EP.14.50

I L L I N O I S
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE:

Revision to the Bachelor of Science in Electrical Engineering in the Department of Electrical and Computer Engineering, College of Engineering

SPONSOR:

William H. Sanders
Interim Department Head, Electrical and Computer Engineering
(217) 333-2300
whs@illinois.edu

COLLEGE CONTACT:

Kevin Pitts
Associate Dean for Undergraduate Programs, College of Engineering
(217) 333-2280
kpitts@illinois.edu

BRIEF DESCRIPTION:

- Replace the computing core classes ECE 190 (4 hr) and ECE 290 (3 hr), which introduce programming and digital design, with proposed new courses ECE 120 (4 hr) and ECE 220 (4 hr).
- Replace the 4 hr version of ECE 110 with a revised 3 hr version of ECE 110.
- Replace the 2 hr version of ECE 385 with a revised 3 hr version of ECE 385.
- Reduce the technical elective hours from 33 hours to 32 hours.
- In Technical Electives revise the 2 ECE Lab requirement as 3 ECE Lab courses of which at least one is a hardware lab.

Please note: New course outlines for ECE 120 (4 hours) and ECE 220 (4 hours), as well as course revision forms to revise ECE 110 to 3 hours and increase ECE 385 from 2 hours to 3 hours were all submitted previously as Appendix D of the "Revision to the Bachelor of Science in Computer Engineering in the Department of Electrical and Computer Engineering, College of Engineering. An Addendum to this proposal includes the course descriptions of ECE 120 and ECE 220 and revised descriptions of ECE 110 and ECE 385.

JUSTIFICATION:

The Department wishes to continue having common introductory courses between the B.S. Computer Engineering (CE) and Electrical Engineering (EE) degree programs. Therefore the EE curriculum is being revised to replace its ECE 190 and ECE 290 sequence with the new ECE 120 and ECE 220 sequence that has been developed as the introductory computer engineering courses in the Department. A major curriculum revision proposal for the CE degree program including detailed descriptions of ECE 120 and ECE 220 has already been submitted to the College of Engineering Executive Committee on 11/19/2013. The proposal also included course revision requests to reduce the hours of ECE 110 from 4 hours to 3 hours and revise the credit of ECE 385 to 3 hours.

BUDGETARY AND STAFF IMPLICATIONS:

a. Additional staff and dollars needed:

   None anticipated as a result of these changes.

b. Internal reallocations (e.g., change in class size, teaching loads, student-faculty ratio, etc.):

   The replacement of ECE 190 and ECE 290 with ECE 120 and ECE 220 will create a bubble of additional teaching load for ECE faculty because the time at which students take these courses shifts from sophomore/junior years down to freshman/sophomore years. We have already managed about half of the additional load through enrollment in the experimental versions of the courses, which are quite popular, and we anticipate being able to manage the remaining effects of the bubble internally. Eventually, we anticipate that the steady state loads will show negligible differences from current loads as a result of this replacement.

c. Effect on course enrollment in other units and explanations of discussions with representatives of those departments:

   No impact.

d. Impact on the University Library:

   No major impact on the Library is expected. Letter provided.

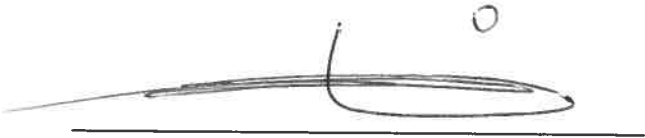e. Impact on computer use, laboratory use, equipment, etc.:

   No impact.

DESIRED EFFECTIVE DATE: Fall 2014

STATEMENT FOR PROGRAMS OF STUDY CATALOG: See Appendix B.

