

PROCESS C

CURRICULUM PROPOSAL SCC #04-05- 411

NEW Programs - MAJOR Program Revisions - PROGRAM Name Changes

LIBRARY RESOURCE FORM REQUIRED

Deadlines: October 8, 2004 to be implemented Fall 2005 ~ February 11, 2005 to be implemented Spring 2006

PROPOSAL TITLE: Modified Electrical & Computer Engineering (ECE) Curriculum (2005)

Sponsors: John L. Schmalzel E-Mail: schmalzel@rowan.edu Ext: 5332

Shreekanth Mandayam E-Mail: shreek@rowan.edu Ext: 5333

DEPARTMENT: Electrical & Computer Engineering

COLLEGE: Engineering

If Liberal Arts & Sciences CHECK : History/Humanities Math/Sciences Social/Behavioral Sciences

UNDERGRADUATE GRADUATE

THE ATTACHED NEW PROGRAM - MAJOR PROGRAM REVISION - PROGRAM NAME CHANGE IS BEST DESCRIBED BY THE ITEM(S) CHECKED.

- New degree program
- Major changes-degree requirements/major/minor or certificate program
- New Major
- Changes to College name, School, Department or Degree
- New Minor
- Quasi-curricular change
- New concentration, specialization, or track
- New Certificate of Graduate Study Program (COGS & COGA)

THE FOLLOWING SIGNATURES REPRESENT APPROVAL

Department Chair: [Signature] Date: 31 MAY 2005

Department Curriculum Chair: [Signature] Date: 2/1/05

Academic Dean: [Signature] Date: 2-11-05

COLLEGE CURRICULUM COMMITTEE

CLOSED HEARING Date: 4/1/05 Approved Not Approved

COLLEGE CURRICULUM CHAIR: [Signature]

UNIVERSITY CURRICULUM COMMITTEE

OPEN HEARING Date: 4/18/05 Approved Not Approved

Senate Curriculum Chair Signature: [Signature] Date: Senate Announcement/Vote: 5/10/05

Comments: _____

EXECUTIVE VICE PRESIDENT/PROVOST Signature: [Signature] Date: 5/23/05

Approved Not Approved

REGISTRAR

Date: 6/1/05 Official Copy & Approval Sheet Filed

Date: _____ Course Description Received & Approved - Heg's Taxonomy & Course # _____

Course Description Received & Approved - Heg's Taxonomy & Course # _____

Registrar Signature: [Signature]

NOTIFICATION FORWARD

- SOC Chair
- Academic Dean
- Department Chair
- Registrar
- IR
- CAP
- VP Student Affairs
- VP Student Affairs
- Others

Major Curriculum Change Proposal

Abstract

Title: Modified Electrical & Computer Engineering (ECE) Curriculum (2005)

Sponsors: John L. Schmalzel and Shreekanth A. Mandayam, ECE Department

Relationship to Department, College, and/or University: The proposed changes affect the structure of the ECE major to allow it to better meet program goals.

Summary of Proposed Curricular Changes: The ECE Department has completed a 12-month review of our curriculum. The timing of this review anticipated the scheduled fall 2006 visit of the Accreditation Board in Engineering and Technology (ABET). Two areas were identified for further work and modification: (1) content of the Computer Engineering portion of the ECE program and (2) expansion in the breadth of the basic science choices. This proposal focuses on the first; proposed changes are summarized in the table below. Summary snapshots of the entire curriculum—current and planned—are included as attachments.

Current CpE Stem	When	SCH	Planned CpE Stem	When	SCH
Computer Science & Programming (C++)	Fr-2	4	Computer Science & Programming (Java, if available)	Fr-2	4
Digital I	So-2	2	Digital I	So-2	3
Digital II: Microprocessors	Ju-1	2	Digital II: Microprocessors	Ju-2	3
Data Structures for Engineers (C++)	Ju-2	3	Data Structures for Engineers (Java, if available)	Ju-2	3
Electronics II: VLSI	Ju-2	3	CpE Core Elective	Sr-1	3
Computer Architecture I: Introduction	Sr-1	2	Computer Architecture I: Introduction	Ju-1	2
Computer Architecture II: Specialized	Sr-1	2			
CS Elective	Sr-1	3	CpE Elective	Sr-1	3
TOTAL		21	TOTAL		21

The review included examination of the recent changes in the Computer Science (CS) major sequence. The outcome of that review is that we want to migrate to Java-based versions of the basic programming courses as they become available. Digital I increases in credit hours from two (2) to three (3) to add sufficient time to treat important hardware descriptor languages (HDLs) such as Verilog. Digital II is increased in credit hours from two (2) to three (3) to allow sufficient time to adequately cover core topics. The additional hours are obtained by removing Computer Architecture II: Specialized as a core CpE requirement and making it available as one of the possible CpE electives. The CS Elective is broadened to be a CpE Elective to allow a wider range of courses to be selected. Finally, these changes transform the senior year of the ECE curriculum to a primarily elective based structure, which reflects a stronger emphasis on option-based components in which students select courses most attuned to their interests while still developing within the two supporting stems of the ECE curriculum.

Implementation time frame: The proposed changes would take effect in spring 2006.

Resources required: The proposed changes do not involve any additional courses added to the curriculum, nor are additional library resources required beyond those available.

Details

Title: Modified Electrical & Computer Engineering (ECE) Curriculum (2005)

Sponsors: John L. Schmalzel and Shreekanth A. Mandayam, ECE Department

Scope and size of the program: The proposed changes affect the structure of the existing 128-SCH ECE major to allow it to better meet program goals.

Need for Program: This proposal seeks only to modify an existing program, which has a total enrollment of 120 majors and produces over 20 graduates annually.

Requirements for admission and graduation: No change is requested from the existing goal of admitting approximately 30 students each year with combined SATs of ≥ 1200 .

Suggested time and scale: Modifications are planned to be effective for fall 2005.

Resource requirements: Program modifications do not require additional resources.

Recommended Library resources: The proposed modifications do not require additional library resources.

Staffing: The proposed modifications do not require additional staffing.

Summary of Proposed Curricular Changes: The ECE Department has completed a 12-month review of our curriculum. The timing of this review anticipates the scheduled fall 2006 visit of the Accreditation Board in Engineering and Technology (ABET). Establishing these changes now gives us time to integrate them into our curriculum so that there is stability when the ABET site visit is conducted. Two areas were identified for further work and modification: (1) content of the Computer Engineering portion of the ECE program and (2) expansion in the breadth of the basic science choices. This proposal focuses on the first as summarized in Table 1 below.

Table 1. Summary changes to ECE program for CpE component.

