2007.
   - Joint recipient of college "EAS Outstanding Teacher of the Year" award (with Dr.Michael Ciletti), 2004.
   - Joint recipient of "University of Colorado-Colorado Springs 2004 Innovations in Teaching with Technology
   - Award" (with Dr. Michael Ciletti), 2004.
   - Elected to "Senior Member" grade of IEEE, 2002.
   - "NSERC 1967 Science and Engineering Graduate Scholarship", 1991–95.
   - This is the most prestigious scholarship given by the Canadian government for graduate studies in Science and
   - Engineering (value of approximately $20,000(cdn) per year for four years plus travel expenses, now discontinued).
   - Only 53 of these scholarships were awarded country-wide in the 1991 year.
   - Stanford University "Reid and Polly Anderson" fellowship, 1991.
   - One-year award toward graduate studies, comprising a tuition grant of $15,867 and a stipend of $9,500.

6. Service activities

- Assessment Committee, (Department): Served: 2010.
- ECE Search Committee, (Department): Served: 2009–.
- ECE1010 Replacement Committee, (Department), Served: 2001–2002.
- Executive Committee, (Department), Served: 2007–.
- Graduate Studies Committee, (Department), Served: 1998–.
- Graduate Studies Coordinator, (Department), Served: 2007–.
- Grievance Committee, (Department), Served: 2008–.
- IEEE Advisor, (Department), Served: 1999–2001.
- IEEE Associate Advisor, (Department), Served: 1998–1999.
- Library Committee, Served: (Department), 2005–2006.
- Undergraduate Studies Committee, (Department), Served: 1999–2006.
- Undergraduate Studies Committee [Chair], (Department), Served: 2001–2003.
- EAS Admissions Fast Track Committee, (College), Served: 2001.
- EAS Instructional Fees Advisory Committee, (College), Served: 1999.
- EAS Resource Allocation Committee, (College), Served: 2006.
- EAS Science and Engineering Building Committee, (College), Served: 2003–2004.
- Instructional Fee Committee, (College), Served: 2007–2009.
- PhD Program Assessment Task Force, (College), Served: 2010.
- Search Committee for new IT hire, (College), Served: 2009.
- Student Affairs, (College), Served: 2005.
- General Education Task Force, (Campus), Served: 2009–
- Graduate Executive Committee, (Campus), Served: 2007–.
- Teaching Excellence Council, (Campus), Served: 2005–2008.
- Committee on University Discoveries, (CU-System), Served: 2007–.
- Consulted with American Electric Vehicles regarding control algorithms for electric vehicles, 2008–.
- Consulted with Compact Power Inc. regarding control algorithms for hybrid electric vehicles, 2001–.
- Consulted with Micro Methods Inc. regarding reviewing patent applications relating to control systems and disk-drive technology, 2000.

7. Professional memberships

- Senior member, Institute of Electrical and Electronic Engineers (IEEE).

8. Publications

- Ciletti, M.D., Dandapani, R., Kalkur, T.S., Plett, G.L.,Wickert, M.A., and Ziemer, R.E., "Balancing the
- ECE Curriculum with the Kolb Learning Cycle", presented at the 2005 ASEE Rocky-Mountain Section
- Conference, Logan, UT (June 2005).
- Ciletti, M.D., Dandapani, R., Kalkur, T.S., Plett, G.L., Wickert, M.A., and Ziemer, R.E., "Balancing
- The ECE Curriculum with the Kolb Learning Cycle", presented at the 2005 NSF Grantees Workshop, Arlington, VA (February 2005).

C- Equipment

Electronic Systems Laboratory

Personal computers networked to the Campus and College servers and internet, electronic breadboards, digital oscilloscopes, logic analyzers, function generators, multimeters, power supplies, electronic circuit boards, and parts and supplies to complete laboratory assignments, such as software (assemblers, linkers, test analog circuit, etc.), modern programmable devices, including flied programmable gate arrays (FPGAs). Networked printers are available.

VLSI Circuit Design Laboratory

Personal computers networked to a SUN Solaris Enterprise 250 server. Software: Cadence tools for VLSI Circuit design, Synopsis tools for VLSI Circuit synthesis, Silvaco tools, and other equipment to complete VLSI circuit design and synthesis assignments. Networked printers are available.

ECE PC Laboratory

34 personal computer workstations networked to the Campus and College servers. A complete list of software installed is in Criterion 7, Facilities, Section B. Networked printers are available. Presentation equipment, such as podium, projector and screen are also available.

Communications and Signal Processing Laboratory

Personal computer workstations networked to the network server, spectrum analyzers, function generators, pulse generators, and other equipment, parts, and supplies as necessary to complete homework and laboratory assignments. Software includes, but is not limited to, Wave file manipulation software, MATLAB, TI Microprocessor Development Tools. Networked printers are available.

Control-Systems and High Capacity Battery Testing Laboratory

Personal computer workstations networked to the network server and control devices, such as Educational Control Products' (ECP) Magnetic Levitation and Control-Moment gyroscope systems and Rhino Robotics six-degree-of-freedom robotic arm. Additionally each workstation has a full-complement of test-and-measurement equipment for control systems. The lab also supports undergraduate analog and digital control-systems lab courses. The laboratory has facilities to perform tests on high-capacity cells, such as those used in hybrid and electric vehicle technology, modules of such cells, and full-size battery packs. The laboratory has cell testing, module testing and pack testing capabilities. Networked printers are available.

Electromagnetics Laboratory (Anechoic Chamber)

The equipment in the Anechoic Chamber is used for performing microwave measurements, including and EMI receiver, network analyzer, infrared imaging system, microwave exposure meter, and houses other equipment, parts, and supplies for use in the laboratory for assignments and other experimentation. Networked printers are available.

Microelectronics Research Laboratory (MRL)

This laboratory is a class-100 clean room and used to fabricate, characterize, and analyze integrated circuits. The laboratory includes multiple measuring and testing equipment based on homework, assignments, and industry use. Students learn the hands-on processes in fabricating modern integrated circuits as well as guidelines for safety handling specific to a class-100 clean room laboratory. Some of the equipment used in the MRL: high temperature furnaces, ultra high vacuum systems, thin film deposition and measurement systems, microlithography systems, ultra-pure deionized water plant, class 100 clean room, HVAC systems, exhaust systems, air compressor systems, process and housekeeping vacuum systems, etc. Networked printers are available.

ECE Kits

Students purchase an ECE kit to start them in the BSCpE program which includes the following equipment:

- 1ea Case
- 1ea 430 Launchpad
- 1ea 7-segment display (common anode
- 2ea I/O expanders (PCF8574)
- 1ea 10 pin 330ohm sip resistor pack
- 1ea 8 position switch
- 1ea breadboard
- 2ea 10 pin cables

Occasionally, student will add equipment to their kit as they progress in the program and based on their projects, courses, or other.

Computing Resources

Additional information on college-wide computing resources is available in Criterion 7, Facilities, Section B.

