

## DOCUMENTS OF THE GENERAL FACULTY

**PROPOSED CHANGES TO THE BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING  
DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE  
UNDERGRADUATE CATALOG 2016-2018**

Dean Sharon L. Wood in the Cockrell School of Engineering has filed with the secretary of the Faculty Council the following changes to the *Undergraduate Catalog, 2016-2018*. The secretary has classified this proposal as legislation of *general* interest to more than one college or school.

The Committee on Undergraduate Degree Program Review recommended approval of the changes on January 7, 2016, and forwarded the proposal to the Office of the General Faculty. The Faculty Council has the authority to approve this legislation on behalf of the General Faculty. The authority to grant final approval on this legislation resides with UT System.

If no objection is filed with the Office of the General Faculty by the date specified below, the legislation will be held to have been approved by the Faculty Council. If an objection is filed within the prescribed period, the legislation will be presented to the Faculty Council at its next meeting. The objection, with reasons, must be signed by a member of the Faculty Council.

To be counted, a protest must be received in the Office of the General Faculty by February 14, 2016.



Hillary Hart, Secretary  
General Faculty and Faculty Council



Response:

e. Does this proposal involve changes to the core curriculum or other basic education requirements (42-hour core, signature courses, flags)? If yes, explain: **No**

**If yes, undergraduate studies must be informed of the proposed changes and their response included:**

Person communicated with:

Date of communication:

Response:

f. Will this proposal change the number of hours required for degree completion? If yes, explain: **No**

## 5. COLLEGE/SCHOOL APPROVAL PROCESS

Department approval date: April 6, 2015

College approval date: April 10, 2015

Dean approval date: April 29, 2015

## PROPOSED NEW CATALOG TEXT:

### BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Students seeking the Bachelor of Science in Electrical Engineering pursue one of two curricula—electrical engineering or computer engineering. Both curricula contain the fundamentals of electrical engineering and computer engineering; they differ in ~~their~~ technical core requirements in order to suit different career objectives.

The curricula in electrical engineering and computer engineering are designed to educate students in the fundamentals of engineering, which are built upon a foundation of mathematics, science, communication, and the liberal arts. Graduates should be equipped to advance their knowledge while contributing professionally to a rapidly changing technology. Areas in which electrical and computer engineers contribute significantly are: communications, signal processing, networks and systems, electronics and integrated circuits, energy systems and renewable energy, fields, waves and electromagnetic systems, nanoelectronics and nanotechnology, computer architecture and embedded systems, and software engineering and design. Typical career paths of graduates include design, development, management, consulting, teaching, and research. Many graduates seek further education in law, medicine, business, or engineering.

The core requirements of the Bachelor of Science in Electrical Engineering provide a foundation of engineering fundamentals. Students then build on the core requirements by choosing a primary and a secondary technical core area; students also choose two advanced laboratory courses. Once the primary technical core area is chosen, the student is assigned a faculty adviser with expertise in that area to help the student select technical core courses that are appropriate to his or her career and educational goals. The curriculum thus ensures breadth through the core courses and the choice of a technical elective; technical core area coursework provides additional depth.

### **Program Student Outcomes**

Electrical and computer engineering graduates should demonstrate:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as analyze and interpret data
- 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
- An ability to function on multidisciplinary teams
- An ability to identify, formulate, and solve engineering problems

- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand what impact engineering solutions have in global, economic, environmental, and societal contexts
- A recognition of the need for and an ability to engage in lifelong learning
- A knowledge of contemporary issues
- An ability to use techniques, skills, and modern engineering tools necessary for engineering practice

### **Program Educational Objectives**

Within a few years of graduation, electrical and computer engineering graduates should:

- Contribute to the economic development of Texas and beyond through the ethical practice of electrical and computer engineering in industry and public service
- Exhibit leadership in technical or business activity through engineering ability, communication skills, and knowledge of contemporary and global issues
- Continue to educate themselves through professional study and personal research
- Be prepared for admission to, and to excel in, the best graduate programs in the world
- Design systems to collect, encode, store, transmit, and process energy and information, and to evaluate system performance, either individually or in teams
- Use their engineering ability and creative potential to create technology that will improve the quality of life in society

### **Portable Computing Devices**

Students enrolled in a degree program in electrical and computer engineering will be expected to own a portable computing device capable of compiling and running a program suitable for use in the classroom and on the University wireless network. Use of these devices in the classroom and as a general part of the learning experience within our programs is at the discretion of faculty and not all classes or courses of instruction will require the use of these devices. Once admitted, students will be informed by the Electrical and Computer Engineering Department (ECE) office about specific device requirements.