Current CpE Stem	When	SCH	Planned CpE Stem	When	SCH
Computer Science & Programming (C++)	Fr-2	4	Computer Science & Programming (Java)	Fr-2	4
Digital I	So-2	2	Digital I	So-2	3
Digital II: Microprocessors	Ju-1	2	Digital II: Microprocessors	Ju-2	3
Data Structures for Engineers (C++)	Ju-2	3	Data Structures for Engineers (Java)	Ju-2	3
Electronics II: VLSI	Ju-2	3	CpE Core Elective	Sr-1	3
Computer Architecture I: Introduction	Sr-1	2	Computer Architecture I: Introduction	Ju-1	2
Computer Architecture II: Specialized	Sr-1	2			
CS Elective	Sr-1	3	CpE Elective	Sr-1	3
TOTAL		21	TOTAL		21

The Computer Engineering (CpE) component of the ECE curriculum includes topics drawn from engineering and Computer Science (CS), so both stems were examined.

CS Component. The most recent evolution of the CS program has moved the C++-based Computer Science & Programming (0704.103) out of the requirements for the CS major, replacing it and the Visual Basic-based Introduction to Programming (0701.102) with two Java-

based courses: Introduction to Object Oriented Programming (0704.113) and Object Oriented Programming and Data Abstraction (0704.114). An earlier revision to the CS program modified Data Structures & Algorithms (DS&A) to a 4-SCH course (0704.222); to avoid increasing the net ECE program hours, a 3-SCH Data Structures for Engineers (0704.225) was created to support the ECE program. DS&A is also a prerequisite for many of the upper-division CS courses; the changes effectively reduce the number of CS electives our students can take.

The net effect of these previous changes is that ECE students are now taking introductory software courses being taught as service courses in a different programming language than is being used within the CS major. One objective of the study was to determine whether it was feasible to bring the CS component of the ECE program more in line with the CS major—especially, with the shift in programming language as the preference within the major. A constraint was looking for solutions that did not increase the total number of hours for the ECE major. A comparison of the ECE and CS tracks is summarized in Table 2 below:

Table 2. Comparison of programming sequence courses between current ECE and CS programs.

ECE Program	SCH	CS Program	SCH	CS Minor for ECE	SCH
Computer Science & Programming (0704.103)	4	Intro to Object Oriented Programming (1701.102)	4	Computer Science & Programming (0704.103)	4
				Java for Object-Oriented Programmers (0704.112)	1
		Object Oriented Programming and Data Abstraction (1701.114)	4	Object Oriented Programming and Data Abstraction (1701.114)	4
Data Structures for Engineers (0704.225)	3	Data Structures & Algorithms (0704.222)	4	Data Structures & Algorithms (0704.222)	4
Total	7	Total	12	Total	13

Our CpE task force worked with the Computer Science Department to see if there were ways to get an ECE student to be able to get to DS&A in an abbreviated fashion to allow our students access to advanced CS electives. This effort was illuminating, but revealed that there was no realistic way—short of adding a minimum of five (5) SCH to the ECE program of study—to get the new Java-based courses in our program of study. A five (5) SCH increase to our program is far more hours than we believe practical—or warranted—to add to the existing 128-SCH ECE program of study. However, there is a reasonable chance to transform the existing CS&P and DSE courses to be Java based. Such changes would better meet our minimum objective of having ECE students take CS courses that are more closely aligned with the CS major course sequence. The conclusion of this language portion of the effort is to retain the existing 7-SCH of CS courses, but request that Java be considered as the language for at least a future ECE section of the CS&P course. It might be possible for CS&P be entirely converted to Java, but we recognize that CS&P is still a requirement for a number of other academic programs. In the case of Data Structures for Engineers, this could be shifted to Java because it is only taken by ECE students.

The ECE program had recently modified the curriculum to expand from the previously mandated Software Engineering to allow a choice among several electives such as Operating

Systems (0704.390), Programming Languages (0704.315), and Software Engineering (0707.321). However, the prerequisite of DS&A (0704.222) for Operating Systems and for Programming Languages now effectively removes those courses as possible electives, leaving only Software Engineering as a possible elective because it has an *or* clause that provides for ECE students. To avoid a return to the previous mandatory CS “elective” model, we propose to change the “CS Elective” requirement to “CpE Elective.” This will allow a student to take an elective identified by the program advisor as satisfying the CpE requirements; such courses can include Software Engineering, but also will offer other options from the available elective-level engineering courses and any future CS courses with prerequisites that ECE students meet.

Engineering Component. Analysis of the flow of the CpE courses carefully examined the original sequence and content: Dig I → Dig II (Microprocessors) → Electronics II (VLSI Design) → Computer Architecture I → Computer Architecture II. The recommendation—and the core of this proposal—is that the sequence be changed (see earlier table) and the number of hours apportioned to the sequence be adjusted. Assessment of the digital sequence identified that certain courses were severely constrained by the 2-SCH assigned to them, and the order of courses was not optimal.

Digital I: Digital I is the introductory course treating the fundamentals of Boolean algebra, switching theory, and digital design. The course was originally intended to include meaningful introduction to hardware descriptor languages (HDLs) such as Verilog or VHDL, but those topics had to be abbreviated to fit within the available 2-SCH. This knowledge has become ever more critical due to the expansion of HDL usage in practice. The proposed modification adds an additional credit hour to Digital I (0909.241) to address this deficiency, changing it to a 3-SCH course from the current 2-SCH. This change will allow sufficient time to provide a meaningful introduction to hardware descriptor languages (HDLs) such as Verilog. A further benefit is that the range of digital and architecture topics can be expanded because the language-based approach more efficiently deals digital structures and their interrelationships. The additional 1-SCH for Digital I and for Digital II (see below) are obtained by removing the 2-SCH Computer Architecture II: Specialized (0909.444) as a core requirement and making it available as one of the possible CpE electives.

Digital II: Digital II remains of key importance because of the pivotal role microprocessors play in modern technology where embedded computer systems are ubiquitous. This proposal seeks to increase Digital II from 2-SCH to 3-SCH to allow sufficient time to adequately cover the core embedded system topics. Digital II is also an important integrating learning experience for our students. It represents the convergence of fundamental knowledge in digital systems, electronics, and software; the additional hour provides more time to adequately tie these threads together in a meaningful way.

Computer Architecture: Digital II was originally offered in the fall of the junior year and treated basic applications and interfacing to an exemplar microprocessor architecture. Yet, students did not know the basics of computer architecture. Computer Architecture I and II were courses offered in the fall of the senior year and covered the fundamentals of computer architecture design based on HDLs with applications to high-performance architectures. This approach was evaluated as being best offered in the opposite order; i.e., students need to learn about the fundamentals of computer architecture before learning to apply one. To this end, Computer Architecture: Introduction (0909.443) has been moved to the fall of the junior year—the position previously occupied by Digital II. This change provides a better continuity of topic

flow between Digital I and Digital II. In Digital I, students have learned all the core architecture elements they need to design a computer system; however, that discovery previously had to wait until their fall semester of the senior year. This proposal closes this gap. Students will immediately apply their digital and HDL skills to the problem of learning about and designing basic computer architectures. Then, they will flow into the spring of the junior year and take Digital II where they will learn to apply an exemplar computer architecture. Thus, they will know what goes into a microprocessor when they take Digital II and can concentrate on how to interface these architectures to the external, physical world.