ECE GENERAL LABORATORY
SAFETY GUIDELINES

1. **EMERGENCY TELEPHONE NUMBERS:**
   ECE Office location: Room 299 in the UCCS Engineering Building. 255-3548 (campus phone x3548)
   Emergency: (9) 911
   Campus Police: 255-3111 (from campus phone x3111)
2. **NO HORSEPLAY.** No intentional electric shocks, explosions, or ignition. No intentional abuse of any materials or intentional creation of any hazardous situation.
3. **WORK ON DE-ENERGIZED CIRCUITS.** As far as possible, remove power before handling a circuit in any way. This may mean turning the power on and off 20 or 30 times during an experiment. That's normal practice. Be sure to double check your wiring and soldering before applying power to the circuit and components.
4. **RINGS, WATCHES, AND NECKLACES** made of metal can be hazardous when they touch energized circuits. Use care and prevent accidents.
5. **HIGH-VOLTAGE SAFETY.** Our work does not normally involve high voltages. If you must work with voltages higher than 35 V, always work with a partner, and clear your experiment with a faculty member in advance.
6. **HIGH-CURRENT SAFETY.** Even at low voltage, some of our power supplies can output enough current to generate appreciable heat, cause burns, and start fires. Know what you're doing. If you don't know approximately how much current will flow in a circuit, don't apply power until a more experienced person has checked it.
7. **LEAD HAZARD**. Many electronic components are pre-coated with solder that contains lead. **DO NOT EAT, DRINK, OR SMOKE** after handling electronic components until you have washed your hands. *This is doubly important when you have been soldering.* Make it a practice to wash your hands before and after working in the labs.
8. **NO FOOD OR DRINKS**. Food and drinks are prohibited in the labs.
9. **BASIC EYE PROTECTION** (eye glassed or goggles) is required for SOLDERING. Request safety glasses from your instructor.
10. **THE SOLDERING IRON** must be kept in its holder when not actually in use (not laid down on the table) and should be turned off when not needed, even if you expect to need it again in a half an hour. It warms up very quickly.
11. **PROPER HANDLING OF COMPONENTS:** Integrated circuits are easily damaged by static electricity. To protect them from damage, avoid touching the pins any more them necessary; touch the frame of a piece of equipment before touching anything inside it. Also, turn off power before inserting components into a circuit.
12. **SAFE USE OF TOOLS:** Use pliers, wrenches, and screwdrivers that fit. It's much easier to get hurt, and to damage the equipment you're working on, when you use the wrong size. The right size Phillips (+) screwdriver is often surprisingly large; always use the largest one that fits.
13. **KEEP IT CLEAN:** A clean work environment can help you avoid many unnecessary accidents. Keep your work area clean and well organized. Pick up any trash that finds its way to the floor.
14. **EXITS:** Know the location of lab and building exits.
15. **PREGNANT WOMEN:** If you are pregnant, all these precautions are doubly important for you, especially about avoiding electric shock, lead and other chemicals and hazards.

FIRE EXTINGUISHERS:

(EN229/230 Electronics labs) In the hall just outside the electronics lab.
(EN241/242 Communications lab) Across from door near the main hall.
(EN249 Robotics Prototype lab) End of hallway near elevator.
(EN134 Control Systems lab) Across hall from lab entry door.

DO NOT USE WATER ON AN ELECTRICAL FIRE.

D- Institutional Summary

1. The Institution

a. *Name and address of the institution*

University of Colorado Colorado Springs
1420 Austin Bluffs Parkway
Colorado Springs, CO 80918

b. *Name and title of the chief executive officer of the institution*

Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado Colorado Springs

c. *Name and title of the person submitting the self-study report.*

Dr. R. Dandapani, Dean, College of Engineering and Applied Science, UCCS.

d. *Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluations.*

UCCS is accredited through the North Central Association (NCA). The previous institutional accreditation review occurred in fall 2006.

2. Type of Control

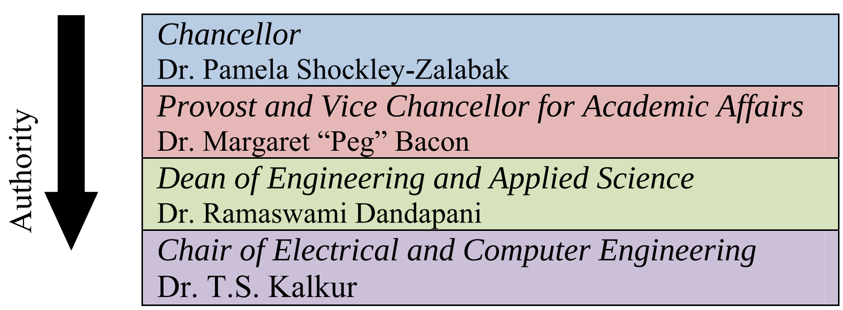
Description of the type of managerial control of the institution, e.g., private-non-profit, private-other, denominational, state, federal, public-other, etc

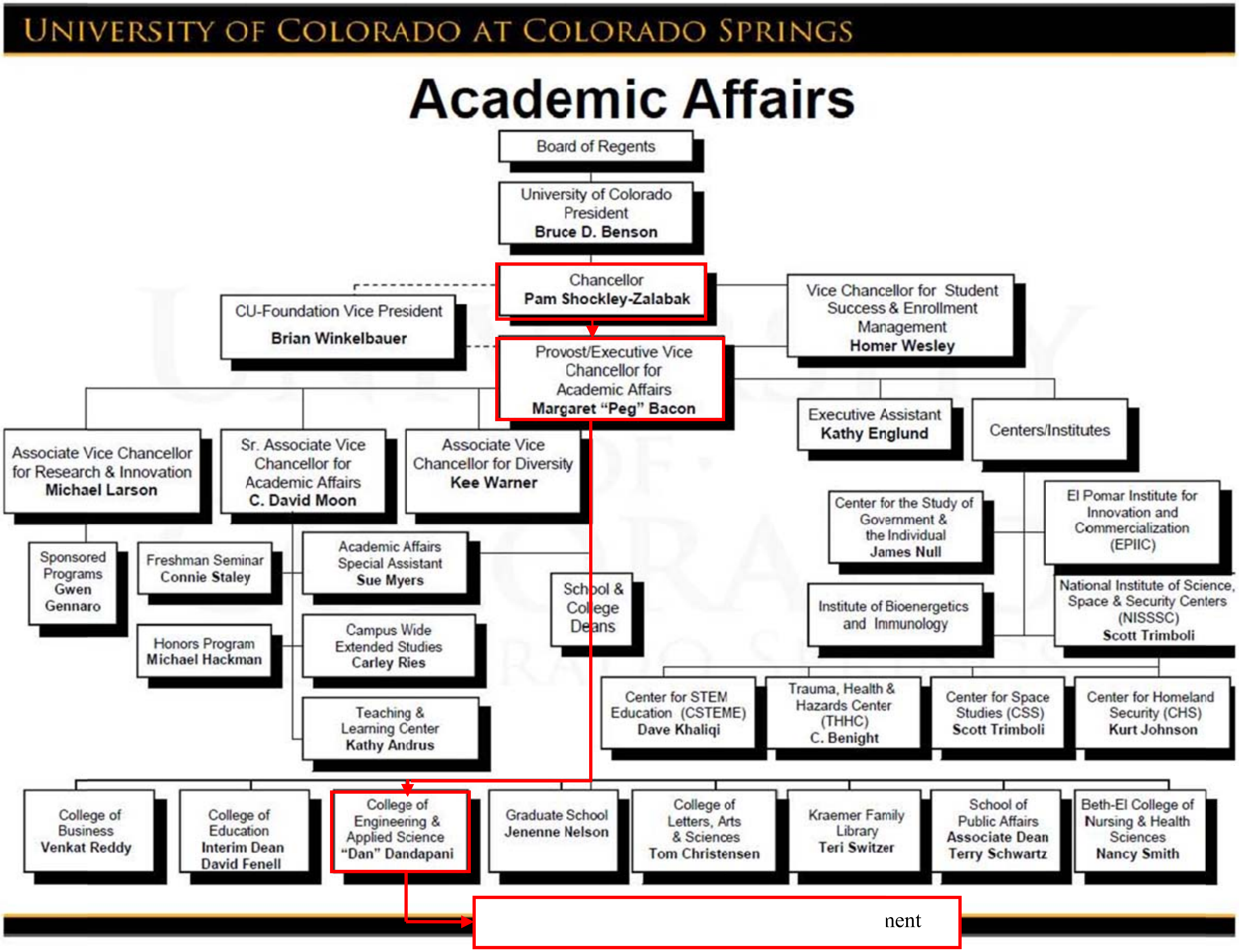
State institution.

