Electrical and Computer Engineering

Professor R. Lessard; Associate Professor S. Fitzhugh (Chair) and J. Beneat; Assistant Professor M. Prairie, Lecturer D. Feinauer.

Mission

The Mission of the Electrical and Computer Engineering Department:

To prepare students for the profession of Electrical and Computer Engineering – to enable them to solve problems of substance through the application of fundamental principles, disciplined practices and modern methods – to instill the humility of contribution to ventures larger than themselves, and the courage to lead others in the pursuit of such ventures – to inspire an ethic of service to all mankind in the context of a global community – and finally, to instill a lifelong thirst for the knowledge of their craft.

The graduates of the Electrical and Computer Engineering programs will:

- Contribute to the engineering profession through the application of the requisite knowledge of engineering fundamentals, mathematics, science, and modern tools to conceive and implement solutions for problems in the electrical and computer engineering field.
- Effectively communicate the results of their work.
- Work professionally in team environments to design electrical/computer systems.
- Maintain a positive outlook on professional life, and recognize the need for professionals and citizens in an evolving global society to pursue a course of life-long learning and continued professional development.
- Demonstrate initiative and perform leadership roles in an ethical manner.
- Perceive the impact on society of their professional decisions.

Students in the Electrical and Computer Engineering programs will demonstrate an ability to:

- Apply knowledge of advanced mathematics, chemistry, physics, and engineering.
- Identify, formulate, and solve electrical engineering problems.
- Design and conduct experiments, as well as to analyze and interpret data.
- Apply the techniques, skills, and modern engineering test equipment and software applications necessary for engineering practice.
- Communicate effectively through written and verbal means.
- Contribute to multidisciplinary / multicultural teams.
- Recognize the need to engage in life-long learning.
- Demonstrate the leadership competencies of self-awareness, self-management, social-awareness, and relationship management.
- Demonstrate an understanding of professional and ethical responsibility.
- 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.
- Appreciate the impact of engineering solutions in a global, economic, environmental, and societal context.
- Demonstrate knowledge of contemporary issues.

The Electrical and Computer Engineering curriculum is accredited by:

The Engineering Accreditation Commission of ABET
111 Market Place, Suite 1050
Baltimore, MD 21202-4012
Telephone: (410) 347-7700

The Electrical and Computer Engineering programs are designed to allow graduates the option of beginning a career in either the military or civilian life immediately upon graduation, or furthering their education in graduate school. Studies are designed to give the broad background necessary to apply electrical and computer engineering principles and methods to solve problems in an ever increasing range of applications. During the first two years, students receive intensive instruction in mathematics and basic physical sciences as well as fundamental principles and techniques of engineering. Students are introduced to the basic tools and problem solving techniques they will use throughout their career. The final two years are spent in a laboratory intensive environment. In the third year, students begin to apply their knowledge solving discipline-specific engineering problems. Project based courses begin to develop the ability to apply knowledge in open-ended problems. In the fourth year, more focused courses cover a broad spectrum of electrical and computer engineering topics. A completely open-ended design experience, where students can exercise creativity solving current engineering problems, spans the senior year. Designing, building, testing, and evaluating projects in such application areas as instrumentation and data acquisition, computer network control, SCADA systems security, robotics, wireless communication, and machinery controls is typical of this experience. Constraints such as economics, safety, reliability, aesthetics, ethics, and social impact are considered. This experience builds upon the fundamental concepts of mathematics, basic sciences, the humanities and social sciences, engineering topics, and communication skills developed earlier in the undergraduate experience. The design team experience allows close coordination with an individual faculty member. The scope of the project is designed to match the requirements of practice within the electrical and computer engineering discipline.