Electronics II: The original sequence course, Electronics II (0909.312) was taken in the spring of the junior year. Again, this course suffers from a sequence problem. We want students to learn about the design of the very large scale integrated circuits (VLSI) methodologies for implementing complex digital systems; however, they have not had a basic architecture course at this point. Moving this course to the senior year solves this problem. In addition, there is recognition that this particular course, Electronics II: VLSI, may not be the best choice. Another course that includes more analog emphasis (a so-called “Mixed Signal” course) may be a better choice. To accommodate this possibility, instead of naming a specific course, we are proposing to make the requirement as “CpE Core Elective.” The nomenclature also reminds us that while there is not a named course, this elective is a core part of ensuring that a student obtains an adequate CpE preparation.

CpE/ECE/EE Electives: The modification of the elective track at the senior level was explained previously. A further benefit is that these changes in aggregate transform the senior year of the ECE curriculum to a primarily elective based structure. This reflects a stronger balance of option-based components in which students select those courses most attuned to their interests while still developing within the two supporting stems of the ECE curriculum. In keeping with the Rowan tradition of teaching excellence and the Rowan Engineering objective of curricular innovation, this change also provides an environment for future curricular innovations, better supports study-abroad programs, etc. Table 3 summarizes assignment of existing electives into the three categories.

Table 3. Summary of Computer Engineering (CpE), Electrical Engineering (EE), and Electrical and Computer Engineering (ECE) electives.

CpE	EE	ECE
Digital Design w/ VHDL (0909.483)	Power Systems Engineering (0909.408)	Forensic Engineering and Product Liability (0909.406)
Computer Architecture II: Specialized Systems (0909.444)	Introduction to Digital Image Processing (0909.452)	Sustainable Design in Engineering (0909.403)
High Speed Interconnects (0909.401)	Introduction to Artificial Neural Networks (0909.454)	Principles of Biomedical Systems and Devices (0909.404)
Modern Solid State Devices (0909.411)	Optical Fiber Communications (0909.431)	Principles of Nondestructive Evaluation (0909.413)
Mixed Signal Technology (0909.484)	Wireless Communications (0909.432)	Electronic Packaging (0909.412)
Backplane Design (0909.481)	Adaptive Filters (0909.453)	Interaction Design (0909.407)
Architectures for DSP (0909.451)	Topics in ECE (0909.402)	Instrumentation (0909.471)
Topics in ECE (0909.402)		Topics in ECE (0909.402)

Implementation time frame: The proposed changes would take effect in fall 2005.

Resources required: The proposed changes do not involve any additional courses added to the curriculum, and they require no additional resources (faculty, space, library) to effect.

Rationale

Specifically indicate the proposal's merits as they relate to the missions of the University and College the goals of the department.

Essence of the Program

Major goals of the Program: The ECE program seeks to provide a high-quality program with the fundamental mission of creating effective engineers by:

- Cultivating capable communicators
- Developing agile technologists
- Fostering multidisciplinary discourse
- Sensitizing to contemporary issues
- Instilling entrepreneurial spirit
- Imparting essential ECE knowledge

These goals remain the same for the proposed curriculum modification.

Specific objectives of the Program:

The ECE Program provides a balance of depth and breadth in topics appropriate to the areas of Electrical and Computer Engineering as articulated by the Institute for Electrical and Electronic Engineering (IEEE) in their program criteria for such programs. Specifically, such engineering programs must provide foundations in mathematics, sciences, and the humanities, combined with engineering topics divided generally between engineering science and engineering design, which treat specialization topics appropriate to Electrical and Computer Engineering. The proposed curriculum modification specifically reorganizes the format and sequence of the Computer Engineering (CpE) component of the curriculum to provide a more logical flow of topics. In addition, the rearrangement transforms the senior year into predominantly elective-based. This affords the student and the faculty maximum flexibility in configuring the “finishing” component of the program of study to best fit student and program goals.

The most recent 2005/2006 ABET program accreditation criteria requirements (www.abet.org) for our Electrical and Computer Engineering program are summarized below.

PROGRAM CRITERIA FOR ELECTRICAL, COMPUTER, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Institute of Electrical and Electronics Engineers
Cooperating Society for Computer Engineering Programs: CSAB

These program criteria apply to engineering programs that include electrical, electronic, computer, or similar modifiers in their titles.

1. Curriculum

The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program. The program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.

Programs containing the modifier “electrical” in the title must also demonstrate that graduates have a knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

Programs containing the modifier “computer” in the title must also demonstrate that graduates have a knowledge of discrete mathematics.

Structure of Program: The organization of the ECE program is summarized in Table 4 below. The existing structure and the planned structure are tabulated together. A sample four-year curriculum is attached for both the current and planned ECE program.

Table 4. Basic structure of the ECE program. (Note: Hegis numbers on attached degree plans.)

Current ECE Program	SCH	Proposed ECE Program	SCH
Basic Math & Sciences (Other than Gen Ed)		Basic Math & Sciences (Other than Gen Ed)	
Calculus II	4		
Math for Engr Anal I	4		
Math for Engr. Anal II	4	Math for Engr. Anal II	4
Physics I	4		
Physics II	4		
Advanced College Chemistry I	4		
General Education		General Education (See ECE Gen Ed proposal.)	
Communication Bank		Communication Bank	
College Comp I	3	College Comp I	3
College Comp II (in Soph Clinic I)		College Comp II (in Soph Clinic I)	
Public Speaking (in Soph Clinic II)		Public Speaking (in Soph Clinic II)	
Mathematics and Science		Mathematics and Science	
Calculus I	4	Calculus I	4
Advanced College Chem I	4	Physics I	4
Social & Behavioral Sciences		Social & Behavioral Sciences	
Microeconomics	3	Microeconomics	3
SBS Elective	3	SBS Elective	3
History, Humanities, and Languages		History, Humanities, and Languages	
HHL Elective	3	HHL Elective	3
HHL Elective	3	HHL Elective	3
Arts		Artistic and Creative Experience	
Art Elective	3	ACE Elective	3
		Non-Program Courses	
		Calculus II	4
		Math for Engineering Analysis I	4
		Physics II	4
Engineering Topics		Engineering Topics	
Freshman Engineering Clinic I	2	Freshman Engineering Clinic I	2
Freshman Engineering Clinic II	2	Freshman Engineering Clinic II	2
Sophomore Engineering Clinic I	4	Sophomore Engineering Clinic I	4
Sophomore Engineering Clinic II	4	Sophomore Engineering Clinic II	4
Junior Engineering Clinic I	2	Junior Engineering Clinic I	2
Junior Engineering Clinic II	2	Junior Engineering Clinic II	2
Senior Engineering Clinic I	2	Senior Engineering Clinic I	2
Senior Engineering Clinic II (WI)	2	Senior Engineering Clinic II (WI)	2
Clinic Consultant (four, 1-SCH experiences)	4	Clinic Consultant (four, 1-SCH experiences)	4
Seminar	1	Seminar	1
Computer Science & Programming (C++)	4	Computer Science & Programming (Java)	4
Data Structures for Engineers (C++)	3	Data Structures for Engineers (Java)	3
Statics	2	Statics	2
Dynamics	2	Dynamics	2
Networks I	2	Networks I	2
Networks II	2	Networks II	2