### **Curriculum**

~~Course requirements are divided into three categories: basic sequence courses, major sequence courses, include courses within the Cockrell School of Engineering and other required courses. In addition, each student must complete the University's core curriculum. In some cases, a course required as part of the basic sequence that fulfills one of the following requirements may also be counted toward the core curriculum; these courses are identified below. To ensure that courses used to fulfill the social and behavioral sciences and visual and performing arts requirements of the core curriculum, and also meet ABET criteria, students should follow the guidance given in ABET Criteria.~~

In the process of fulfilling engineering degree requirements, students must also complete coursework to satisfy the following flag requirements: one independent inquiry flag, one course with a quantitative reasoning flag, one ethics and leadership flag, one global cultures flag, one cultural diversity in the US flag, and two writing flags. The independent inquiry flag, the quantitative reasoning flag, the ethics and leadership flag, and two writing flags are carried by courses specifically required for the degree; these courses are identified below. Courses that may be used to fulfill flag requirements are identified in the *Course Schedule*. More information about flags is given in Skills and Experiences Flags.

~~Enrollment in major sequence courses is restricted to students who have been admitted to the major sequence. Requirements for admission to a major sequence are given in Admission to a Major Sequence. Enrollment in other required courses is not restricted by completion of the basic sequence.~~

~~Enrollment in some courses requires upper division standing in the major. Upper division standing in the major is defined as the successful completion (credit with a grade of C- or better) of at least nineteen semester credit hours of EE major coursework.~~

Enrollment in EE 333T, EE 160, EE 260, EE 360, EE 460, and EE 379K requires completion of EE 312 or EE 313 with a grade of at least C-.

Pre-approved courses are used to fulfill technical core, advanced math and/or science and core technical electives; other elective courses must be approved by the electrical and computer engineering faculty before the student enrolls in them.

Transfer Coursework: No more than twenty-five semester credit hours of transfer electrical engineering coursework may be counted for credit toward the electrical engineering degree.

<b>Requirements</b>		<b>Hours</b>
<b>Basic Sequence Electrical Engineering Courses</b>		
E E 302	<u>Introduction to Electrical Engineering (part II science and technology)</u>	3
E E 306	<u>Introduction to Computing</u>	3
E E 411	<u>Circuit Theory</u>	4
E E 312 or 312H	<u>Software Design and Implementation I</u>	3
E E 313	<u>Linear Systems and Signals</u>	3
E E 319K	<u>Introduction to Embedded Systems</u>	3
E E 333T	<u>Engineering Communication (writing flag)</u>	3
E E 351K	<u>Probability and Random Processes</u>	3
E E 364D	<u>Introduction to Engineering Design (writing flag)</u>	3
or E E 364E	<u>Interdisciplinary Entrepreneurship</u>	
<u>One of the following senior design project courses:</u>		4
E E 464G	<u>Multidisciplinary Senior Design Project (independent inquiry flag)</u>	
E E 464H	<u>Honors Senior Design Project (independent inquiry flag)</u>	
E E 464K	<u>Senior Design Project (independent inquiry flag)</u>	
E E 464R	<u>Research Senior Design Project (independent inquiry flag)</u>	
E E 464S	<u>Start-Up Senior Design Project</u>	
Primary technical core: Core courses (six-seven hours), core laboratory course (four hours), advanced mathematics course (three-four hours)*		14
Primary core electives: Four courses ( <u>minimum twelve to fourteen hours</u> )		12
Secondary technical core: Core courses (six-seven hours), core laboratory course (four hours), advanced mathematics course (three-four hours)		14
<b>Other Technical Courses</b>		
<b>Mathematics</b>		
M 408C & M 408D	Differential and Integral Calculus and Sequences, Series, and Multivariable Calculus (mathematics; quantitative reasoning flag)	8
or		
M 408K & M 408L & M 408M	Differential Calculus and Integral Calculus and Multivariable Calculus	
M 427KJ or M 427K	<del>Advanced Calculus for Applications I</del> <u>Differential Equations with Linear Algebra</u> (quantitative reasoning flag)	4
M 340L	Matrices and Matrix Calculations	3