CLEARANCES: *(Clearances should include signatures and dates of approval. **These signatures must appear on a separate sheet.** If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)*

Signatures:

_____
Unit Representative:

Date: 2/11/14

_____
College Representative:

Date: 4/9/14

_____
Graduate College Representative:

Date: _____

_____
Council on Teacher Education Representative:

Date: _____

Appendix A:
(Proposed Curriculum Revisions)

Current Requirements:	Current Hours	Revised Requirements:	Revised Hours
Major Core Requirement		*Major Core Requirement*	
ECE 190 – Intro to Computing Systems **AND** ECE 290 – Computer Engineering I	7 Hours	ECE 120 – Intro to Computing **AND** ECE 220 – Computer Systems & Programming	8 Hours
ECE 110 – Introduction to Electrical and Computer Engineering	4 Hours	ECE 110 – Introduction to Electrictronics	3 Hours
ECE 385 – Digital System Laboratory	2 Hours	ECE 385 – Digital System Laboratory	3 Hours
Technical Electives Chosen from departmentally approved list: 20 hrs from ECE, including the 3-of-5 courses and 2 ECE labs; at least 6 hrs of non-ECE.	33 Hours	**Technical Electives**[1] Chosen from departmentally approved list: 20 hrs from ECE, including the "3-of-5" courses, 3 ECE labs including at least one ECE hardware lab and at least 6 hrs of non-ECE courses.	32 Hours

[1] This elective requirement gives each student freedom to define a technical course of study in electrical engineering of considerable breadth and focus. The Advanced Core ECE Electives are introductory to major subdisciplines of electrical engineering

Hours	Requirements
32 to include *at least*:	Selected from the departmentally approved List of Technical Electives (LTE)[1]
(i) 6 hours	Non-ECE courses on the LTE list
(ii) 3 courses	Selected from the following list of Advanced Core ECE electives:
4 hours	ECE 391—Computer Systems Engineering **or** CS 225—Data Structures
3 hours	ECE 310—Digital Signal Processing
3 hours	ECE 330—Power Circuits & Electromechanics
3 hours	ECE 342—Electronic Circuits
3 hours	ECE 350—Fields and Waves II
(iii) 3 courses	ECE labs as identified in the List of Technical Electives, including at least one hardware lab
(iv) 20 hours	ECE courses (including those taken to satisfy (ii) and (iii)) from the LTE list
32	Total

1. A minimum of 32 hours chosen from the departmentally approved list of Technical Electives. Of these, at least three courses are to be chosen from the ECE advanced core electives and three courses from the list of ECE laboratory electives. 20 hours of the 32 must be ECE course work, six hours non-ECE course work, and the remaining hours may be chosen from the entire List.

Electrical and Computer Engineering

ece.illinois.edu
Head of Department: William Sanders, Interim Head
Department Office: 155 Everitt Laboratory, 1406 West Green, Urbana,
(217) 333-2300

Curriculum in Electrical Engineering

ece.illinois.edu

For the Degree of Bachelor of Science in Electrical Engineering

Electrical engineering is a multifaceted discipline that, over the last century, has produced an astounding progression of technological innovations that have shaped virtually every aspect of modern life. Electrical engineers need a broad and solid foundation in mathematics and physics to support their education in the engineering principles of analysis, synthesis, design, implementation, and testing of the devices and systems that provide the bedrock of modern energy, communication, sensing, computing, medical, security, and defense infrastructures. Within each subdiscipline one can find application domains that strongly rely on hands-on experimental work or that are based on theoretical, mathematical and computational approaches. The multidisciplinary nature of the electrical engineering education addresses the growing demand for the innovation and design of sensing, communication, computing, and decision-making systems of increasing complexity in consumer, defense, and medical applications. The curriculum starts with a core of fundamental courses on circuits, electromagnetics, solid-state electronics, and computer systems, leading to a comprehensive array of specialized courses and laboratories in all of the important areas of modern electrical engineering. These range from power and energy systems to electronic, opto-electronic, and photonic devices; integrated circuits; telecommunications and remote sensing; control systems; robotics; signal processing; and bio-medical instrumentation and sensing.

Overview of Curricular Requirements

The curriculum requires 128 hours for graduation and is organized as shown below. Technical grade point average requirements for graduation and advanced-level course registration apply to students in this curriculum. These rules are summarized at the College of Engineering's

Orientation and Professional Development

These courses introduce the opportunities and resources your college, department, and curriculum can offer you as you work to achieve your career goals. They also provide the skills to work effectively and successfully in the engineering profession.