Electronics I	2	Electronics I	2
Electronics II: VLSI Design	3	CpE Core Elective	3
Electromagnetics I	2	Electromagnetics I	2
Electromagnetics II	2	Electromagnetics II	2
Systems and Control	3	Systems and Control	3
Digital Signal Processing	3	Digital Signal Processing	3
Electrical Communications	4	Electrical Communications	4
Digital I	2	Digital I	3
Digital II: Microprocessors	2	Digital II: Microprocessors	3
Computer Architecture I: Introduction	2	Computer Architecture I: Introduction	2
Computer Architecture II: Specialized	2		
CS Elective	3	CpE Elective	3
Elective	3	Elective	3
Elective	3	Elective	3
Technology Focus Elective	3	Technology Focus Elective	3
Technology Focus Elective	3	Technology Focus Elective	3
TOTAL	128	TOTAL	128

Identification of courses with brief description and credit hours for each.

(See previous table.)

Sequence of course work with description of major and general education requirements. Include an example of courses that would typically be taken term by term, pointing out any course prerequisites.

(See summary curricular worksheets as ending attachments.)

Describe to what extent courses from other units in the institution will be used and include evidence of agreement from those units to provide such services.

Proposed changes contained in this proposal do not require substantive changes from serving departments.

Compare and contrast the program with similar programs of high quality.

There are fourteen (14) accredited ECE programs; when Rowan Engineering first started, there were only five (5). We believed at that time—and still do—that the combination of Electrical Engineering topics with Computer Engineering topics into a combined degree program is the best approach considering the strong interrelationship between the topics in those two areas. Table 5 lists the currently accredited ECE programs (www.abet.org).

Table 5. Currently accredited Electrical & Computer Engineering programs. (Accredited programs as of 1995 shown **bolded**.)

	Institution
1	Baylor
2	University of CA-Berkeley
3	Carnegie-Melon
4	University of CO-Boulder
5	Cornell
6	Duke
7	Lafayette College
8	University of MN-Duluth
9	NY Institute of Technology
10	University of Rochester
11	<u>Rowan University</u>
12	Rutgers
13	Worcester Polytechnic Institute

Rowan is clearly in some excellent company. While all these programs have to adhere to the same general accreditation guidelines, Rowan does have some very unique features. Perhaps one of the most unique aspects of all the Rowan Engineering programs is the 8-semester multidisciplinary Engineering Clinic sequence. This is not found in the other programs. A difference unique to the Rowan ECE program is the integration of laboratories with traditionally lecture-based courses. That is, in other curricula, there will be “laboratory” courses. Our ECE program includes a laboratory experience as part of all core courses.

Administration (describe the administrative organization of the program with details of the specific role of each group and/or department).

The proposed curriculum change does not involve any change in administration or departmental organization.

Program Evaluation: Procedures that will be used to assess the success of the program in meeting its goals and objectives.

The same outcomes assessment and critical review process that has been in place will continue in force as the essential mechanism for providing continuous review of the curriculum. A recent addition to our program evaluation process is the fall 2004 creation of an Industrial Advisory Board whose input will include evaluation of curriculum in the context of regional industry needs.

Results of Consultation

- a. Letters of consultation with all departments that have similar programs, courses, or course titles MUST be included. If it is a graduate level program a letter or letters from the Graduate Council and Dean must be included. In addition, the proposal in this case should not be submitted until the requisite program announcement has been made.
- b. List the names of persons from department and/or disciplines consulted. Attach a statement about the results (pro and con).

Computer Science: Dr. Jennifer Kay

- c. Attach copies of any written consultations.

The exchange of consult e-mails to date (06 FEB 2005):

Jennifer,

Thanks for your preliminary review of our Curriculum Proposal. In order to help your Curriculum Committee understand our necessary usage of the term "Computer Engineering," I have updated the proposal to include ABET's Program Criteria (<http://www.abet.org/images/Criteria/E001%2005-06%20EAC%20Criteria%2011-17-04.pdf>) that define our "Electrical and Computer Engineering" Program. After reading your note, I realized that your faculty must not be aware of the ABET Criteria that define what we do as part of our ECE curriculum, so I embedded it in the proposal. I hope that this helps provide the clarification your committee needs so that they can see that it would be impossible to rename our program--and its program elements--to something else.

Please let me know if there are other concerns that need to be addressed.

Also, in my latest check w/ Shreekanth on Friday in which we checked Steve's list, we find that we have completed all the consults that your department requested; let us know if there are still any others that may have escaped our attention.

John

>>> Jennifer Kay <kay@elvis.rowan.edu> 02/03/05 03:30PM >>>
John,

We've taken a look at your prop, and unfortunately there is a concern that we hope will be easy for you to address before we write the official consult.

As I see it, the things that affect CS are:

1. Going from Soft Eng/OS/PL to perhaps no CS courses (we can cope with that)
2. Moving CS&P and DSE to java (again, probably doable with some work)

3. This is where the sticky point comes up: the curriculum committee *strongly* opposes the use of the phrase "Computer Engineering" and "Computer Engineering Electives" throughout your prop. You know the history of this going back to the memo of understanding ... it also doesn't help that some of your students go around calling themselves CpE majors.

So, if you guys can rewrite the prop removing your use of "Computer Engineering" and "CpE" everywhere, I think we'll be able to write you a completely positive letter of support.

Please let me know asap if you're going to rewrite. If not, we'll work on a consult with what you've given us.

I'm hoping this isn't a major issue with you and we can ship this out quickly.

Thanks,

-- Jennie

- d. Consulted parties may appear in person at the Open Hearing.

New Courses

- a. Include proposals for new courses needed for the program. The program cannot be fully approved if New Course Proposals are not included.
- b. Conditional approval can be granted to new programs requiring the development of new courses. Final approval will be authorized only after complete approval of all courses included in the program has been granted.