3. Educational Unit

Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The BSEE program is located in the Department of Electrical and Computer Engineering. The chain of responsibility is as follows:




UNIVERSITY OF COLORADO AT COLORADO SPRINGS
Academic Affairs
Board of Regents
University of Colorado President Bruce D. Benson
Chancellor Pam Shockley-Zalabak
CU-Foundation Vice President Brian Winkelbauer
Vice Chancellor for Student Success & Enrollment Management Homer Wesley
Provost/Executive Vice Chancellor for Academic Affairs Margaret "Peg" Bacon
Executive Assistant Kathy Englund
Centers/Institutes
Associate Vice Chancellor for Research & Innovation Michael Larson
Sr. Associate Vice Chancellor for Academic Affairs C. David Moon
Associate Vice Chancellor for Diversity Kee Warner
Center for the Study of Government & the Individual James Null
El Pomar Institute for Innovation and Commercialization (EPIIC)
Sponsored Programs Gwen Gennaro
Freshman Seminar Connie Staley
Academic Affairs Special Assistant Sue Myers
School & College Deans
Institute of Bioenergetics and Immunology
National Institute of Science, Space & Security Centers (NISSSC) Scott Trimboli
Honors Program Michael Hackman
Campus Wide Extended Studies Carley Ries
Teaching & Learning Center Kathy Andrus
Center for STEM Education (CSTEME) Dave Khaliqi
Trauma, Health & Hazards Center (THHC) C. Benight
Center for Space Studies (CSS) Scott Trimboli
Center for Homeland Security (CHS) Kurt Johnson
College of Business Venkat Reddy
College of Education Interim Dean David Fenell
College of Engineering & Applied Science "Dan" Dandapani
Graduate School Jenenne Nelson
College of Letters, Arts & Sciences Tom Christensen
Kraemer Family Library Teri Switzer
School of Public Affairs Associate Dean Terry Schwartz
Beth-El College of Nursing & Health Sciences Nancy Smith
nent

4. **Academic Support Units**
   List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

   English: Dr. Rebecca Laroche, Associate Professor, Chairperson

   Mathematics: Dr. Gregory Morrow, Professor, Chair

   Physics: Dr. James Burkhart, Professor, Chair

   Computer Science: Dr. Xiaobo Zhou, Professor, Chair

   Humanities: Dr. Teresa Meadows, Associate Professor, Director

   Biology: Dr. Jacqueline Berning, Associate Professor, Chair

5. **Non-academic Support Units**
   List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

   Library: M. Rita Hug, Head of Technical Services, Kramer Library.

   Campus Computing Facilities: Jerry Wilson, CTO and Executive Director of IT

   Internships: Jane Wampler, Internship Coordinator, EAS.

   Scholarships: Tina More, EAS Scholarship Coordinator

   Student Success Center: Robert King, Engineering Academic Advisor

   Disability Services and Testing Center: Ida Dilwood, Director

6. **Credit Unit**
   It is assumed that one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

   The same standards are used to measure a credit unit.

7. **Tables**
   Complete the following tables for the program undergoing evaluation.

Table D-1. Program Enrollment and Degree Data

BSEE

	Academic Year		Enrollment Year 1st	2nd	3rd	4th	5th	Total Undergrad	Total Grad	Degrees Awarded: Associates	Bachelors	Masters	Doctorates
Current Year	2010	FT	9	11	20	13	7	60	19	-	12	3	1
		PT	0	1	3	1	6	11	21				
1	2009	FT	8	16	11	13	16	64	12	-	14	7	1
		PT	1	1	1	2	2	7	24				
2	2008	FT	13	9	14	22	10	68	16	-	22	11	1
		PT	2	4	1	5	8	20	38				
3	2007	FT	12	13	20	13	12	70	21	-	22	8	3
		PT	1	2	5	6	10	24	35				
4	2006	FT	13	11	18	21	4	67	27	-	11	12	3
		PT	2	3	2	4	10	21	47				

Give official fall term enrollment figures (head count) for the current and preceding four academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the fall visit.

FT--full time
PT--part time

Table D-2. Personnel
BSEE
Year[1]: 2011

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative[3]	1	-	0.50
Faculty (tenure-track)	7	-	6.50
Other Faculty (excluding student Assistants)	1	10	2.30
Student Teaching Assistants	-	-	-
Student Research Assistants	-	5	2.00
Technicians/Specialists	-	1	0.40
Office/Clerical Employees	1	-	1.00
Others[4]	-	2	0.92

Report data for the program being evaluated.

[1] Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.

[2] For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc. For faculty members, 1 FTE equals what your institution defines as a full-time load.

[3] Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.

[4] Specify any other category considered appropriate, or leave blank.

E- Advisory Board

Name	Affiliation	Position	Mailing Address	Phone	Fax	E-mail	EE	CpE
John Lindsey	Agilent Technologies	Senior Engineer	Agilent Technologies P.O. Box 2197 Colorado Springs, CO 80901	719-590-1900	-	john_lindsey@agilent.com	x	
Alison Brown	NAVSYS Corporation	President/ CEO	NAVSYS Corporation 14960 Woodcarver Road Colorado Springs, CO 80921	719-481-4877 x102	719-481-4908	abrown@navsys.com	x	
Dr. Nick Cramer	Atmel	Senior Engineer	Atmel Corporation 1150 E Cheyenne Mtn Blvd. Colorado Springs, CO 80906	540-1000	719-540-1759	Darwin.Enicks@atmel.com	x	
Dr. Jennifer Price	RT Logic	Senior Engineer	RTLogic 12515 Academy Ridge VW Colorado Springs, CO 80921	719-598-2801	719-598-2655	price.jennifer@gmail.com	x	x
Alex Herrera	Cypress	Site Manager	Cypress 6005 Delmonico Dr., Suite 200 Colorado Springs, CO 80919	268-2609	-	ajh@cypress.com	x	x
Paul Kalthoff	Senior Engineer	Maxim	Maxim 5136 Iron Horse Trail, Colorado Springs, CO 80917	278-2011	-	paul.kalthoff@ieee.org	x	
Jim Laffenburger	EM Microelectronic	Technical Sales Manager	5475 Mark Dabling Blvd. Suite 200, Colorado Springs, CO 80918	593-9224	593-2864	jim.lauffenburger@emmicro-us.com	x	
John Meredith	ASIC Design	Consulting Engineer	ASIC Design 5220 Escapardo Way Colorado Springs, CO 80917	590-3382	-	john4meredith@yahoo.com	x	
Dr. Younus Lotfi	Aeroflex	Principal Engineer	Aeroflex Colorado Springs, 4350 Centennial Blvd. Colorado Springs, CO 80907	594-8005	594-8468	younes.lotfi@aeroflex.com	x	
Steve Callicut	LSI Logic	Manager	LSI Logic 4420 ArrowsWest Drive Colorado Springs, CO 80907	533-7562	-	Steve.Callicott@lsi.com	x	x
Al Rosa	USAFA	Academy Fellow	USAFA 330 Buckeye Dr., Colorado Springs, CO 80919	333-6870	-	arosa@du.edu	x	x
Larry Scally	Colorado Engineering, Inc.	President	Colorado Engineering, Inc. 1310 United Heights, Suite 105, Colorado Springs, CO 80921	388-8582		larry.scally@coloradoengineeringinc.com	x	x
David Ward	Semquest Inc.	President	1230 Arizona Sun Grove, Colorado Springs, CO 80909	447-8757		dward@semquest.com		

F- Exit Interview Surveys

Department of Electrical and Computer Engineering
Exit Interview – EE Graduating Students

Graduation Date: ___________

Now that you are about to graduate, we are seeking your input on the value of your engineering education for our annual self-assessment of our EE program. All information shared on this survey will be kept confidential.