~~Electrical Engineering~~**Physics**

PHY 103M	Laboratory for Physics 303K	1
PHY 103N	Laboratory for Physics 303L	1
PHY 303K	Engineering Physics I (part I science and technology; quantitative reasoning flag)	3
PHY 303L	Engineering Physics II (part I science and technology; quantitative reasoning flag)	3

**Rhetoric and Writing**

RHE 306	Rhetoric and Writing (English composition)	3
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~~Major Sequence Courses~~~~Electrical Engineering~~**Other Required Courses**

Approved elective		3
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**Remaining Core Curriculum Courses**

E 316L	British Literature (humanities) ( <u>some sections carry a global cultures flag</u> )	3
or E 316M	American Literature ( <u>some sections carry a cultural diversity flag</u> )	
or E 316N	World Literature ( <u>some sections carry a global cultures flag</u> )	
or E 316P	Masterworks of Literature	
American and Texas government	<u>(some sections carry a global cultures and/or cultural diversity flag)</u>	6
American history	<u>(some sections carry a cultural diversity flag)</u>	6
Visual and performing arts	<u>(some sections carry a global cultures and/or cultural diversity flag)</u>	3
Social and behavioral sciences	<u>(some sections carry a global cultures and/or cultural diversity flag)</u>	3
UGS 302	First-Year Signature Course ( <del>some</del> <u>all</u> sections carry a writing flag)	3
or UGS 303	First-Year Signature Course ( <u>some sections carry a writing flag</u> )	
Total Hours		<u>Minimum</u> 125

\*EE Option: Primary Technical Core (mathematics) is 4 hours and one Primary Technical Core Requirement is 3 hours

\*CE Option: Primary Technical Core (mathematics) is 3 hours and one Primary Technical Core Elective is 4 hours

**Integrated BSEE/MSE program**

The integrated degree program results in simultaneously awarding a Bachelor of Science in Electrical Engineering: Integrated Option (BSEE) degree, and a Master's of Science in Engineering (MSE) degree in any one of the ten graduate tracks offered by the graduate program in electrical and computer engineering (ECE).

There are two stages to admission, an informal non-binding department based stage and a second stage in which the student formally applies to the Graduate School within the integrated BSEE/MSE program and within one of the available ECE graduate tracks. At stage one, undergraduate students in the ECE department may apply to the integrated degree program after qualifying for admission to major sequence. The purpose of stage one is primarily to provide appropriate advising to students interested in and appropriate for the integrated program. Admission to the integrated program at stage one is based on the applicant's grade point average, letters of recommendation, a statement of purpose, and other relevant examples of academic ability and leadership. Students will be advised by the integrated program adviser about the appropriate courses to take and reserve for graduate credit in their senior year in order to complete the integrated program as efficiently as possible. As for admission to the regular standalone MSE program, all admissions decisions at stage two are made by the

admissions committee in the respective graduate track, with admission requirements set by the graduate track, with the exception that Graduate Record Exam (GRE) test scores are not required of integrated program participants. While optimal, application and admission at stage one are not required for application and admission to the integrated program at stage two.

The integrated program requires 120 semester credit hours (SCH) for the BSEE portion of the integrated program, as opposed to the 125 SCH minimum required for the BSEE degree alone. Students in the integrated program begin taking graduate courses as seniors. Students admitted to the integrated program will normally take and reserve for graduate credit two graduate courses in place of approved electives from the primary and secondary technical cores that would *otherwise* be required in the regular/standalone BSEE program. However, precisely which BSEE electives are to be replaced by the graduate courses can be adjusted as approved by technical core faculty advisers.

Students in this program will receive the BSEE and MSE degrees simultaneously after successfully completing a minimum total of 150 semester credit hours, thirty of which must qualify for the MSE program of work in electrical and computer engineering. Students unable to successfully complete the integrated program may obtain a BSEE degree by satisfying all of the requirements for the standalone BSEE degree. Since the regular BSEE degree requirements are a subset of the Integrated BSEE/MSE Program degree requirements, an undergraduate student should still be on a trajectory to graduate with the regular BSEE degree in the same timeframe that the student was on when applying to the Integrated BSEE/MSE Program. A student dismissed from the integrated program while a graduate student should already meet the degree requirements for the regular BSEE degree.

Information regarding the integrated program requirements and policies may be obtained from the ECE advising offices.

### **Upper-Division Technical Core Areas**

Both electrical engineering and computer engineering students must choose a primary and a secondary technical core area. Electrical engineering students must choose their primary technical core area from the electrical engineering technical core areas listed below; computer engineering students must choose their primary technical core area from the computer engineering core areas. For the secondary technical core area, students may choose any technical core area, including academic enrichment.