Library Resources

The Provost requires documentation of library resources for the purpose of providing a channel of communication between the library and faculty designing new courses/programs. The information will be used to assess the resources available in the library, and to identify resources the library should acquire to support the course/program. The information will also provide rationale for institutional support for library acquisitions. This form should be completed in a coordinated effort between the course sponsor(s) and the academic department liaison librarian.

The proposed curriculum change requires no additional library resources beyond those currently available to support the ECE program.

CURRENT: ELECTRICAL & COMPUTER ENGINEERING PROGRAM: Class of 2008

Rowan Hall 212, (856) 256-5330

FIRST YEAR

Freshman Engineering Clinic I (0901.101)	2	Freshman Engineering Clinic II (0901.102)	2
Composition I (1501.111)	3	Computer Science & Programming (0704.103)	4
Calculus I (1701.130)	4	Calculus II (1701.131)	4
Advanced College Chemistry I (1906.105)	4	Physics I (1902.200)	4
General Education I ¹	3	General Education II ¹	3
Total Units	16	Total Units	17

SECOND YEAR

Sophomore Engineering Clinic I (0901.201) w/ Composition II	4	Sophomore Engineering Clinic II (0901.202) w/ Public Speaking	4
Engineering Analysis I (1701.235)	4	Engineering Analysis II (1701.236)	4
Physics II (1902.201)	4	Statics (0901.271)	2
Network I (0909.201)	2	Dynamics (0901.291)	2
Network II (0909.202)	2	Digital I (0909.241)	2
Total Units	16	Electronics I (0909.311)	2
		Total Units	16

THIRD YEAR

Junior Engineering Clinic I (0901.301)	2	Junior Engineering Clinic II (0901.301)	2
Clinic Consultant ⁴ (0909.400)	1	Clinic Consultant ⁴ (0909.400)	1
Systems & Control I (0909.321)	3	Data Structures for Engineers ⁵ (0704.225)	3
Engineering Electromagnetics I (0909.301)	2	Digital Signal Processing (0909.351)	3
Engineering Electromagnetics II (0909.302)	2	Electrical Communication Sys (0909.331)	4
Digital II: Microprocessors (0909.242)	2	Electronics II: VLSI Design (0909.312)	3
General Education III (μ Econ, 2204.102) ¹	3	Total Units	16
Total Units	15		

FOURTH YEAR

Senior Engineering Clinic I (0901.401)	2	Senior Engineering Clinic II (WI ¹) (0901.402)	2
Clinic Consultant ⁴ (0909.400)	1	Clinic Consultant ⁴ (0909.400)	1
Computer Arch. I: Introduction (0909.443)	2	Seminar: Engineering Frontiers (0909.498)	1
Computer Arch. II: Specialized (0909.444)	2	Elective ²	3
CS Elective ⁶	3	Technology Focus Elective ²	3
Elective ²	3	General Education IV ¹	3
Technology Focus Elective ²	3	General Education V ¹	3
Total Units	16	Total Units	16

Total Credits: 128

- Notes:
1. General Education courses chosen to satisfy SBS (6 SCH), HHL (6 SCH), and ART (3 SCH) banks, and to satisfy LIT, M/G, and WI.
 2. Electives and Technology Focus Electives are chosen w/ consent of advisor to meet student and program goals. Electives are typically ECE courses; Technology Focus Electives are expected to be multidisciplinary engineering courses.
 3. With prior permission, up to 2 hours of Engineering Clinic at the 3rd or 4th year may be satisfied by a supervised summer internship.
 4. Clinic consultant is a 1-hour experience that is repeated for credit. Work and projects guided by the ECE Discipline Managers.
 5. Students wishing to minor in Computer Science (CS) should instead take the 4-SCH, "Data Structures and Algorithms." Consult the CS Department for the latest information on CS minor requirements.
 6. Chosen from approved CS electives (Software Engineering, Operating Systems, Programming Languages, and/or others)

PROPOSED: ELECTRICAL & COMPUTER ENGINEERING PROGRAM: Class of 2009

Rowan Hall 212, (856) 256-5330

FIRST YEAR

Freshman Engineering Clinic I (0901.101)	2	Freshman Engineering Clinic II (0901.102)	2
College Composition I (1501.111)	3	Computer Sci. & Programming ² (0704.103)	4
Calculus I (1701.130)	4	Calculus II (1701.131)	4
Advanced College Chemistry I (1906.105)	4	Physics I (1902.200)	4
General Education I ¹	3	General Education II ¹	3
Total Units	16	Total Units	17

SECOND YEAR

Sophomore Engineering Clinic I (0901.201)	4	Sophomore Engineering Clinic II (0901.202)	4
w/ College Composition II		w/ Public Speaking	
Engineering Analysis I (1701.235)	4	Engineering Analysis II (1701.236)	4
Physics II (1902.201)	4	Statics (0901.271)	2
Network I (0909.201)	2	Dynamics (0901.291)	2
Network II (0909.202)	2	Digital I (0909.241)	3
		Electronics I (0909.311)	2
Total Units	16	Total Units	17

THIRD YEAR

Junior Engineering Clinic I (0901.301)	2	Junior Engineering Clinic II (0901.301)	2
Clinic Consultant ³ (0909.400)	1	Clinic Consultant ³ (0909.400)	1
Systems & Control I (0909.321)	3	Data Structures for Engineers ² (0704.225)	3
Engineering Electromagnetics I (0909.301)	2	Digital Signal Processing (0909.351)	3
Engineering Electromagnetics II (0909.302)	2	Electrical Communication Sys (0909.331)	4
Computer Arch. I: Introduction (0909.443)	2	Digital II: Microprocessors (0909.242)	3
General Education III (μEcon, 2204.102) ¹	3		
Total Units	15	Total Units	16

FOURTH YEAR

Senior Engineering Clinic I (0901.401)	2	Senior Engineering Clinic II (WI ¹) (0901.402)	2
Clinic Consultant ³ (0909.400)	1	Clinic Consultant ³ (0909.400)	1
CpE Core Elective⁴	3	Seminar: Engineering Frontiers (0909.498)	1
CpE Elective⁴	3	ECE Elective⁴	3
EE Core Elective⁴	3	Technology Focus Elective ⁵	3
Technology Focus Elective ⁵	3	General Education IV ¹	3
		General Education V ¹	3
Total Units	15	Total Units	16

Total Program Credits: 128

- Notes:
1. General Education courses chosen to satisfy banks of Social and Behavioral Science (SBS), 6 SCH; History, Humanities, and Language (HHL), 6 SCH; and Artistic and Creative Experience (ACE), 3 SCH. Also must satisfy Multicultural/Global (MC/G), Literature (LIT), and Writing Intensive (WI) requirements.
 2. Java-based language course if available.
 3. Clinic consultant is a 1-hour experience that is repeated for credit. Work and projects guided by the ECE Discipline Managers.
 4. Computer Engineering (CpE), Electrical Engineering (EE), and Electrical and Computer Engineering (ECE) electives are chosen w/ consent of advisor to meet student and program goals. CpE electives may include approved CS courses.
 5. Technology Focus Electives are chosen w/ consent of advisor to meet student and program goals and are typically multidisciplinary engineering or interdisciplinary courses.