Please evaluate by placing an **X** in the appropriate box on a scale of:

① Needs improvement
② Adequate
③ Good
④ Exceeds Standards
⑤ Excellent
⑥ Outstanding

Question #1

Rate us on how well you feel UCCS prepared you to accomplish your future plans. *Comments:*	①	②	③	④	⑤	⑥

Question #2

Rate the Electrical Engineering program overall. *Suggestions for improvement:*	①	②	③	④	⑤	⑥

Question #3

How do you plan to keep up to date with changes in technology? *Comments:*

Question #4

Please share comments about your overall experience here at UCCS. (Faculty, staff, labs, college life, etc.) *Comments:*

Department of Electrical and Computer Engineering
Exit Interview – EE Graduating Students

Graduation Date: ___________

The Electrical and Computer Engineering Department Faculty and Staff congratulate you on your success. Please keep in touch!

Please provide a phone number and/or e-mail address for future contact.

Name: ____

Phone Number:________________________ E-mail:_____________________________

Please tell us about your future plans:

Employment (Please let us know if you have accepted a job or have an offer(s), with whom, and if you are willing to share, your starting salary).

Graduate School (Give names of school(s) applied to, program you plan on pursuing, and if accepted).

College of Engineering and Applied Science
Electrical and Computer Engineering Program Educational Objectives
EE Graduating Students

Graduation Date:__________________

Evaluation of the Educational Objectives for the Electrical Engineering degree program is being solicited. The graduating students of the department of Electrical and Computer Engineering-ECE have been identified as an important contributor. Please give your opinion on the following objectives on a scale of:

① Needs Improvement
② Adequate
③ Good
④ Exceeds standards
⑤ Excellent
⑥ Outstanding

The objectives of the department of ECE are that its graduates are able to:

1. Read, interpret, and critically assess literature in electrical and computer engineering and evaluate its impact on current issues in engineering and society.

   ① ② ③ ④ ⑤ ⑥

2. Write technical reports and other documentation, and to present oral reports of a technical nature.

   ① ② ③ ④ ⑤ ⑥

3. Use basic knowledge in science and mathematics, as well as knowledge and tools in engineering disciplines, to analyze and synthesize real-world engineering problems.

   ① ② ③ ④ ⑤ ⑥

4. Design processes, devices, circuits or computer using engineering knowledge and tools while considering economics, safety, ethics, ergonomics, and aesthetics.

   ① ② ③ ④ ⑤ ⑥

5. Function in an effective manner, alone or as part of a team, in an engineering capacity.

   ① ② ③ ④ ⑤ ⑥

6. Appreciate the importance of keeping up with the engineering field.

   ① ② ③ ④ ⑤ ⑥

Please give below your ideas on improving the objectives.

Electrical Engineering
Educational Objectives
Student Survey
Graduation Date: __________

Evaluation of the Educational Objectives for the Electrical Engineering degree program is being solicited. Advanced students with an interest in Electrical Engineering have been identified as important contributors. Please give your opinion on the following objectives on a scale of:

① Unimportant
②
③
④
⑤
⑥ Essential

The objectives for the Bachelor of Science program in Electrical Engineering are:

1. Illuminate – lifelong learning in electrical engineering
   Alumni are expected to learn new engineering technologies as needed and pursue graduate school or technology careers, including but not limited to technical development, project management and technical sales

   ① ② ③ ④ ⑤ ⑥

2. Investigate – demonstration of electrical engineering principles
   Alumni should have the ability to find and access information relevant to an application under development and have the ability to understand and approach various engineering problems and convert their solutions into engineering products

   ① ② ③ ④ ⑤ ⑥

3. Innovate – creative application of electrical engineering principles
   Alumni should be able to apply the theory and techniques of electrical engineering - circuit design, communication systems, computer design, control systems, digital design, electromagnetics, microelectronics, signal processing - to innovative real-world solutions.

   ① ② ③ ④ ⑤ ⑥

Please give below your ideas on improving the objectives.

____
____
____
____
____
____

EE/CpE

Senior Exit Interview

____
Date

Name:

Positives:

Negatives:

Plan to keep abreast of changes in technology to keep current in the field?

G- Alumni Surveys

College of Engineering and Applied Science
Electrical Engineering Alumni Survey

The Electrical and Computer Engineering (ECE) Department at the University of Colorado at Colorado Springs (UCCS) requests your assistance in assessing its educational objectives. Please complete the survey below and return it by email to the ECE Department at ecedept@eas.uccs.edu. The results of the survey will be kept confidential.

EE Program Educational Objectives:

1. Illuminate – lifelong learning in electrical engineering
   Alumni are expected to learn new engineering technologies as needed and pursue graduate school or technology careers, including but not limited to technical development, project management and technical sales

2. Investigate – demonstration of electrical engineering principles
   Alumni should have the ability to find and access information relevant to an application under development and have the ability to understand and approach various engineering problems and convert their solutions into engineering products

3. Innovate – creative application of electrical engineering principles
   Alumni should be able to apply the theory and techniques of electrical engineering to innovative real-world solutions.

Questions

1. Are you currently engaged in employment as an engineer including, but not limited to technical development, project management, and technical sales? ___Yes; ___No; Number of years_____

2. On average, to what extent have you pursued lifelong learning?
   a. Professional development courses: ___Never; ___Seldom; ___One/2 yrs; ___One/yr
   b. Masters degree: ___Pursuing; ___Complete (year:_____)
   c. PhD: ___Course work; ___Dissertation; ___Complete (year:_____)
   d. Attend professional conferences: ___Never; ___Seldom; ___One/2 yrs; ___One/yr
   e. Not applicable
   f. Other ____

3. Where do you find the information relevant to your work as an engineer (circle applicable ones)?
   a. Library (company or other)
   b. Internet
   c. Supplier
   d. Colleague
   e. Other ____

4. How well do the theory and methodology of electrical engineering learned while in school serve you in creatively applying them in your work?

   ___Not at all; ___Very little; ___Somewhat; ___Well; ___Very well

College of Engineering and Applied Science
Department of Electrical and Computer Engineering
Stakeholder Survey

The Electrical and Computer Engineering (ECE) department at the University of Colorado at Colorado Springs (UCCS) requests your assistance in assessing their baccalaureate alumni. Please complete the survey below to the best of your ability and return it by email to the ECE Department at ecedept@eas.uccs.edu. The results of this survey will be kept confidential.

1. How many UCCS Electrical Engineering baccalaureate alumni do you employ? ________

2. To the best of your knowledge, in what technology career areas are UCCS Electrical Engineering baccalaureate alumni employed: *(Please circle all that apply.)*
   a. Technical sales
   b. Product management
   c. Technology development
   d. Other ______________________________

3. In what ways do UCCS Electrical Engineering baccalaureate alumni continue to develop intellectually and professionally (lifelong learning)? *(Please circle all that apply.)*
   a. Professional development courses
   b. Advanced degrees
   c. Present at or attend professional conferences
   d. Not applicable
   e. Other ____

Please rate UCCS Electrical Engineering baccalaureate alumni in the following areas:

	Excellent	Good	Average	Fair	Poor
4. Technical skills	5	4	3	2	1
5. Demonstrate effective problem solving skills	5	4	3	2	1
6. Ability to solve complex technical problems	5	4	3	2	1
7. Ability to develop new technologies	5	4	3	2	1
8. Possess a global awareness in a changing engineering field	5	4	3	2	1
9. Ability to work as effective technical team members	5	4	3	2	1

10. Please write any additional comments below.

H- Course Assessment Materials

ECE 4899 Proposal Presentation Evaluation

Team Members: ____

Title: ____

Reviewer: ____________________________ **Date:**________________

Individual Characteristics (circle choice)	**Member 1**	**Member 2**	**Member 3**
Does the speaker have good poise?	**Y N**	**Y N**	**Y N**
Is the pointer used effectively?	**Y N**	**Y N**	**Y N**
Is the speaker's voice loud enough?	**Y N**	**Y N**	**Y N**
Does the speaker often have his/her eyes on the audience and not the slides?	**Y N**	**Y N**	**Y N**