For all technical core areas, the student must complete all courses in the core area on the letter-grade basis. A course may not be counted toward more than one technical core area.

In cases where a single electrical engineering course appears on both the primary and secondary technical core area list, the student must replace the secondary technical core area course with an elective from the same secondary technical core area list or obtain approval from a faculty adviser for course substitution. In the case of a duplicate mathematics course, the student must choose an approved mathematics or science course to replace it.

### **Academic Enrichment Technical Core Area**

A student may choose the academic enrichment technical core area, but only as his or her secondary technical core area. For this core area, the student selects a minimum of fourteen hours of elective coursework to support his or her personal or career goals, which must include an upper-division course in either mathematics or science. Before registering for these courses, the student must prepare a career plan statement and a list of relevant electives; this plan must be approved by the undergraduate adviser.

These electives may include traditional upper-division technical courses in electrical engineering and other engineering fields; courses in other fields at the University that satisfy degree requirements, such as business, economics, communication, music, and philosophy; or research done with a faculty member in Electrical Engineering 160, 260, 360, or 460, *Special Problems in Electrical and Computer Engineering*. The courses must be completed in residence; courses in an approved study abroad program require the approval of the undergraduate adviser. A minimum of fourteen semester credit hours is required, which may include Electrical Engineering 155R, *Undergraduate Research Seminar* and 325L, *Cooperative Engineering*, or up to three hours in Electrical Engineering 125S, *Internship in Electrical and Computer Engineering*, but not both. Students

selecting software engineering and design as their primary technical core and academic enrichment as their secondary technical core must also ensure that their program of work includes adequate hardware coursework. That is:

1. If the senior design project consists of software only, then the electives include at least two of the following: Electrical Engineering 316, Electrical Engineering 445L, Electrical Engineering 445M.
2. If the senior design project involves a significant hardware design component, then the electives must include at least one of the following: Electrical Engineering 316, Electrical Engineering 445L, Electrical Engineering 445M.

### *Electrical Engineering Technical Cores*

#### *Communications, Signal Processing, Networks, and Systems*

Communications, signal processing, networks, and systems broadly encompasses the principles underlying the design and implementation of systems for information transmission. The field considers how information is represented, compressed, and transmitted on wired and wireless links and how communication networks can be, and are, designed and operated. A student who chooses this technical core area should recognize that communications and networking is a broad application domain where many engineering tools come into play: from circuit design for wireless phones to embedded network processors to system and application software for networked systems.

Students complete the following:

1. Electrical Engineering 325, *Electromagnetic Engineering*
2. Either Electrical Engineering 351M, *Digital Signal Processing* or Electrical Engineering 362K, *Introduction to Automatic Control*
3. Core laboratory course: Electrical Engineering 445S, *Real-Time Digital Signal Processing Laboratory*
4. Core mathematics course: Mathematics 427L, *Advanced Calculus for Applications II*
5. Four courses from the following list:  
 Electrical Engineering 325K, *Antennas and Wireless Propagation*  
 Electrical Engineering 351M, *Digital Signal Processing*  
 Electrical Engineering 360C, *Algorithms*  
 Electrical Engineering 360K, *Introduction to Digital Communications*  
 Electrical Engineering 361M, *Introduction to Data Mining*  
 Electrical Engineering 362K, *Introduction to Automatic Control*  
 Electrical Engineering 363M, *Microwave and Radio Frequency Engineering*  
 Electrical Engineering 370K, *Computer Control Systems*  
 Electrical Engineering 370N, *Introduction to Robotics and Mechatronics*  
 Electrical Engineering 471C, *Wireless Communications Laboratory*  
 Electrical Engineering 371R, *Digital Image and Video Processing*  
 Electrical Engineering 372N, *Telecommunication Networks*  
 Mathematics 325K, *Discrete Mathematics*  
 Mathematics 362M, *Introduction to Stochastic Processes* (carries a quantitative reasoning flag)  
 Mathematics 365C, *Real Analysis I*

#### *Electronics and Integrated Circuits*

The electronics and integrated circuits technical core area involves the design and analysis of the circuits that provide the functionality of a system. The types of circuits that students encounter include analog and digital integrated circuits, radio frequency circuits, mixed signal (combination of analog and digital) circuits, power electronics, and biomedical electronics. The design and implementation of integrated circuits and systems using analog and digital building blocks are included in this core area. A student should choose this technical core area if he or she is interested in designing chips for applications, such as computing, telecommunications, and signal processing.