B.S. in Electrical and Computer Engineering - Curriculum Map

First Year

Fall	Credits	Spring	Credits
EG 109 Introduction to Engineering i	3	EG 110 Introduction to Engineering II	3
CH 103 General Chemistry I	4	EE 200 Engineering Programming	3
EN 101 Composition and Literature I	3	EN 102 Composition and Literature II	3
MA 121 Calculus I	4	MA 122 Calculus II	4
		General Education Elective[1]	3
	14		**16**

Second Year

Fall	Credits	Spring	Credits
EE 215 Fundamentals of Digital Design	4	EE 356 Electrical Circuits II	3
EE 204 Electrical Circuits I	3	EG 206 Thermodynamics I	3
MA 223 Calculus III	4	MA 224 Differential Equations	4
PS 211 University Physics I	4	PS 212 University Physics II	4
General Education Elective[1]	3		
	18		**14**

Third Year

Fall	Credits	Spring	Credits
EE 321 Embedded Systems	4	EE 325 Computer Architecture and Operating Systems	3
EE 350 Linear Systems	3	EE 303 Electromagnetic Field Theory I	3
EE 357 Electronics I	3	EE 366 Electronics II	4
MA 306 Discrete Mathematics	3	EE 373 Electrical Energy Conversion	4
EE 359 Electrical Engineering Laboratory	1	EN 204 Professional and Technical Writing	3
General Education Elective[1]	3		
	17		**17**

Fourth Year

Fall	Credits	Spring	Credits
EE 491 Electrical System Design I	3	EE 494 Electrical System Design II	3
EE 478 Control Systems	3	EE 411 Microprocessor-Based Systems	4
MA 311 Statistical Methodology	3	EE 486 Digital Signal Processing	3
EE 463 Communication Systems	4	EE 487 Digital Signal Processing Lab	1
EG 450 Professional Issues	3	EE 459 Power Systems Analysis	3
		General Education Elective[1]	3
	16		**17**

Total Credits: 129

1 University general education requirement dictates that the Humanities-Social Science Electives be distributed as follows: one history course, one literature course, one course in psychology, sociology, economics or political science, and one arts or humanities course beyond the literature course.

ROTC is required 6 semesters for members of the Corps of Cadets.

Courses

EE 200. Engineering Programming. 3 Credits.
Introduction to a high level programming language such as C/C++. Topics include structure and organization of a computer program, variables and basic data types, flow of control, functions, file I/O, arrays and strings, computer memory, CPU and pointers, user defined structures, computer algortithms, modular design and documentation. Introduction to object oriented programming concepts. This course is offered once a year.

EE 204. Electrical Circuits I. 3 Credits.
A study of principles and methods of analysis of electric circuits with both direct and time varying sources in the steady state. KCL, KVL, mesh and nodal techniques. Network theorems are developed and applied to the analysis of networks. Energy storage elements. First order and second order circuits with forced and natural responses. Sinusoidal analysis, complex numbers, phasor diagrams. Power; average effective, and complex power in single phase systems. Classroom: 3 hours. Corequisite: MA 122.

EE 215. Fundamentals of Digital Design. 4 Credits.
An introductory course on formal design techniques for combinational and sequential logic circuits. Topics include combinational logic networks, minimization techniques, registers, synchronous sequential neworks, and control units. Applications of the concept developed in the classroom will be implemented in the laboratory. Classroom 3 hours, laboratory 2 hours.

EE 240. Electrical Concepts and Applications. 3 Credits.
A course on the theory and application of electrical devices and circuits. Discussions include magnetic circuits, transformers, electric machines, diodes, bipolar transistors, and field effect transistors. Integrated circuits are introduced. Digital switching circuits are treated, including logic gates, flip-flops, and counters. Operational amplifiers and their major applications are studied. Offered to qualified students not majoring in Electrical Engineering. Classroom 2 hours, laboratory 3 hours. Prerequisite: EE 204.

EE 242. Digital Systems Design. 4 Credits.
Topics are hierarchical design methods, design and debugging of digital hardware, determination of circuit behavior, control and timing, machine organization, control unit implementation, and interface design. A hardware design language will be used and students will acquire design experience implementing digital hard ware. Classroom 3 hours, laboratory 2 hours. Prerequisite: EE 215.

EE 303. Electromagnetic Field Theory I. 3 Credits.
Maxwell's Equations are developed from the experimental laws of electric and magnetic fields. Topics involving electric fields include Gauss's Law, divergence, energy, potential, conductors, dielectrics, and capacitance. Topics involving magnetic fields include the Biot-Savart Law, Ampere's Law, magnetic forces, magnetic materials, and inductance. Maxwell's Equations are used to describe wave motion in free space and in dielectric media. Classroom 3 hours. Prerequisites: MA 223, EE 204.