Team Characteristics	**Circle Choice, 1 lowest, 5 highest**
Is the team able to communicate effectively (is the talk well organized)?	**1 2 3 4 5**
Is the explanation of individual topics detailed enough?	**1 2 3 4 5**
Can the project be finished (is it feasible) within the subsequent semester?	**1 2 3 4 5**
Are the design requirements reasonable (too weak/too strong)?	**1 2 3 4 5**
Does the team include an introduction and summary/conclusion?	**1 2 3 4 5**
Does the team have a well defined schedule for the project?	**1 2 3 4 5**
Does the team have a well defined budget for the project?	**1 2 3 4 5**
Does the proposed project demonstrate meeting needs with realistic constraints (e.g., economic, environmental, social, political, ethical, health, safety, manufacturability and sustainability)?	**1 2 3 4 5**
How well does the team function as a team (even distribution of effort)?	**1 2 3 4 5**
Rate the multidisciplinary nature of the team/project, with 5 being the highest.	**1 2 3 4 5**

Comments:

ECE 4899 Design Review Evaluation

Team Members: ____

Title: ____

Reviewer: __________________________ **Date:**________________

Individual Characteristics (circle choice)	Member 1	Member 2	Member 3
Does the speaker have good poise?	Y N	Y N	Y N
Is the pointer used effectively?	Y N	Y N	Y N
Is the speaker's voice loud enough?	Y N	Y N	Y N
Does the speaker often have his/her eyes on the audience and not the slides?	Y N	Y N	Y N

Team Characteristics	Circle Choice, 1 lowest, 5 highest
Is the team able to communicate effectively (is the talk well organized)?	1 2 3 4 5
Is the explanation of individual topics detailed enough?	1 2 3 4 5
Has the team displayed the knowledge of contemporary issues?	2 2 3 4 5
Has the team displayed the ability to use techniques, skills and tools needed for engineering practice?	1 2 3 4 5
How well was the literature search performed?	1 2 3 4 5
How good is the analysis and fundamental design work on the project?	1 2 3 4 5
How well are the engineering tradeoffs supporting the technical decisions explained?	2 2 3 4 5
Have project schedule changes been explained and justified?	1 2 3 4 5
Does the proposed project demonstrate meeting needs with realistic constraints (e.g., economic, environmental, social, political, ethical, health, safety, manufacturability and sustainability)?	1 2 3 4 5
Does the team include an introduction and summary/conclusion?	1 2 3 4 5
How well does the team function as a team (even distribution of effort)?	1 2 3 4 5

Comments:

ECE 4890 Topic Talks A, B and C

General Evaluation

Topic A B C (circle one): ____
Team Members:____

Reviewer: _______________________________ **Date:**____________________

Individual Characteristics (circle choice)	Member 1	Member 2	Member 3
Does the speaker have good poise?	Y N	Y N	Y N
Has he/she overcome nervousness?	Y N	Y N	Y N
Is any pointer used?	Y N	Y N	Y N
Is the pointer used effectively?	Y N	Y N	Y N
Is the speaker's voice loud enough?	Y N	Y N	Y N
Does the speaker often have his/her eyes on the audience?	Y N	Y N	Y N
Has the speaker avoided constant reading from the screen?	Y N	Y N	Y N

Team Characteristics	Circle Choice, 1 lowest, 5 highest
Are the visual aids well prepared?	1 2 3 4 5
Is the presentation clearly delivered?	1 2 3 4 5
Is the talk well organized?	2 2 3 4 5
Dies the talk effectively cover the intended topics?	1 2 3 4 5
Does the team include an introduction and summary/conclusion?	1 2 3 4 5
Did each member of the team have approximately an equal share in the presentation?	1 2 3 4 5

Comments:

ECE 4890 Topic Talks A, B and C
Specific Evaluation

Topic A B C (circle one): ____

____

What have you learned?

ECE 4899 Final Report Evaluation

Team Members: ____
Title: ____

Reviewer: ______________________________ **Date:**____________________

Please evaluate by circling the numbers on a scale of: 1 Needs improvement 3 Good 5 Excellent 2 Adequate 4 Exceed standards 6 Outstanding	
Is report written in a formal organization as commonly used in the professional engineering work place? (contains Intro, Summary/Conclusion, figures/tables and references etc.)	**1 2 3 4 5 6**
Does the report exhibit correct English Grammar?	**1 2 3 4 5 6**
Does the report exhibit correct word usage?	**1 2 3 4 5 6**
Does the report exhibit correct spelling?	**1 2 3 4 5 6**
Do figures have correct format?	**1 2 3 4 5 6**
Do tables have correct format (IEEE)?	**1 2 3 4 5 6**
Do references have correct format (IEEE)?	**1 2 3 4 5 6**
Are contents effectively conveyed?	**1 2 3 4 5 6**
Does report contain sufficient detail?	**1 2 3 4 5 6**
Is report neatly prepared?	**1 2 3 4 5 6**

Comments:

ECE 4899 Final Demonstration Evaluation

Team Members: ____

Title: ____

Reviewer: _____________________________________ **Date:** _______________________

Please evaluate by circling the numbers on a scale of: **1 Needs improvement 3 Good 5 Excellent** **2 Adequate 4 Exceed standards 6 Outstanding**	
Is the demo working with few glitches?	**1 2 3 4 5 6**
Does the team have an orderly flow to the demonstration?	**1 2 3 4 5 6**
Has the team thought out how to effectively demonstrate the relevant design requirements and features of the project?	**1 2 3 4 5 6**
In their strong correlation between the oral presentation description of the hardware/software and what is actually seen in the demo?	**1 2 3 4 5 6**
How well does the team function as a team (even distribution of effort, working together)?	**1 2 3 4 5 6**
Does the team answer questions effectively?	**1 2 3 4 5 6**

Comments:

ECE 4899 Design Review Evaluation

Team Members: ____

Title: ____

Reviewer: ____________________________________ **Date:**_______________________

Individual Characteristics (circle choice)	Member 1	Member 2	Member 3
Does the speaker have good poise?	Y N	Y N	Y N
Is the pointer used effectively?	Y N	Y N	Y N
Is the speaker's voice loud enough?	Y N	Y N	Y N
Does the speaker often have his/her eyes on the audience and not the slides?	Y N	Y N	Y N

Team Characteristics	Circle Choice, 1 lowest, 5 highest
Is the team able to communicate effectively (is the talk well organized)?	1 2 3 4 5
Has the team displayed knowledge of contemporary issues?	1 2 3 4 5
Has the team displayed the ability to use techniques, skills and tools needed for engineering practice?	1 2 3 4 5
Have issues unresolved at the design review now been addressed?	1 2 3 4 5
Has the project resulted in working hardware/software/simulation?	1 2 3 4 5
Does the team, as a whole, answer questions effectively?	1 2 3 4 5
How well are the engineering tradeoffs supporting the technical decisions explained?	1 2 3 4 5
Has the project stayed on time and on budget?	1 2 3 4 5
Has the project demonstrated meeting needs with realistic constraints (e.g., economic, environmental, social, political, ethical, health, safety, manufacturability and sustainability)?	1 2 3 4 5
Does the team include an introduction and summary/conclusion?	1 2 3 4 5
Have the original goals/requirements been met?	1 2 3 4 5
Has each member of the team performed an equal share of the project?	1 2 3 4 5

Comments:

ECE 4890 Pre-Proposal Presentation Evaluation

Team Members: ____

Title: ____

Reviewer: ______________________ **Date:**______________

Individual Characteristics (circle choice)	Member 1	Member 2	Member 3
Does the speaker have good poise?	Y N	Y N	Y N
Is the pointer used effectively?	Y N	Y N	Y N
Is the speaker's voice loud enough?	Y N	Y N	Y N
Does the speaker often have his/her eyes on the audience and not the slides?	Y N	Y N	Y N