Students complete the following:

1. Electrical Engineering 325, *Electromagnetic Engineering*
2. Electrical Engineering 339, *Solid-State Electronic Devices*
3. Core laboratory course: Electrical Engineering 438, *Fundamentals of Electronic Circuits I Laboratory*
4. Core mathematics course: Mathematics 427L, *Advanced Calculus for Applications II*



5. Electrical Engineering 316, *Digital Logic Design*
6. Three courses from the following list:
  - Electrical Engineering 321K, *Mixed Signal and Circuits Laboratory*
  - Electrical Engineering 438K, *Analog Electronics*
  - Electrical Engineering 338L, *Analog Integrated Circuit Design*
  - Electrical Engineering 440, *Integrated Circuit Nanomanufacturing Techniques*
  - Electrical Engineering 445L, *Embedded Systems Design Laboratory*
  - Electrical Engineering 445S, *Real-Time Digital Signal Processing Laboratory*
  - Electrical Engineering 460M, *Digital Systems Design Using HDL*
  - Electrical Engineering 460N, *Computer Architecture*
  - Electrical Engineering 460R, *Introduction to VLSI Design*
  - Electrical Engineering 360S, *Digital Integrated Circuit Design*
  - Electrical Engineering 361R, *Radio-Frequency Electronics*
  - Electrical Engineering 363M, *Microwave and Radio Frequency Engineering*
  - Electrical Engineering 374K, *Biomedical Electronic Instrument Design*
  - Electrical Engineering 374L, *Applications of Biomedical Engineering*

### *Energy Systems and Renewable Energy*

This technical core area provides the foundation for a career in electric power systems, generation, grid operation, motors and drives, and renewable energy sources. This core area involves the study and design of reliable and economic electric power systems, including both traditional and renewable resources. Energy conversion involves conversion to and from electrical energy, including the study and design of electrical machines.

Students complete the following:

1. Electrical Engineering 325, *Electromagnetic Engineering*
2. Electrical Engineering 368L, *Power Systems Apparatus and Laboratory* or Electrical Engineering 369, *Power Systems Engineering*
3. Core laboratory course: Electrical Engineering 462L, *Power Electronics Laboratory*
4. Core mathematics course: Mathematics 427L, *Advanced Calculus for Applications II*
5. Electrical Engineering 362K, *Introduction to Automatic Control*
6. Three courses from the following list:
  - Electrical Engineering 339, *Solid-State Electronic Devices*
  - Electrical Engineering 339S, *Solar Energy Conversion Devices*
  - Electrical Engineering 341, *Electric Drives and Machines*
  - Electrical Engineering 362Q, *Power Quality and Harmonics*
  - Electrical Engineering 362R, *Renewable Energy and Power Systems*
  - Electrical Engineering 362S, *Development of a Solar-Powered Vehicle*
  - Electrical Engineering 368L, *Power Systems Apparatus and Laboratory*
  - Electrical Engineering 369, *Power Systems Engineering*
  - ~~Electrical Engineering 339S, *Solar Energy Conversion Devices*~~
  - Mechanical Engineering 337C, *Introduction to Nuclear Power Systems*

### *Fields, Waves, and Electromagnetic Systems*

Students in this technical core area study different aspects of applied electromagnetics, including antennas, radio wave propagation, microwave and radio frequency circuits and transmission structures, optical components and lasers, and engineering acoustics. A student should choose the electromagnetic engineering core area if he or she is interested in engineering that involves the physical layer in modern communication and radar systems. Graduates are well positioned for jobs in antenna design and testing, propagation channel characterization, microwave and radio frequency circuit design, electromagnetic emission testing from electronic devices and systems, radar system design and development, optical telecommunication, optical information and signal processing systems, and component design and development.