EE 314. Elements of Electrical Engineering. 4 Credits.
A course on the theory and application of electrical devices and circuits. Topics that are appropriate for discussion include dc circuits, single-phase and three-phase ac circuits, amplifiers, transducers, transformers, and electric machines. Offered to qualified students not majoring in Electrical Engineering. Classroom 3 hours, laboratory 3 hours. Prerequisite: MA 122.

EE 321. Embedded Systems. 4 Credits.
The use of computing devices in embedded applications is introduced. Computer organization topics include the arithmetic logic unit, timing and control, memory, serial and parallel I/O ports, and the bus system. Programs are written and run in assembly language and higher-level languages. Additional topics include peripheral interface control, interrupts, cross assembly and applications. Classroom 3 hours, laboratory 2 hours. Prerequisite: EG 110 or IS 130.

EE 325. Computer Architecture and Operating Systems. 3 Credits.
Machine architecture - machine performance relationships, computer classification, and computer description languages. Consideration of alternative machine architectures. Software influences on computer design. Topics include digital logic, VLSI components, instruction sets, addressing schemes, memory hierarchy ache and virtual memories, integer and floating point arithmetic, control structures, , buses, RISC vs. CISC, multiprocessor and vector processing (pipelining) organizations. Examples are drawn from Pentium and Sparc microcomputers. The primary focus is on the attributes of a system visible to an assembly level programmer. This course also introduces the fundamentals of operating systems. Topics include concurrency, scheduing, memory and device management, file system structure, security, and system performance evaluation. Lecture 3 hours. Offered once per year.

EE 350. Linear Systems. 3 Credits.
This course provides the foundations of signal and system analysis. Linear, time-invariant, causal, and BIBO stable analog and digital systems are discussed. System input-output descriptions, convolution and the impulse response are covered. Additional topics include singularity functions, Fourier and Laplace circuit analysis, circuit transfer functions, Bode plots, ideal filters, and real filters including Butterworth, Chebyschev, and Elliptic. Discrete topics include the transform, difference equations, FIR and IIR filters, the bilinear transformation, the DTFT, the DFT, and the FFT. Classroom 3 hours. Prerequisite EE 356.

EE 356. Electrical Circuits II. 3 Credits.
This course is a continuation of Electric Circuits I (EE 204). The complete solutions of linear circuits by Laplace transforms are developed. The concepts of frequency response, resonance, network functions, two port networks including hybrid parameters are studied in depth. The concepts of transformers, power, coupled circuits, multi-phase circuits, and Fourier series are introduced. Computer-based circuit simulation is used throughout. Classroom 3 hours. Prerequisite: EE 204.

EE 357. Electronics I. 3 Credits.
The basic building blocks used in electronic engineering are studied. Diodes, bipolar transistors, and MOS transistors are modeled and then used to describe the operation of logic gates and amplifiers. Emphasis is placed on the operation and applications of standard integrated circuit chips. Classroom 3 hours. Prerequisite: EE 204.

EE 359. Electrical Engineering Laboratory. 1 Credit.
Implementation, analysis, and design of electric and electronic circuits involving resistors, inductors, capacitors, diodes, bipolar transistors, MOS transistors, operational amplifiers and filters. Study and practice in the use of standard electrical engineering laboratory instrumentation. Laboratory 2 hours. Prerequisite: EE 215; corequisites: EE 356, EE 357.

EE 366. Electronics II. 4 Credits.
This course is a continuation of Electronics I (EE 357). Analog and digital circuits are discussed. Analog topics include frequency response, real world applications of operational amplifiers, power amplifiers, filters, oscillators and A/D and D/A converters. Digital electronic building blocks are discussed, including flip-flops, counters, coding and decoding circuits and memory. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 357, EE 359.