Team Characteristics	Circle Choice, 1 lowest, 5 highest
Is the team able to communicate effectively (is the talk well organized)?	1 2 3 4 5
Is the explanation of individual topics detailed enough?	1 2 3 4 5
Can the project be finished (is it feasible) within the subsequent semester?	1 2 3 4 5
Are the design requirements reasonable (too weak/too strong)?	1 2 3 4 5
Does the team include an introduction and summary/conclusion?	1 2 3 4 5
Does the team have a well defined schedule for the project?	1 2 3 4 5
Does the team have a well defined budget for the project?	1 2 3 4 5
Does the proposed project demonstrate meeting needs with realistic constraints (e.g., economic, environmental, social, political, ethical, health, safety, manufacturability and sustainability)?	1 2 3 4 5
How well does the team function as a team (even distribution of effort)?	1 2 3 4 5
Rate the multidisciplinary nature of the team/project, with 5 being the highest.	1 2 3 4 5

Comments:

ECE 4899 Department of Electrical and Computer Engineering

Final Oral Presentation Evaluation

Date: ______________ Course: ECE4899 Evaluator: ____________________
Presentation Team: ____
Title: ____

Please evaluate by filling in the circled numbers. (1 = lowest, 6 = best)

1.	**General questions on oral presentation (0 = No, 1 = Yes)**	
a)	Is the presentation time kept within allowed limit?	⓪ ①
b)	Does the speaker have good poise?	⓪ ①
c)	Has he/she overcome nervousness?	⓪ ①
d)	Is any pointer used?	⓪ ①
e)	Is the pointer used effectively?	⓪ ①
	Subtotal: (Add 1a through 1e)	⓪ ① ② ③ ④ ⑤
2.	**Voice and visual aids (0 = No, 1 = Yes)**	
a)	Is the speaker's voice loud enough?	⓪ ①
b)	Does the speaker often have his/her eyes on the audience?	⓪ ①
c)	Has the speaker avoided constant reading from the transparencies?	⓪ ①
d)	Is the font size appropriate?	⓪ ①
e)	Does he/she include Introduction and Summary/Conclusion?	⓪ ①
	Subtotal: (Add 2a through 2e)	⓪ ① ② ③ ④ ⑤
3.	Are the visual aids well prepared?	① ② ③ ④ ⑤ ⑥
4.	Do the visual aids contain many spelling or grammar errors?	① ② ③ ④ ⑤ ⑥
5.	Is the presentation clearly delivered?	① ② ③ ④ ⑤ ⑥
6.	Is the explanation of individual topics detailed enough?	① ② ③ ④ ⑤ ⑥
7.	Is the talk well organized?	① ② ③ ④ ⑤ ⑥
8.	Does the talk effectively cover the intended topics?	① ② ③ ④ ⑤ ⑥
9.	Has the speaker successfully achieved the intended goal?	① ② ③ ④ ⑤ ⑥
10.	Does the speaker answer the questions effectively?	① ② ③ ④ ⑤ ⑥
	SUBTOTAL (FOR ABET RECORDS): (out of 58)	☐

Completed Project: (1 = lowest, 5 = best)

1.	Have issues unresolved at the design review now been addressed?	① ② ③ ④ ⑤
2.	Has the project stayed on-time and on-budget?	① ② ③ ④ ⑤
3.	Has the project resulted in a working simulation or working hardware?	① ② ③ ④ ⑤
4.	How good is the fundamental design work on the project?	① ② ③ ④ ⑤
5.	How well are the engineering tradeoffs supporting the technical decisions explained?	① ② ③ ④ ⑤
6.	Have the original goals been met?	① ② ③ ④ ⑤
7.	Has each member of the team performed equal share of project?	① ② ③ ④ ⑤

Presentation: (1 = lowest, 5 = best)

1.	Is the presentation delivered clearly and effectively?	① ② ③ ④ ⑤
2.	Is the presentation evenly distributed among team members?	① ② ③ ④ ⑤
	TOTAL SCORE: (out of 103)	☐

Department of Electrical and Computer Engineering
Final Written Report Evaluation

Course: ECE4899 Evaluator: ______________________
Project Team: Project Title: ____

Please evaluate by filling in the circled numbers on a scale of:

① Needs improvement ③ Good ⑤ Excellent
② Adequate ④ Exceeds standards ⑥ Outstanding

1.	Is the report written in a formal organization as commonly used in the professional engineering work place? (contains Introduction, Summary/ Conclusion, figures/ tables, and references, etc.)	① ② ③ ④ ⑤ ⑥
2.	Does the report exhibit correct English grammar?	① ② ③ ④ ⑤ ⑥
3.	Does the report exhibit correct word usage?	① ② ③ ④ ⑤ ⑥
4.	Does the report exhibit correct spelling?	① ② ③ ④ ⑤ ⑥
5.	Do figures have correct format?	① ② ③ ④ ⑤ ⑥
6.	Do tables have correct format?	① ② ③ ④ ⑤ ⑥
7.	Do references have correct format?	① ② ③ ④ ⑤ ⑥
8.	Are the contents effectively conveyed?	① ② ③ ④ ⑤ ⑥
9.	Does report contain sufficient detail?	① ② ③ ④ ⑤ ⑥
10.	Is report neatly prepared?	① ② ③ ④ ⑤ ⑥
	Overall Report Grade (out of 60)	

Comments: (particularly, should all team members receive the same grade?)

Department of Electrical and Computer Engineering
Final Written Report Evaluation

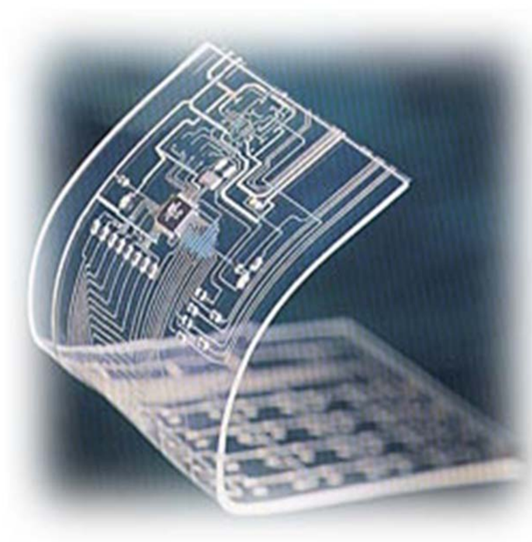
Course: ECE4899 Evaluator: ______________________
Project Team: Project Title: ____

Please evaluate by filling in the circled numbers on a scale of:

① Needs improvement ③ Good ⑤ Excellent
② Adequate ④ Exceeds standards ⑥ Outstanding

1.	Is the report written in a formal organization as commonly used in the professional engineering work place? (contains Introduction, Summary/ Conclusion, figures/ tables, and references, etc.)	① ② ③ ④ ⑤ ⑥
2.	Does the report exhibit correct English grammar?	① ② ③ ④ ⑤ ⑥
3.	Does the report exhibit correct word usage?	① ② ③ ④ ⑤ ⑥
4.	Does the report exhibit correct spelling?	① ② ③ ④ ⑤ ⑥
5.	Do figures have correct format?	① ② ③ ④ ⑤ ⑥
6.	Do tables have correct format?	① ② ③ ④ ⑤ ⑥
7.	Do references have correct format?	① ② ③ ④ ⑤ ⑥
8.	Are the contents effectively conveyed?	① ② ③ ④ ⑤ ⑥
9.	Does report contain sufficient detail?	① ② ③ ④ ⑤ ⑥
10.	Is report neatly prepared?	① ② ③ ④ ⑤ ⑥
	Overall Report Grade (out of 60)	

Comments: (particularly, should all team members receive the same grade?)