Students complete the following:

1. Electrical Engineering 325, *Electromagnetic Engineering*

2. Electrical Engineering 339, *Solid-State Electronic Devices*
3. Core laboratory course: Electrical Engineering 438, *Fundamentals of Electronic Circuits I Laboratory* or Electrical Engineering 462L, *Power Electronics Laboratory*
4. Core mathematics course: Mathematics 427L, *Advanced Calculus for Applications II*
5. Either Electrical Engineering 325K, *Antennas and Wireless Propagation* or Electrical Engineering 363M, *Microwave and Radio Frequency Engineering*
6. Three courses from the following list:
  - Electrical Engineering 321K, *Mixed Signal and Circuits Laboratory*
  - Electrical Engineering 325K, *Antennas and Wireless Propagation*
  - Electrical Engineering 334K, *Quantum Theory of Engineering Electronic Materials*
  - Electrical Engineering 341, *Electric Drives and Machines*
  - Electrical Engineering 347, *Modern Optics*
  - Electrical Engineering 348, *Laser and Optical Engineering*
  - Electrical Engineering 361R, *Radio-Frequency Electronics*
  - Electrical Engineering 363M, *Microwave and Radio Frequency Engineering*
  - Electrical Engineering 363N, *Engineering Acoustics*
  - Electrical Engineering 369, *Power Systems Engineering*
  - Electrical Engineering 374K, *Biomedical Electronic Instrument Design*
  - Electrical Engineering 374L, *Applications of Biomedical Engineering*

### *Nanoelectronics and Nanotechnology*

Students in this technical core area learn about the materials and devices used in modern electronic and optoelectronic systems. Through required and electives courses, students learn about the fundamentals of charge transport and interactions with light in semiconductors. They learn about devices beginning with diodes and transistors, the building blocks of integrated circuits, and extending to photodiodes, semiconductor lasers, photodetectors and photovoltaic devices. They learn about microelectronics fabrication techniques. And they are introduced to quantum mechanics, particularly as it applies to electronic and optoelectronic materials and devices. Students may also explore device applications through digital and analog circuit design. With exposure to the topics in this area, students are well positioned to work in a wide variety of fields that rely on semiconductor devices, such as computers, telecommunications, the automotive industry, and consumer electronics.

Students complete the following:

1. Electrical Engineering 325, *Electromagnetic Engineering*
2. Electrical Engineering 339, *Solid-State Electronic Devices*
3. Core laboratory course: Electrical Engineering 440, *Integrated Circuit Nanomanufacturing Techniques*
4. Core mathematics course: Mathematics 427L, *Advanced Calculus for Applications II*
5. Four courses from the following list:
  - Electrical Engineering 334K, *Quantum Theory of Engineering Electronic Materials*
  - Electrical Engineering 438, *Fundamentals of Electronic Circuits I Laboratory*
  - Electrical Engineering 338L, *Analog Integrated Circuit Design*
  - Electrical Engineering 339S, *Solar Energy Conversion Devices*
  - Electrical Engineering 347, *Modern Optics*
  - Electrical Engineering 348, *Laser and Optical Engineering*
  - Electrical Engineering 360S, *Digital Integrated Circuit Design*
  - ~~Electrical Engineering 339S, *Solar Energy Conversion Devices*~~
  - Electrical Engineering 438, *Fundamentals of Electronic Circuits I Laboratory*
  - Electrical Engineering 460R, *Introduction to VLSI Design*

### *Computer Engineering Technical Core Areas*

#### *Computer Architecture and Embedded Systems*

Computer architecture involves understanding the operation and design of computers on many different levels. These levels include the instruction set, microarchitecture, and logic design. Embedded systems represent the

combination of software and hardware that are designed to perform specific functions. These systems may be stand-alone items or an integral part of a larger system. Within this technical core area, students are exposed to logic design, programming, computer architecture, systems design, and digital signal processing. The student studying computer architecture will be well positioned to join the microprocessor design industry as a logic designer or a circuit designer. After a good deal of experience on the job, the student would be well positioned to become the chief architect of a new design.

Jobs in embedded systems involve defining, designing, and fabricating application-specific processors and computers in areas such as automotive electronics, consumer devices, and telecommunications.

Students complete the following:

1. Electrical Engineering 316, *Digital Logic Design*
2. Electrical Engineering 460N, *Computer Architecture*
3. Core laboratory course: Electrical Engineering 445L, *Embedded Systems Design Laboratory*
4. Core mathematics course: Mathematics 325K, *Discrete Mathematics*
5. Electrical Engineering 360C, *Algorithms*
6. Three courses from the following list:
  - Electrical Engineering 422C, *Software Design and Implementation II*
  - Electrical Engineering 445M, *Embedded and Real-Time Systems Laboratory*
  - Electrical Engineering 445S, *Real-Time Digital Signal Processing Laboratory*
  - Electrical Engineering 460M, *Digital Systems Design Using HDL*
  - Electrical Engineering 360P, *Concurrent and Distributed Systems*
  - Electrical Engineering 460R, *Introduction to VLSI Design*
  - Electrical Engineering 362K, *Introduction to Automatic Control*
  - Computer Science 375, *Compilers*