Hours	Requirements
0	ENG 100—Engineering Orientation[1]
0	Total

1. External transfer students take ENG 300—Engrg Transfer Orientation instead.

Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

Hours	Requirements
3	CHEM 102—General Chemistry I
1	CHEM 103—General Chemistry Lab I
4	MATH 221—Calculus I[1]
3	MATH 231—Calculus II
4	MATH 241—Calculus III
4	MATH 286—Intro to Differential Eq Plus
4	PHYS 211—University Physics: Mechanics
4	PHYS 212—University Physics: Elec & Mag
2	PHYS 213—Univ Physics: Thermal Physics
2	PHYS 214—Univ Physics: Quantum Physics
31	Total

1. MATH 220—Calculus may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

Electrical Engineering Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of electrical engineering.

Hours	Requirements
3	ECE 110—Introduction to Electronics
4	ECE 120—Introduction to Computing
4	ECE 210—Analog Signal Processing
4	ECE 220—Computer Systems & Programming
3	ECE 313—Probability with Engrg Applic[1]

3	ECE 329—Fields and Waves I
3	ECE 385—Digital Systems Laboratory
3	ECE 340—Semiconductor Electronics
4	ECE 445—Senior Design Project Lab
31	Total

1. STAT 410—Statistics and Probability II may be substituted.

Technical Electives

This elective requirement gives each student freedom to define a technical course of study in electrical engineering of considerable breadth and focus. The Advanced Core ECE Electives are introductory to major subdisciplines of electrical engineering.

Hours	Requirements
32 to include *at least*:	Selected from the departmentally approved List of Technical Electives (LTE)[1]
(i) 6 hours	Non-ECE courses on the LTE list
(ii) 3 courses	Selected from the following list of Advanced Core ECE electives:
4 hours	ECE 391—Computer Systems Engineering **or** CS 225—Data Structures
3 hours	ECE 310—Digital Signal Processing
3 hours	ECE 330—Power Circuits & Electromechanics
3 hours	ECE 342—Electronic Circuits
3 hours	ECE 350—Fields and Waves II
(iii) 3 courses	ECE labs as identified in the List of Technical Electives, including at least one hardware l
(iv) 20 hours	ECE courses (including those taken to satisfy (ii) and (iii)) from the LTE list
32	Total

1. *A minimum of 32 hours chosen from the departmentally approved list of Technical Electives. Of these, at least three courses are to be chosen from the ECE advanced core electives and three courses from the list of ECE laboratory electives. 20 hours of the 32 must be ECE course work, six hours non-ECE course work, and the remaining hours may be chosen from the entire List.*

Liberal Education

The liberal education courses develop students' understanding of human culture and society, build skills of inquiry and critical thinking, and lay a foundation for civic engagement and lifelong learning.

Hours	Requirements
6	Electives from the campus General Education social & behavioral sciences list.
6	Electives from the campus General Education humanities & the arts list.
6	Electives either from a list approved by the college, or from the campus General Education sciences or humanities & the arts.

18	Total

Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

Composition

These courses teach fundamentals of expository writing.

Hours	Requirements
4	RHET 105—Principles of Composition
	Advanced Composition (satisfied by completing ECE 445 in the Electrical Engineering Te completing a course in either the liberal education or free elective categories which has th designation.
4	Total

Free Electives

These unrestricted electives, subject to certain exceptions as noted at the College of Engineering advising Web site, give the student the opportunity to explore any intellectual area of unique interest. This freedom plays a critical role in helping students to define research specialties or to complete minors. At least seven hours must be taken for a grade.

Hours	Requirements
12	Free electives. Additional unrestricted course work, subject to certain exceptions as noted advising Web site, so that there are at least 128 credit hours earned toward the degree.

Suggested Sequence

The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

First Year

Hours	First Semester
3	CHEM 102—General Chemistry I
1	CHEM 103—General Chemistry Lab [1]

Hours	
0	ENG 100—Engineering Orientation
4	MATH 221—Calculus I[1]
3	ECE 110—Introduction to Electronics
4	Liberal education elective[2]
15	Total

Hours	Second Semester
4	ECE 120—Introduction to Computing
3	MATH 231—Calculus II
4	PHYS 211—University Physics: Mechanics
4	RHET 105—Principles of Composition
15	Total

Second Year

Hours	First Semester
4	ECE 220 Computer Systems & Programming
4	MATH 241—Calculus III
4	PHYS 212—University Physics: Elec & Mag
4	Liberal education elective[3]
16	Total