EE 373. Electrical Energy Conversion. 4 Credits.
A course on principles of energy conversion in electromechanical devices and machines. Analysis of transformers, polyphase synchronous and asynchronous machines, single phase fractional horsepower machines, and DC machines. Classroom 3 hours, laboratory 2 hours. Prerequisite: EE 356; corequisite: MA 224.

EE 399. EE Topics. 3 Credits.

EE 3XX. Electical Engineering. 4 Credits.

EE 411. Microprocessor-Based Systems. 4 Credits.
This course deals with organization, operation and design of systems where the microprocessor controls special interfaces to non-standard devices and responds to external events in a timely fashion. Topics include interface of special purpose peripherals, data structures, control structures, program and data organization and real time operating systems. Application to communications, automated measurement, process and servo control are discussed. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 215, CP 321.

EE 459. Power Systems Analysis. 3 Credits.
This course presents the foundations of electric power systems analysis after an initial review of single and three-phase power, complex power and transformers. Topics include per unit quantities, generators, transmission line models, transformer models, short-circuit analysis, load flow, and power systems economics. Lecture: 3 hours. Prerequisites: EE 356 and EE 373. Offered once per year.

EE 463. Communication Systems. 4 Credits.
Analog transmission of information signals by communication systems is analyzed. The component parts of transmitters and receivers including AM/FM modulators, filters, detectors and decoders are discussed. Mathematical concepts include the Fourier Series, Fourier Transform, dirac delta function and sinc function. Signal classification and digital modulation techniques such as ASK, FSK, PSK, PAM and QAM. Classroom 3 hours, laboratory 2 hours. Prerequisites: EE 356, EE 357, EE 359.

EE 468. Solid State Materials. 3 Credits.
Solid state materials, physics of electronic devices and integrated circuit design are studied. Topics include silicon crystal properties, diffusion, implantation, lithography and circuit fabrication. Device models are derived for junction diodes, bipolar and MOS transistors. Classroom 3 hours. Prerequisites: EE 303, EE 357.

EE 478. Control Systems. 3 Credits.
Analysis and design of continuous-time and discrete-time control systems using classical and state-space methods. Laplace transforms, transfer functions and block diagrams. Transient-response analysis, Routh-Hurwitz stability criterion, and steady-state error analysis. Analysis of control systems using the root-locus and frequency-response methods. Computer-aided design and analysis. Lecture: 3 hours. Prerequisites: EE 204 and MA 224. Offered once per year.

EE 486. Digital Signal Processing. 3 Credits.
An introductory level course that discusses the conversion of analog signals to discrete time signals. Emphasis will be on the processing of discrete signals using both time-domain and frequency-domain analysis. These techniques will be applied to the design of digital filters. Classroom 3 hours. Prerequisite: EE 350 or instructor's permission.

EE 487. Digital Signal Processing Lab. 1 Credit.
Implementation analysis and design of digital signal processing functions and techniques. Study and practice in the use of software and hardware platforms used for digital signal processing applications. Laboratory: 3 hours. Prerequisite: EE 350. Co-requisite: EE 486. This course is offered once a year.

EE 490. Advanced Topics. 3 Credits.
A course that provides advanced study in an area of the instructor's special competence. Courses that have been offered in the past include Power System Stability, Electrical Communications II, Microwave Theory and Techniques and Digital Systems. Offered as the occasion demands. Classroom 3 hours. Prerequisite: senior standing.

EE 491. Electrical System Design I. 3 Credits.
Introduction to design problems. Application of concepts of electrical engineering to a capstone design project. The first of a two-semester sequence, this course focuses on the problem statement, specification, preliminary design, design review and approval stages of the design processes, the design process involves exploring alternate solutions and design optimization and simulation. Economic constraints and human factors are considered in the design process. The course requires nine hours per week of directed reading, research and experimentation. Prerequisite: seventh semester standing and permission of the instructor.

EE 494. Electrical System Design II. 3 Credits.
This course is the second in the two-semester capstone design project sequence. It focuses on the final stages of the design process-finalized design, implementation and testing. A written project report and an oral presentation to students and faculty is required. Nine hours per week of directed readings, research, and experimentation. Prerequisite: EE 491.