To: John Schmalzel & Shreekant Mandayam, ECE Program
From: Computer Science Department Curriculum Committee
Re: Modified Electrical & Computer Engineering Curriculum (2005) Proposal
Date: February 9, 2005

We are pleased to support the *content* of your major curricular changes to the ECE program, however we have strong objections to your introduction of the terms “Computer Engineering” and “Computer Engineering Elective” into your curriculum.

Please note that if the terms “Computer Engineering” and “Computer Engineering Elective” were removed from this proposal, we would fully support it.

- We accept your move from requiring a CS course (Software Engineering, Operating Systems, or Programming Languages) to requiring a CS course or an ECE course. The motivation seems unclear, since your recent request to allowing OS or PL was specifically designed to give ECE majors with a CS minor a little more flexibility; ECE students without a CS minor have always been required to take Software Engineering. Indeed, the prerequisites for software engineering were specifically written to enable ECE majors to take the course.

We would appreciate guidance from you on how many students you anticipate will choose non-CS electives so that we may adequately plan our course schedules. We anticipate that this may result in the loss of a full section of Software Engineering each year from our departmental course offerings.

- We will work with you to align the Computer Science & Programming and Data Structures for Engineers courses so that they both use the Java language. This would be significantly easier for us if all the programs in Engineering that require these courses would agree to the move to Java from C++, and we would appreciate if you would contact those departments and seek their agreement to move to Java also. Computer Science & Programming will likely continue to also be offered in C++ for non-engineering majors.
- As we have discussed in the past, we continue to be concerned about the large gap between the time students take Computer Science and Programming (Spring of Freshman Year) and Data Structures for Engineers (Spring of Junior Year). The DS for E course depends entirely on the material taught in CS&P, and we do not believe that this gap is in the best interest of the students.
- We strongly object to the consistent use of the language “Computer Engineering” in your proposal. The Memorandum of Understanding between CS & ECE (attached) clearly states, “Planning for possible future curriculum development related to Computer Engineering or to Software Engineering as a major, minor, or concentration should include both ECE and CS, and in all probability the result will be jointly administered.”

We are concerned with the increasing frequency with which the phrase “Computer Engineering” is being used in association with your program. For example:

1. The College of Engineering ECE brochure states, “Rowan has one of only eight combined electrical and computer engineering programs in the US.”
2. In the past year, we have heard many of your students referring to themselves as “Computer Engineering” majors.
3. You repeatedly use the phrase “Computer Engineering” in this proposal, and indeed propose that the term “Computer Engineering Electives” should appear in the Course Catalog.

We recognize that it is not your intent to suggest that you are developing a “Computer Engineering” major, minor, or concentration, as this would clearly contradict the Memorandum of Understanding. However, we believe that your use of the phrase may be confusing or misleading to students, parents, and employers.

Prior to writing this consultation, we had informal discussions with you about your use of the phrase “Computer Engineering,” and it seems to be your position that the ABET criteria (included on page 6 of your proposal) necessitate the use of the term “Computer Engineering.” We see nothing in the ABET criteria that requires the use of this term.

We strongly object to your introducing the phrases “Computer Engineering” and “Computer Engineering Elective” into your major. We request that you to remove the phrase from your proposal, and that you avoid use of the phrase Computer Engineering in conjunction with your program and degree in the future.

Attach: Memorandum of Understanding between the Computer Science Department & the Electrical & Computer Engineering Program.


Memorandum of Understanding

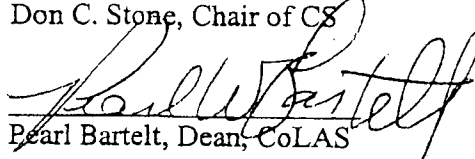
7 April 1999

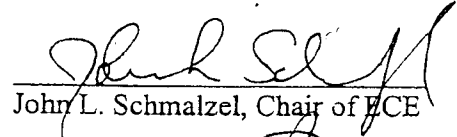
Purpose: The purpose of this memorandum of understanding is to clarify some of the issues relating to shared curriculum interests between the Department of Computer Science (CS) and the Electrical and Computer Engineering (ECE) Program.

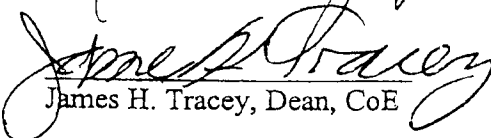
Background: The active collaboration between ECE and CS is of significant value; efforts to date have resulted in funded NSF proposals, course development, and laboratory development. We would like to continue to develop our interaction, building upon the strengths of our respective areas. We also recognize that both CS and ECE must operate in such a way as to meet the program needs developed by their respective faculties to achieve their curricular goals and to meet the requirements of accrediting bodies such as Computing Sciences Accreditation Board (CSAB) and the Accreditation Board for Engineering and Technology (ABET). Both CS and ECE believe that their current curricula are creditable essentially as they now stand without significant changes in content.

1. **Areas of significant efforts.** Both CS and ECE deal broadly with computers; however, each will concentrate most of their efforts in one of two areas. CS will emphasize *software* and *algorithms* and ECE will emphasize *hardware systems*. Recognizing that hardware and software are part of a continuum, this agreement does not preclude the inclusion of an appropriate balance of hardware and software in either program. However, ECE makes a commitment not to put significant resources into developing new capabilities in the software/algorithms area, and CS makes a commitment not to put significant resources into developing new capabilities in the hardware area.
2. **Future curriculum development.**
 - a. **Undergraduate programs:** Planning for possible future curriculum development related to Computer Engineering or to Software Engineering as a major, minor, or concentration should include both ECE and CS, and in all probability the result will be jointly administered.
 - b. **Graduate programs:** CS will support (if proposed) an MS in ECE in the College of Engineering, and ECE will support (if proposed) an MS in CS or an MS in Software Engineering in the College of Liberal Arts and Sciences.
3. **Minor in Computer Science.** Some of the courses included in the current ECE program are requirements or elective options for a minor in CS; other courses in the ECE program are similar to required or elective courses for the CS minor. It would be a benefit for students majoring in ECE if they could obtain a minor in CS within the existing curriculum requirements of the 4-year, 128-hour degree, and this does appear to be possible. Clarifying the coursework equivalence between the CS minor and the ECE program will facilitate this process and can be done as part of the process of developing the equivalences relating to a dual major in ECE and CS.