Hours	Second Semester
4	ECE 210—Analog Signal Processing
4	MATH 286—Intro to Differential Eq Plus
2	PHYS 213—Univ Physics: Thermal Physics
2	PHYS 214—Univ Physics: Quantum Physics
4	Free Elective
16	Total

Third Year

Hours	First Semester
3	ECE 313—Probability with Engrg Applic[3]
3	ECE 329—Fields and Waves I
7	Technical elective[5]
4	Liberal education elective[3]
17	Total

Hours	Second Semester
3	ECE 340—Semiconductor Electronics
3	ECE 385---Semiconductor Electronics
8	Technical electives[4]
4	Liberal education elective[3]

17	Total

Fourth Year

Hours	First Semester
4	ECE 445—Senior Design Project Lab[5]
5	Technical electives[4]
3	Liberal education elective[2]
4	Free electives
16	Total

Hours	Second Semester
12	Technical electives[4]
4	Free electives
16	Total

1. MATH 220—Calculus may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

2. Liberal education electives must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

3. STAT 410—Statistics and Probability II may be substituted

4. A minimum of 32 hours chosen from the departmentally approved list of Technical Electives. Of these, at least three courses are to be chosen from the ECE advanced core electives and three courses from the list of ECE laboratory electives; 20 hours of the 32 must be ECE course work, 6 hours non-ECE course work, and the remaining hours may be chosen from the entire List.

5. Satisfies the General Education Advanced Composition requirement.

Addendum: Course Descriptions and Outlines of ECE 120 and ECE 220 and revised versions of ECE 110 and ECE 385

Course Descriptions:

ECE 110 – Introduction to Electronics: Introduction to selected fundamental concepts and principles in electrical engineering. The course places an emphasis on measurement, modeling, and analysis of circuits and electronics while introducing numerous applications. The course integrates other subdiscipline topics of ECE including, but not limited to, electromagnetics, control, signal processing, microelectronics, communications, and scientific computing basics. The lecture material is driven through lab work where sensors and motors are incorporated into an autonomous moving vehicle which is designed and constructed to perform tasks jointly determined by the instructors and students.

ECE 120 – Introduction to Computing: This course provides an introduction to digital logic, computer systems, and computer languages. Topics include representation of information, combinational and sequential logic analysis and design, finite state machines, the von Neumann model, basic computer organization, and machine language programming. Laboratory assignments provide hands-on experience with design, simulation, implementation, and programming of digital systems.

ECE 220 – Computer Systems & Programming: Advanced use of LC-3 assembly language for I/O and function calling convention. C programming, covering basic programming concepts, functions, arrays, pointers, I/O, recursion, simple data structures, linked lists, dynamic memory management, and basic algorithms. Information hiding and object-oriented design as commonly implemented in modern software and computer systems programming.

ECE 385 – Digital Systems Laboratory: Design, build, and test digital systems using transistor-transistor logic (TTL), SystemVerilog, and field-programmable gate arrays (FPGAs). Topics include combinational and sequential logic, storage elements, input/output and display, timing analysis, design tradeoffs, synchronous and asynchronous design methods, datapath and controller, microprocessor design, software/hardware co-design, and system-on-a-chip.

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

University Library

Office of Dean of Libraries
and University Librarian
230 Main Library, MC-522
1408 West Gregory Drive
Urbana, IL 61801

March 24, 2014

Kevin Pitts
Associate Dean for Undergraduate Programs
College of Engineering
441 Loomis
M/C 704

Dear Dean Pitts:

Thank you for providing the University Library with the opportunity to review the College of Engineering's proposal to the Senate Committee on Educational Policy to revise the requirements of the Bachelor of Science in Electrical Engineering in the Department of Electrical and Computer Engineering. Based upon the proposal that we reviewed, we do not believe that there will be any substantive impact on existing library offerings—either in terms of library materials or personnel.

The librarians in the Grainger Engineering Library have an excellent relationship with the College and if additional services or materials are required as the program develops, I have every confidence that we will be able to work together to meet the needs of the students.