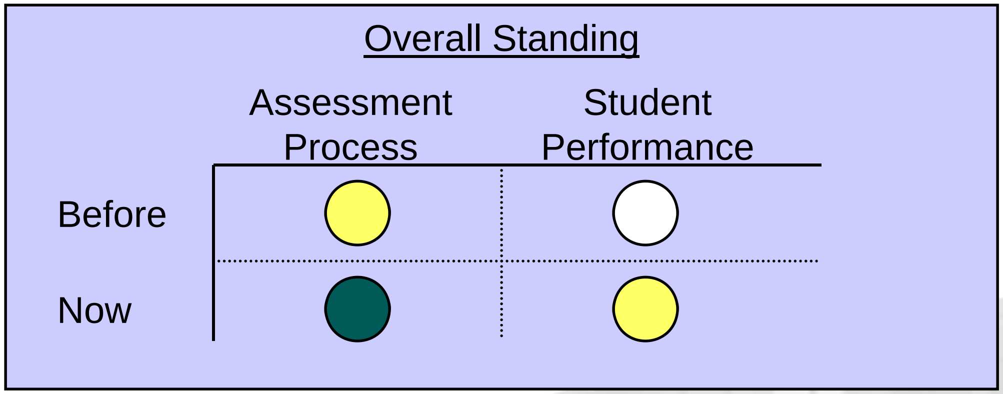


ECE3205
Circuits and Systems II

Course Assessment: December 20, 2006

Course Instructor: Rodger Ziemer

Term: Autumn 2006



Department of Electrical and Computer Engineering
University of Colorado at Colorado Springs

Catalog Description and Linkages

- "A continuation of topics introduced in ECE 2205. Also, phasors, sinusoidal steady-state response, impedance models, Fourier series and Laplace transforms. Computer-aided design of active and passive analog filters. Includes lectures, demonstrations, and laboratory assignments."

Prerequisites:

③ Circuits and Systems I [ECE2205]

Course Goals: By successfully completing this course, the student will be able to:

- Be proficient in applying analog and digital system analysis and design principles to real world problems
- Have facility with the tools of Fourier analysis, power concepts, Bode analysis, stability tests (Routh), and analog and digital filter design techniques for use in analysis and design of hybrid systems

Target Courses:

② Electronics II [ECE3220]

② Electronics Laboratory II [ECE3240]

Level ①: Exposure; vocabulary; qualitative and quantitative understanding

Level ②: Ability to apply knowledge to qualitative and quantitative analysis over limited set of problems

Level ③: Ability to apply knowledge to qualitative and quantitative analysis over wide range of problems

Mapping B.S.E.E Outcomes to B.S.E.E Objectives

B.S.E.E Outcomes	B.S.E.E Objectives		
	1	2	3
(a) An ability to apply knowledge of mathematics, science and engineering	X	X	X
(b) An ability to design and conduct experiments as well as analyze and interpret data		X	

B.S.E.E Objectives:
1. Illuminate – Lifelong learning in electrical engineering.
2. Investigate – Demonstration of electrical engineering principles.
3. Innovate – Creative application of electrical engineering principles.

Assessment Mapping

Course Outcomes (Current Offering)	Representative Criteria (primarily highlights & problem areas - not a complete list)	Student Performance (Assessment Type)	
(a) An ability to apply knowledge of mathematics, science and engineering	1. Selected problems on final 2. Weekly homework sets 3. Weekly quizzes	🟡 🟢 🟡	EX (75%) HW (84%) EX (73%)
(b) An ability to design and conduct experiments as well as analyze and interpret data	1. Laboratory experiments 2. Final project	🟢 🟢	R (86% average over all labs) R (89% average)

EX = Graded Tests (Final, Exams, Quizzes); R = Rubrics; P = Peer Evaluations; CS = Project Cut Sheets;
HW = Homework; PR = Graded Project or Lab Report; O = Faculty Observations; FG = Focus Groups

🟢 = "good" 🟡 = "okay" 🔴 = "bad" ⚪ = "n/a"

Assessment and Performance

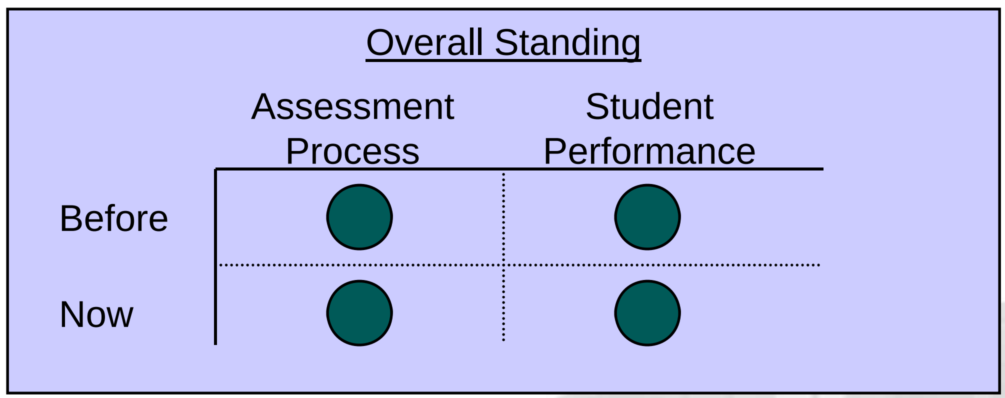
Course Outcomes (Current Offering)	A	P	Problem (Fall 2006)	Action (Fall 2007)	Impact of Action
An ability to apply knowledge of mathematics, science and engineering			Work on final showed spotty overall knowledge While overall problem sets averaged in 80s about ¼ the class struggled with working them	Will try more inclass examples Will stress the importance of practice	TBD TBD
An ability to design and conduct experiments as well as analyze and interpret data			Early labs showed some indecisiveness in experimental procedure Early lab reports showed incompleteness in analyzing results and inability to write concise and logical explanations	Lab assistant and instructor will give more in-lab supervision/ help Instructor will take one class session to explain and point out the rudiments of good lab reports	TBD TBD

ECE1001
Introduction to Robotics

Course Assessment: May 17, 2011

Course Instructor: Robert W. Kressin

Term: Spring 2011



Department of Electrical and Computer Engineering
University of Colorado at Colorado Springs

Catalog Description and Linkages

- "An introductory course presenting foundational material in the design of robots. Topics include basic properties of sensors, motors, gears, drive mechanisms, control schemes and processors to guide and control robots. LEGO kits will be used to implement student designs."

Prerequisites:

② High-school degree (especially math)

Course Goals: By successfully completing this course, the student will be able to:

- Analyze and write simple "C" programs;
- Design simple mechanical structures involving bracing, motors, gears;
- Understand and apply basic principles of electronics, sensors, microprocessors, and control systems;
- Work in groups to accomplish lab exercises and a final project.

Target Courses:

① Computer-Based Modeling and Methods of Engineering [ECE1021]

Level ①: Exposure; vocabulary; qualitative and quantitative understanding
Level ②: Ability to apply knowledge to qualitative and quantitative analysis over limited set of problems
Level ③: Ability to apply knowledge to qualitative and quantitative analysis over wide range of problems

Mapping B.S.E.E/CpE Outcomes to B.S.E.E/CpE Objectives

B.S.E.E/CpE Outcomes	B.S.E.E/CpE Objectives		
	1	2	3
An ability to function on multi-disciplinary teams	X		

B.S.E.E/CpE Objectives:
1. Illuminate – Lifelong learning in electrical engineering.
2. Investigate – Demonstration of electrical engineering principles.
3. Innovate – Creative application of electrical engineering principles.