#### *Software Engineering and Design*

Courses in this area cover the engineering life cycle of software systems, including requirement analysis and specification, design, construction/programming, testing, deployment, maintenance, and evolution. Area courses are intended to teach students theory, practical methods, and tools for designing, building, delivering, maintaining, and evolving software to meet stakeholder requirements. Every software engineer must understand how software systems operate and how they can be used to solve engineering problems and deliver solutions. The courses in this area are designed to educate students about a diverse and relevant set of technologies and about the ways that technology can be used to design and build software systems.

Students complete the following:

1. Electrical Engineering 422C, *Software Design and Implementation II*
2. Electrical Engineering 360C, *Algorithms*
3. Core laboratory course: Electrical Engineering 461L, *Software Engineering and Design Laboratory*
4. Core mathematics course: Mathematics 325K, *Discrete Mathematics*
5. Four courses from the following list:
  - Electrical Engineering 316, *Digital Logic Design*
  - Electrical Engineering 445L, *Embedded Systems Design Laboratory*
  - Electrical Engineering 445M, *Embedded and Real-Time Systems Laboratory*
  - Electrical Engineering 360F, *Introduction to Software Engineering*
  - Electrical Engineering 460N, *Computer Architecture*
  - Electrical Engineering 360P, *Concurrent and Distributed Systems*
  - Electrical Engineering 361Q, *Requirements Engineering*
  - Electrical Engineering 372N, *Telecommunication Networks*
  - Electrical Engineering 360T, *Software Testing*
  - Electrical Engineering 361M, *Introduction to Data Mining*

#### *Alternate Mathematics Courses*

For students who choose both primary and secondary technical core areas in computer engineering:

Mathematics 427L, *Advanced Calculus for Applications II*

Mathematics 328K, *Introduction to Number Theory*

Mathematics 343K, *Introduction to Algebraic Structures*

Mathematics 344K, *Intermediate Symbolic Logic*

Mathematics 348, *Scientific Computation in Numerical Analysis* (carries a quantitative reasoning flag)

Mathematics 358K, *Applied Statistics* (carries a quantitative reasoning flag)

Mathematics 374M, *Mathematical Modeling in Science and Engineering*

Computer Science 341, *Automata Theory*

Computer Science 346, *Cryptography*

For students who choose both primary and secondary technical core areas in electrical engineering:

Mathematics 325K, *Discrete Mathematics*

Mathematics 328K, *Introduction to Number Theory*

Mathematics 346, *Applied Linear Algebra*

Mathematics 348, *Scientific Computation in Numerical Analysis* (carries a quantitative reasoning flag)

Mathematics 358K, *Applied Statistics* (carries a quantitative reasoning flag)

Mathematics 361, *Theory of Functions of a Complex Variable*

Mathematics 362M, *Introduction to Stochastic Processes*

Mathematics 372K, *Partial Differential Equations and Applications*

Mathematics 374, *Fourier and Laplace Transforms*

Mathematics 374M, *Mathematical Modeling in Science and Engineering*

### Suggested Arrangement of Courses

#### Electrical and Computer Engineering Curriculum – Primary Technical Core: Electrical Engineering

<b>First Year</b>				
<b>First Term</b>	Hours		<b>Second Term</b>	Hours
E E 302	3	E E 319K		3
E E 306	3	M 408D		4
M 408C	4	PHY 303K		3
RHE 306	3	PHY 103M		1
UGS 302 or 303	3	Visual and performing arts or social and behavioral sciences		3
	16			14
<b>Second Year</b>				
<b>First Term</b>	Hours		<b>Second Term</b>	Hours
E E 411	4	E 316L, 316M, 316N, or 316P		3
<u>M 427J or M 427K</u>	4	E E 312		3
PHY 303L	3	E E 313		3
PHY 103N	1	GOV 310L		3
Visual and performing arts or social and behavioral sciences	3	M 340L		3
	15			15
<b>Third Year</b>				
<b>First Term</b>	Hours		<b>Second Term</b>	Hours
E E 333T	3	Secondary technical core (mathematics)		<u>3-4</u>
E E 351K	3	Secondary technical core laboratory		4
Primary technical core (mathematics)	<u>4-4</u>	Secondary technical core requirement		<u>4-4</u>
Primary technical core laboratory	4	Primary technical core requirement		3
Primary technical core requirement	<u>3-4</u>	Primary technical core (requirement or elective)		3
	<u>17-18</u>			<u>17-18</u>
<b>Fourth Year</b>				
<b>First Term</b>	Hours		<b>Second Term</b>	Hours
E E 364D	3	E E 464C, 464G, 464H, 464K, or 464R		4