Sincerely,

John Wilkin
Juanita J. and Robert E. Simpson
Dean of Libraries and University Librarian

c: Thomas Teper
        William Mischo
        Mary Schlembach
        Elizabeth Stovall, Graduate Programs Director, CoE

Office of the Provost and Vice Chancellor
for Academic Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820

April 10, 2014

Gay Miller, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Miller:

Enclosed is a copy of a proposal from the College of Engineering to revise the Bachelor of
Science in Electrical Engineering.

The proposal has been reviewed and approved by the College of Engineering Executive
Committee. It now requires Senate review.

Sincerely,

Kristi A. Kuntz
Assistant Provost

Enclosures

c: K. Pitts
    U. Ravaioli
    D. Ruzic
    B. Sanders
    E. Stovall

April 9, 2014

Kristi Kuntz
Assistant Provost
217 Swanlund Administration Building
MC-304

Via: Andreas Cangellaris, Engineering College

Dear Provost Kuntz:

The College of Engineering Executive Committee has reviewed and approved the following:

"Revision to BS in Electrical Engineering in Department of ECE"

Attached is a copy of the request.

Sincerely yours,

David Ruzic, Vice Chair
Executive Committee

Approval Recommended:

4-9-2014

Andreas Cangellaris, Dean   Date
College of Engineering

Enclosure

c: David Ruzic
     Kevin Pitts
     Umberto Ravaioli
     Bill Sanders
     Elizabeth Stovall

Senate Educational Policy Committee
Proposal Check Sheet

PROPOSAL TITLE (Same as on proposal): <u>Revision to the Bachelor of Science in Electrical Engineering in the Department of Electrical and Computer Engineering, College of Engineering</u>

PROPOSAL TYPE (select all that apply below):

A. ☒ Proposal for a NEW or REVISED degree program. Please consult the Programs of Study Catalog for official titles of existing degree programs.

    1. Degree program level:

        ☐ Graduate   ☐ Professional   ☒ Undergraduate

    2. ☐ Proposal for a new **degree** (e.g. B.S., M.A. or Ph.D.):

        Degree name, "*e.g., Bachelor of Arts or Master of Science*": _____

    3. ☐ Proposal for a new or revised **major, concentration, or minor**:

        ☐ New or ☒ Revised **Major** in (name of existing or proposed major): <u>Electrical Engineering</u>

        ☐ New or ☐ Revised **Concentration** in (name of existing or proposed concentration): _____

        ☐ New or ☐ Revised **Minor** in (name of existing or proposed minor): _____

    4. ☐ Proposal to rename an existing major, concentration, or minor:

        ☐ Major   ☐ Concentration   ☐ Minor

        Current name: _____

        Proposed new name: _____

    5. ☐ Proposal to terminate an existing degree, major, concentration, or minor:

        ☐ Degree   ☐ Major   ☐ Concentration   ☐ Minor

        Name of existing degree, major, or concentration: _____

    6. ☐ Proposal involving a multi-institutional degree:

        ☐ New   ☐ Revision   ☐ Termination

        Name of existing Illinois (UIUC) degree: _____

Name of non-Illinois partnering institution: _____

Location of non-Illinois partnering institution:

☐ State of Illinois   ☐ US State: _____   ☐ Foreign country: _____

B. ☐ Proposal to create a new academic unit (college, school, department, program or other academic unit):

Name of proposed new unit: _____

C. ☐ Proposal to rename an existing academic unit (college, school, department, or other academic unit):

Current name of unit: _____

Proposed new name of unit: _____

D. ☐ Proposal to reorganize existing units (colleges, schools, departments, or program):

1. ☐ Proposal to change the status of an existing and approved unit (e.g. change from a program to department)

Name of current unit including status: _____

2. ☐ Proposal to transfer an existing unit:

Current unit's name and home: _____

Proposed new home for the unit: _____

3. ☐ Proposal to merge two or more existing units (e.g., merge department A with department B):

Name and college of unit one to be merged: _____

Name and college of unit two to be merged: _____

Proposed name and college of new (merged) unit: _____

4. ☐ Proposal to terminate an existing unit:

Current unit's name and status: _____

E. ☐ **Other educational policy proposals** (e.g., academic calendar, grading policies, etc.)

Nature of the proposal: _____

Revised 10/2012