Assessment Mapping

Course Outcomes (Current Offering)	Representative Criteria		Student Performance (Assessment Type)
An ability to function on multi-disciplinary teams	1. Ability to complete directed laboratory exercises as a team, involving hardware, software, and report writeup.	good	PR [Avg = 85.5%]
	2. Ability to extend beyond the directed laboratory exercises to create solutions to more complex problems.	good	PR [part of above percentage]
	3. Ability to manage a design project, including design proposal, Gantt charts, and progress reports.	good	HW [Avg = 86.4%]
	4. Ability to complete a design project.	good	PR [Avg = 89.4%]
	5. Individual understanding of what to do with “hitchhikers” and “couch potatoes” on teams	good	HW [Avg = 88.3%]
	6. Effectively dealing with “hitchhikers” and “couch potatoes” as the need arises	good	P/O
	7. Demonstrate individual learning through pre-laboratory assignments and quizzes	good	EX, HW [Avg = 76.1%]

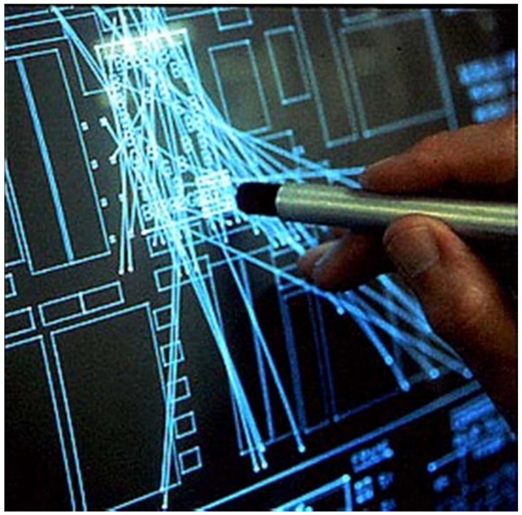
Note: Teams (nominally comprising three members) were formed by selecting one member whose major was either EE or CpE, one member from pre-engineering, and one member from a non-EE major whenever possible. This enforced the multidisciplinary nature of the teams in ECE1001.

EX = Graded Tests (Final, Exams, Quizzes); R = Rubrics; P = Peer Evaluations; CS = Project Cut Sheets;
HW = Homework; PR = Graded Project or Lab Report; O = Faculty Observations; FG = Focus Groups

● = “good” ● = “okay” ● = “bad” ○ = “n/a”

Assessment and Performance

Course Outcomes (Current Offering)	A	P	Problem (Spring 2011)	Action (Fall 2011)	Impact of Action
An ability to function on multi-disciplinary teams					

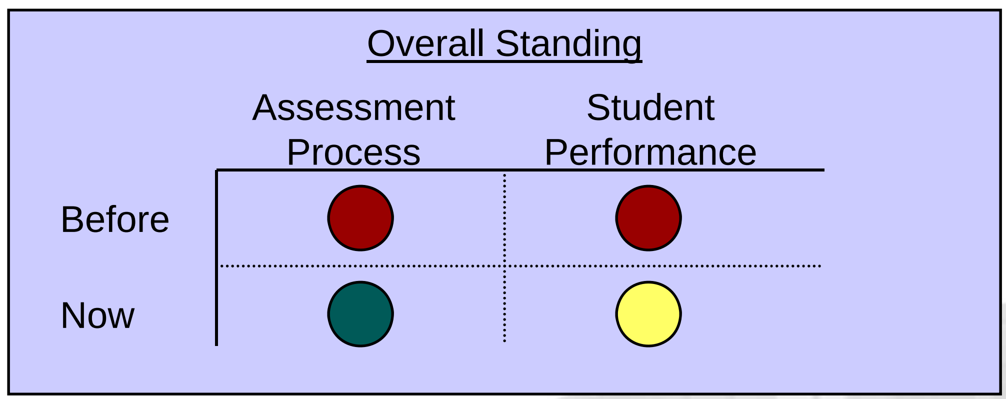


ECE4890
Senior Seminar

Course Assessment: December 20, 2006

Course Instructor: Mark Wickert

Term: Autumn 2006



Department of Electrical and Computer Engineering
University of Colorado at Colorado Springs

Catalog Description and Linkages

- "Design principles and a variety of realistic constraints such as economic factors, safety, reliability, aesthetics, ethics and social impact; design project organization and design goals; techniques for making oral presentations and organizing written reports; interviewing and resume writing skills along with the art of making a favorable first impression."

Prerequisites:

② [none]

Course Goals: By successfully completing this course, the student will be able to:

- Become proficient in the use of library resources and the search for technical information
- Learn the skills and techniques of oral project presentation
- Learn good written project report procedures
- Learn the basics of engineering design
- Learn the ethical practices in engineering
- Prepare for the Senior Design Project Course

Target Courses:

③ Senior Design [ECE4899]

Level ①: Exposure; vocabulary; qualitative and quantitative understanding
Level ②: Ability to apply knowledge to qualitative and quantitative analysis over limited set of problems
Level ③: Ability to apply knowledge to qualitative and quantitative analysis over wide range of problems

Mapping B.S.E.E Outcomes to B.S.E.E Objectives

B.S.E.E Outcomes	B.S.E.E Objectives		
	1	2	3
(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		X	X
(d) An ability to function on multi-disciplinary teams	X		
(f) An understanding of professional and ethical responsibility	X		
(g) An ability to communicate effectively	X		X
(h) The broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context	X		

B.S.E.E Objectives:
1. Illuminate – Lifelong learning in electrical engineering.
2. Investigate – Demonstration of electrical engineering principles.
3. Innovate – Creative application of electrical engineering principles.

Assessment Mapping

Course Outcomes (Current Offering)	Representative Criteria (primarily highlights & problem areas)	Student Performance (Assessment Type)	
(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	1. Team topics oral presentations; standard worksheets use for students to report 2. Individual notes/worksheet describing the noted design aspects/constraints	🟢 🟢	O (89%), P HW (90%)
(d) An ability to function on multi-disciplinary teams	1. Team assignments and oral presentation on ABET outcomes (c), (f), & (h) 2. Final design team selection by peers for 4890/4899 capstone design project	🟡 🟡	O (89%) O (95%)
(f) An understanding of professional and ethical responsibility	1. Team topics oral presentations 2. Individual notes/worksheet documenting professional and ethical topics	🟢 🟢	O (89%), P HW (90%)
(g) An ability to communicate effectively	1. Team topics oral presentations 2. Design requirements document 3. Design project pre-proposal presentation	🟢 🟡 🟢	O (89%) PR (90%) O (82.3%)
(h) The broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context	1. Team topics oral presentations 2. Individual notes/worksheet describing engineering impacts	🟢 🟢	O (89%), P HW (90%)

EX = Graded Tests (Final, Exams, Quizzes); R = Rubrics; P = Peer Evaluations; CS = Project Cut Sheets; HW = Homework; PR = Graded Project or Lab Report; O = Faculty Observations; FG = Focus Groups

🟢 = "good" 🟡 = "okay" 🔴 = "bad" ⚪ = "n/a"

Assessment and Performance

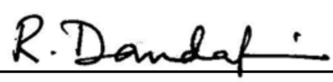
Course Outcomes (Current Offering)	A	P	Problem (Spring 2006)	Action (Fall 2006)	Impact of Action
An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			Prior to Fall 2006 no direct means to assess this was implemented	Students teams give oral presentations on these issues in terms of engineering design	Awareness raised, aspects being revealed in actual design projects
An ability to function on multi-disciplinary teams			Multidisciplinary outside of ECE & CPE not enforced	All design projects require sponsorship by a company	Interaction with outside engineers/marketing
An understanding of professional and ethical responsibility			Prior to Fall 2006 no direct means to assess this was implemented	Students teams give oral presentations on professional and ethical responsibility	Fa 06 & Sp 07 awareness raised, case study discussions effective
An ability to communicate effectively			Design requirements document to connect to design project	Design teams meet with sponsor to create requirements doc	Projects now have stated requirements & acceptance test plans
The broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context			Prior to Fall 2006 no direct means to assess this was implemented	Students teams give oral presentations on these issues in terms of engineering design	Awareness of these issues has been raised as evidenced by worksheet

SIGNATURE PAGE

By signing below, I attest to the following:

That the Bachelor of Science in Computer Engineering (BSCpE) has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's *Criteria for Accrediting Engineering Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual.*

Dean of Engineering and Applied Science
Dr. Ramaswami Dandapani



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Signature **Date**