American history	3	GOV 312L	3
Secondary technical core requirement	<del>3</del> 6	American history	3
Primary technical core electives	<del>6</del> 3	Primary technical core elective	3
		Approved elective	3
	15		16

Total credit hours: ~~423~~ ~~427~~ 125

- EE Option: Primary Technical Core (mathematics) is 4 hours and one Primary Technical Core Requirement is 3 hours
- CE Option: Primary Technical Core (mathematics) is 3 hours and one Primary Technical Core Elective is 4 hours

### **Suggested Arrangement of Courses**

#### **Electrical and Computer Engineering Curriculum – Primary Technical Core: Computer Engineering**

##### **First Year**

<b><u>First Term</u></b>	<b><u>Hours</u></b>	<b><u>Second Term</u></b>	<b><u>Hours</u></b>
<u>E E 302</u>	<u>3</u>	<u>E E 319K</u>	<u>3</u>
<u>E E 306</u>	<u>3</u>	<u>M 408D</u>	<u>4</u>
<u>M 408C</u>	<u>4</u>	<u>PHY 303K</u>	<u>3</u>
<u>RHE 306</u>	<u>3</u>	<u>PHY 103M</u>	<u>1</u>
<u>UGS 302 or 303</u>	<u>3</u>	<u>Visual and performing arts or social and behavioral sciences</u>	<u>3</u>
-	<u>16</u>	-	<u>14</u>

##### **Second Year**

<b><u>First Term</u></b>	<b><u>Hours</u></b>	<b><u>Second Term</u></b>	<b><u>Hours</u></b>
<u>E E 411</u>	<u>4</u>	<u>E 316L, 316M, 316N, or 316P</u>	<u>3</u>
<u>M 427J or M 427K</u>	<u>4</u>	<u>E E 312</u>	<u>3</u>
<u>PHY 303L</u>	<u>3</u>	<u>E E 313</u>	<u>3</u>
<u>PHY 103N</u>	<u>1</u>	<u>GOV 310L</u>	<u>3</u>
<u>Visual and performing arts or social and behavioral sciences</u>	<u>3</u>	<u>M 340L</u>	<u>3</u>
-	<u>15</u>	-	<u>15</u>

##### **Third Year**

<b><u>First Term</u></b>	<b><u>Hours</u></b>	<b><u>Second Term</u></b>	<b><u>Hours</u></b>
<u>E E 333T</u>	<u>3</u>	<u>Secondary technical core (mathematics)</u>	<u>3-4</u>
<u>E E 351K</u>	<u>3</u>	<u>Secondary technical core laboratory</u>	<u>4</u>
<u>Primary technical core (mathematics)</u>	<u>3</u>	<u>Secondary technical core requirement</u>	<u>3</u>
<u>Primary technical core laboratory</u>	<u>4</u>	<u>Primary technical core requirement</u>	<u>3</u>
<u>Primary technical core requirement</u>	<u>4</u>	<u>Primary technical core elective</u>	<u>3</u>
-	<u>17</u>	-	<u>16-17</u>

##### **Fourth Year**

<b><u>First Term</u></b>	<b><u>Hours</u></b>	<b><u>Second Term</u></b>	<b><u>Hours</u></b>
<u>E E 364D</u>	<u>3</u>	<u>E E 464C, 464G, 464H, 464K, or 464R</u>	<u>4</u>
<u>American history</u>	<u>3</u>	<u>GOV 312L</u>	<u>3</u>
<u>Secondary technical core requirement</u>	<u>4*</u>	<u>American history</u>	<u>3</u>
<u>Primary technical core elective</u>	<u>6</u>	<u>Primary technical core elective</u>	<u>3</u>

	<u>Approved elective</u>	<u>3</u>
<u>16</u>		<u>16</u>

Total credit hours: 125 Hrs.

\*3 credit hours needed if choosing a secondary electrical engineering technical core.

- EE Option: Primary Technical Core (mathematics) is 4 hours and one Primary Technical Core Requirement is 3 hours
- CE Option: Primary Technical Core (mathematics) is 3 hours and one Primary Technical Core Elective is 4 hours