Don C. Stone, Chair of CS


Pearl Bartelt, Dean, CoLAS


John L. Schmalzel, Chair of ECE


James H. Tracey, Dean, CoE



*Computer Science Department
Don C. Stone, Ph.D., Chair*

To: Carol Matteson, Exec. VP / Provost
From: Don Stone, Chair, Computer Science
Date: 7 December 1998
Re: Name change to Electrical and Computer Engineering

There is a long history of collaboration between Computer Science and Electrical Engineering on campus, most recently in two NSF-funded projects, and we look forward to continuing this type of collaboration.

Concerning the proposed change of designation from "Electrical Engineering Program" to "Department of Electrical and Computer Engineering," we understand that this is a name change for the department/program only; the degree received by their students will continue to be a B. S. in Electrical Engineering.

We want to be sure that the name change from Electrical Engineering Program to Electrical and Computer Engineering Department does not carry with it a connotation that any new initiatives which relate to both computers and engineering will automatically be housed in or controlled by that department. Hence, we would like to see a formal statement that the consideration of any new initiatives which relate to both computers and engineering will directly involve the Computer Science Department. This would include, for example, a change in the name of the Electrical Engineering degree to incorporate the word "computer" or the development of a curriculum entitled Computer Engineering.


c: Pearl Bartelt, College of Liberal Arts and Sciences
✓ James Tracey, College of Engineering
John Schmalzel, Electrical Engineering
Lauretta Reeves, Senate Curriculum Committee



Office of the Dean of Engineering

January 8, 1999

TO: Dr. Carol Matteson
Executive VP/Provost

FROM: James H. Tracey 

RE: Name Change to Electrical and Computer Engineering

This is an attempt to clarify the position of the College of Engineering regarding the proposed Electrical and Computer Engineering Program. A copy of a recent memo to you from Don Stone is attached.

We currently have a Program entitled Electrical Engineering. Dr. Schmalzel is the Program Chair. The Program offers a baccalaureate degree entitled Electrical Engineering.

We are proposing to change the name of the Program and the baccalaureate degree offered to Electrical and Computer Engineering. This has been a popular trend across the country for years. I suspect that there are more baccalaureate degrees offered in Electrical and Computer Engineering than in Electrical Engineering.

A degree program in Electrical and Computer Engineering should involve close collaboration with a Computer Science program. It is our expectation that will be the case at Rowan University.

We are not interested in a third degree program entitled Computer Engineering. I think that would simply diffuse the two strong programs we already have or are developing.

I understand that a change in degree title requires approval at the Board of Trustee level and perhaps higher. Could we get started on the process?

attachment

c: Pearl Bartelt
Lauretta Reeves ✓
John Schmalzel
Don Stone



*Computer Science Department
Don C. Stone, Ph.D., Chair*

To: John Schmalzel, Chair, Electrical and Computer Engineering
From: Don Stone, Chair, Computer Science
Date: 6 April 1999
Re: Computer Science and Electrical and Computer Engineering

We have been thinking hard about the issues involved in the proposed change of the Electrical Engineering degree from BS in Electrical Engineering (EE) to BS in Electrical and Computer Engineering (ECE). We have been trying to clarify why we have had reservations about the name change, and as part of this process we have also been thinking more generally about the relationship between the Computer Science (CS) Department and the Electrical and Computer Engineering (ECE) Program. In this memo we will suggest a general guiding principle for resolving issues between CS and ECE; this principle can also to some extent help resolve the immediate issues before us.

Electrical Engineering and Computer Science are related fields: the former focuses on hardware and the latter on software and algorithms. Software executes on physical devices and the physical devices are enabled and enhanced by software. It is natural that the curricula in Computer Science and Electrical Engineering will have some tendency to overlap.

We have surveyed a number of different U.S. undergraduate departments and degrees in EE, ECE, Computer Engineering (CE), and CS. We have found many different combinations and variations. At many institutions, the configuration seems to be dependent in large part on past history. Unfortunately, at many institutions there is a fair amount of conflict between different areas which have computer-related courses. We would like to avoid this at Rowan.

There are several possible relationships between ECE and CS here at Rowan. One framework for discussing each category of the relationship is two-dimensional: the amount of interaction in a category being one dimension and the nature of the interaction (competition vs. collaboration) being the other. In the area of proposals and grants, for example, we have had a fairly large amount of collaborative interaction, and the CS Department is delighted by our joint successes in this area. (At least in some areas there appears to be an advantage in proposing interdisciplinary projects for funding.) Another area of successful cooperation is on joint projects between CS courses and engineering clinics, etc. In contrast to this, in the curriculum area we have had a relationship that is relatively independent, with some tendencies toward competition (claiming turf) in areas of overlap. And we are concerned that the designation "Electrical and Computer Engineering" may make overlap somewhat more likely.

One strategy for attempting to minimize competitiveness between ECE and CS in curriculum development is to have both groups develop and extend their curricula fairly independently of each other, i.e., to agree not to worry about apparent curricular overlaps. This was our approach initially when reviewing EE curricular matters, and we amplified it by saying that in areas that involve both hardware and software, ECE and CS may have similar courses, but these courses will have different perspectives and will assume somewhat different backgrounds. However, now we have begun to worry a bit about duplication. There are a number of inefficiencies associated with duplication, none dramatic by itself but cumulatively worrisome.

Offering essentially identical courses in two different departments reduces scheduling flexibility. If each term, for example, one section of a CS course is needed for CS majors, and one section of a very similar ECE course is needed for ECE majors, then teaching these courses separately makes it impossible to assign them to the same faculty member in order to assist with compliance with the no-more-than-three-preparations rule. (Also note that if there were a single course satisfying both departments, then ECE and CS students needing this course would have two sections to choose from.) Note in addition that having similar courses taught in two different departments puts a slightly greater burden on the departments in terms of faculty expertise necessary to cover the major. The departments may end up hiring people with similar areas of expertise; if the course were taught by just one department, the number of different areas of expertise covered by the two departments together could be somewhat greater (certainly a plus for the university as a whole). Finally, if there is duplication between the ECE and CS curricula, this could translate into uneconomical duplication in equipment for labs and perhaps even space for labs.

The problems just itemized are somewhat subtle; they might be ignored if we were not in a situation where the level of state funding for Rowan is somewhat unpredictable, where we are right-sizing, where we are competing with other schools for students, and where we are looking for minor economies and improvements in efficiency.

Hence we would like to propose the following guiding principle: **ECE will not put significant resources into developing new capabilities in the software/algorithms area, and CS will not put significant resources into developing new capabilities in the hardware area.**

One corollary of this guiding principle relates to possible Computer Engineering initiatives. We want it to be understood that the appearance of the phrase "Computer Engineering" in the designation "Electrical and Computer Engineering" does not mean that any initiatives related to Computer Engineering will be housed in and administered by Electrical and Computer Engineering. It is our position that CE involves fairly large amounts of both EE and CS. We believe that the expertise currently available in the ECE Program and the CS Department would be able to support a CE degree, for example, except that both ECE and CS would probably need staff increases in order not to negatively impact existing degree programs. When we have proposed in the past that a CE program be jointly developed by ECE and CS and also be jointly administered, there has not been much enthusiasm for this from the engineering side. What we would like at this point, consistent with the above

guiding principle, is a commitment from engineering that if there is to be any Computer Engineering initiative at Rowan, whether it is a major or a minor or a track, it will be jointly developed by ECE and CS and then will be jointly administered. In other words, the Computer Science Department hereby affirms that it will not develop a Computer Engineering initiative by ourselves, and we would like a similar commitment from engineering. We think a shared CE major would be quite attractive, but we'll not push hard for it if you don't currently evaluate it as a very high priority.

In the area of graduate curricula, this guiding principle implies that CS may develop and administer a graduate program in CS or Software Engineering (and we would expect your support for this) but would not develop or administer a graduate program in which there is more emphasis on hardware than software. Similarly, EE will not develop or administer a graduate program in which there is more emphasis on software than hardware. If a graduate program is to be developed in an area that involves hardware and software in about equal measure, then we believe that it should be jointly developed and administered.

This guiding principle doesn't specifically deal with past history, just with future initiatives. We think it makes sense to take the current CS and ECE curricula as given, and not to look back and reevaluate the locations of existing curricular elements; we want to emphasize, however, that these various earlier decisions should not be viewed as precedents to follow in future decisions. In this spirit, since the ECE courses Comp. Arch. I and Comp. Arch. II have been included in curricular planning for some time and are needed in order to complete the E(C)E curriculum, we are willing to accept these courses in almost the form in which they were proposed. The specific change that we would like to see is title changes to give more information: e.g., Comp. Arch. I: Introduction and Comp. Arch. II: Specialized Systems. For curricular issues further back in time, we are willing to leave things as they are (e.g., accepting 0909.560 Artificial Neural Networks as a fait accompli, and accepting 0909.552 Digital Image Processing as proposed, with the assumption that ECE will support, for example, a graduate Computer Vision course, if we should propose one).

If this guiding principle appears reasonable to you as ECE program chair and to Dean Tracey, and if each of you acknowledge this in writing, this would go a long way toward responding to the concerns expressed by CS department members, and it would bring us in CS to the point where we are more comfortable with the relationship between CS and ECE.

There is one further area in which we have a concern relating to the name change. This is the question of how much computer science (or computer-related) coursework is required and how much is possible within the EE/ECE curriculum. We think it is reasonable to expect at a minimum that an ECE curriculum would include enough work with computers so that it is possible for an ECE student to have a CS minor without going over 128 s.h. or taking more than 4 years.

Some CS students might be interested in an ECE minor, and we encourage ECE to develop one that CS students could take without going over 128 s.h. or taking more than 4 years.

We were very pleased to receive the recent package of course proposals from ECE, and we would like to continue the policy of keeping each other well informed of any developments of possible interest, by exchanging all course proposals, etc.

In conclusion, if the curricular concerns expressed above are addressed adequately and if the guiding principle above is acknowledged, then Computer Science will support the name change from BS in EE to BS in ECE.

c: Carol Matteson
Pearl Bartelt
James Tracey



Computer Science Department
Don C. Stone, Ph.D., Chair

To: John L. Schmalzel, Chair, Electrical and Computer Engineering
From: Don C. Stone, Chair, Computer Science DCS
Date: 8 April 1999
Re: B. S. in Electrical and Computer Engineering

Extensive discussions between Computer Science and Electrical and Computer Engineering concerning curriculum concerns and issues have resulted in the attached Memorandum of Understanding. In light of this memorandum, the Computer Science Department supports the change of designation of degree title from B. S. in Electrical Engineering to B. S. in Electrical and Computer Engineering.

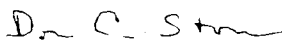
Memorandum of Understanding

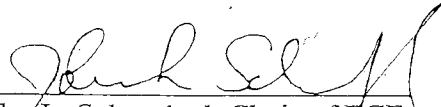
7 April 1999

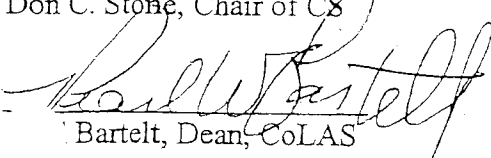
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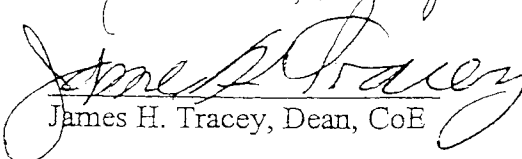
Background: The active collaboration between ECE and CS is of significant value; efforts to date have resulted in funded NSF proposals, course development, and laboratory development. We would like to continue to develop our interaction, building upon the strengths of our respective areas. We also recognize that both CS and ECE must operate in such a way as to meet the program needs developed by their respective faculties to achieve their curricular goals and to meet the requirements of accrediting bodies such as Computing Sciences Accreditation Board (CSAB) and the Accreditation Board for Engineering and Technology (ABET). Both CS and ECE believe that their current curricula are accreditable essentially as they now stand without significant changes in content.

1. **Areas of significant efforts.** Both CS and ECE deal broadly with computers; however, each will concentrate most of their efforts in one of two areas. CS will emphasize *software* and *algorithms* and ECE will emphasize *hardware systems*. Recognizing that hardware and software are part of a continuum, this agreement does not preclude the inclusion of an appropriate balance of hardware and software in either program. However, ECE makes a commitment not to put significant resources into developing new capabilities in the software/algorithms area, and CS makes a commitment not to put significant resources into developing new capabilities in the hardware area.
2. **Future curriculum development.**
 - a. **Undergraduate programs:** Planning for possible future curriculum development related to Computer Engineering or to Software Engineering as a major, minor, or concentration should include both ECE and CS, and in all probability the result will be jointly administered.
 - b. **Graduate programs:** CS will support (if proposed) an MS in ECE in the College of Engineering, and ECE will support (if proposed) an MS in CS or an MS in Software Engineering in the College of Liberal Arts and Sciences.
3. **Minor in Computer Science.** Some of the courses included in the current ECE program are requirements or elective options for a minor in CS; other courses in the ECE program are similar to required or elective courses for the CS minor. It would be a benefit for students majoring in ECE if they could obtain a minor in CS within the existing curriculum requirements of the 4-year, 128-hour degree, and this does appear to be possible. Clarifying the coursework equivalence between the CS minor and the ECE program will facilitate this process and can be done as part of the process of developing the equivalences relating to a dual major in ECE and CS.


Don C. Stone, Chair of CS


John L. Schmalzel, Chair of ECE


Bartelt, Dean, CoLAS


James H. Tracey, Dean, CoE