the student to develop skills in specialized areas such as communications and signal processing, control systems, electric power systems, electronics, and digital systems. The computer engineering degree is a more specialized degree with more required courses and fewer electives. Specific requirements for the electrical and computer engineering programs are given below.

**Electrical Engineering**

- **Course**
- **Hrs.**
- **General Education Courses**
  - **Basic Skills:**
    - ENGL 101/100 and 102, College English I & II...6
    - COMM 111, Public Speaking...3
  - **PHIL 385, Ethics**
  - **Other fine arts/humanities & social/behavioral science courses**...15

- **Mathematics/Natural Sciences:**
  - MATH 242, 243 & 344, Calculus I, II & III...13
  - MATH 555, Differential Equations I...3
  - PHYS 313 & 314, University Physics I & II...8
  - CHEM 111, General Chemistry...5
  - IEN 254, Engineering Probability and Stats. I...3

- **Engineering Core Courses:**
  - AE 223, Statics...3
  - ECE 284, Circuits II...3
  - IEN 255, Engineering Economy...3
  - ME 398, Thermodynamics I...3

- **Major Courses:**
  - ECE 138, Engineering Computing in C...3
  - ECE 194, Introduction to Digital Design...4
  - ECE 284, Circuits II...3
  - ECE 363, Electromagnetic Field Theory...3
  - ECE 383, Signals and Systems...3
  - ECE 410, Distributed Parameter Circuits...3
  - ECE 488, Electric Machines & Transformers...4
  - ECE 492, Electronic Circuits I...3
  - ECE 493 or 688, Elect. Circuits II or Power Elect...4
  - ECE 583 or 592, Intro. Control System Concepts or Linear Systems, or ME 659, Mech. Control Systems...3
  - ECE 586, Intro. to Communication Systems...4
  - ECE 585 & 595, Electrical Design Proj. I & II...4
  - Technical Electives**...15

- **Mathematics/Natural Sciences:**
  - MATH 242 & 243, Calculus I & II...10
  - MATH 555, Differential Equations I...3
  - PHYS 313 & 314, University Physics I & II...8
  - CHEM 111, General Chemistry...5
  - IEN 254, Engineering Probability and Stats. I...3
  - CS 300, Data Systems and Algorithms...3

- **Engineering Core Courses:**
  - AE 223, Statics...3
  - ECE 282, Circuits I...4
  - IEN 255, Engineering Economy...3
  - ME 398, Thermodynamics I...3

- **Major Courses:**
  - ECE 138, Engineering Computing in C...3
  - ECE 194, Introduction to Digital Design...4
  - ECE 284, Circuits II...3
  - ECE 294, Digital Design Techniques...3
  - ECE 383, Signals and Systems...3
  - ECE 394, Intro. to Computer Architecture...3
  - ECE 492, Electronic Circuits I...3
  - ECE 594, Microprocessor-based System Design...4
  - ECE 585 & 595, Electrical Design Project I & II...3
  - CS 444, Intro. to UNIX...3
  - CS 540, Operating Systems...3

- **Technical Electives**...16

- **Refer to graduation requirements at the beginning of this section for details.**
- **Must be chosen with advisor’s approval from a departmentally approved list.**

**Lower-Division Courses**

- ECE 101. Introduction to Electrical Engineering (1). Gives those students also enrolled in ENGR 101 the opportunity for a hands-on experience in each of the areas of specialization in electrical engineering: digital design, power, communications, and control.

- ECE 138. Engineering Computing in C (3). Introductory course in digital computer programming using C with applications to elementary engineering problems. Stresses both C syntax rules and problem solving approaches. Laboratory exercises given for programming on personal computers. Prerequisite: MATH 111 or 112 or equivalent.

- ECE 194. Introduction to Digital Design (4). 3R; 3L. An introduction to digital design concepts. Includes number systems, Boolean algebra, Karnaugh maps, combinational circuit design, adders, multiplexers, decoders, sequential circuit design, state diagram, flip flops, sequence detectors, and test different combinational and sequential circuits. Uses CAD tools for circuit simulation. Prerequisite: MATH 111 or equivalent.

- ECE 238. Assembly Language Programming for Engi-neers (3). An introduction to basic concepts of computer organization and operation. Studies machine and assembly language programming concepts that illustrate basic principles and techniques. Laboratory exercises given for experience using personal computers. Prerequisite: ECE 138.


- ECE 284. Circuits II (3). Includes circuits with mutually coupled elements, transfer functions emphasizing frequency response, two-port networks, Laplace transforms and application to transient circuit analysis, and the application of computer-aided analysis software toward circuit analysis and design. Prerequisites: ECE 282 and MATH 243.

- ECE 294. Digital Design Techniques (3). Digital design techniques include registers and register transfer language, RTL state design, memory, memory interfacing, and microprogramming; programmable logic devices, different types of PLDs, combinational and sequential circuit design using PLDs; ABEL programming; PLD-based design using ABEL, CMOS logic family; TTL to CMOS and CMOS to TTL interfacing. Uses CAD tools for circuit simulation. Prerequisite: ECE 194. Corequisite: ECE 138.

**Upper-Division Courses**

- ECE 363. Electromagnetic Field Theory (3). A vector development of electric and magnetic fields, including experimental laws, polarization phenomena, and Maxwell’s equations. Prerequisites: ECE 282, MATH 344 and 555.

- ECE 383. Signals and Systems (3). Properties of signals and systems, convolution and its application to system response, Fourier series representation of periodic signals, Fourier transforms and continuous spectra, filters, time domain sampling, and Z-transforms. Many of these topics involve discrete as well as continuous systems. Prerequisites: MATH 555 and ECE 138. Corequisite: ECE 284.

- ECE 394. Introduction to Computer Architecture (3). Introduces memory systems, arithmetic circuits, and computer architecture.ASMall computer will be designed in class. Studies instruction set selection, bus systems, hard-wired design, and microprogrammed design. Prerequisite: ECE 294.

- ECE 410. Distributed Parameter Circuits (3). 2R; 3L. A study of the theory and applications of distributed parameter circuits with emphasis on transmission lines. Treats telegraphers’ equations, transient signals on lossless lines, steady state signals on lossless lines, effects of lumped impedances, and Smith Chart techniques. Prerequisite: ECE 383.

- ECE 477. Selected Topics in Electrical Engineering (1-4). New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

- ECE 481A. Co-op Education (1). Provides the student the opportunity to obtain practice in application of engineering principles by employment in an engineering-related job integrating course work with a planned and supervised professional experience. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education
coordinators. Intended for students who will be working full-time on their Co-op assignment and need not be enrolled in any other course. Offered Cr/NCr only. Prerequisites: junior standing and approval by appropriate faculty sponsor.

ECE 481P. Co-op Education (1). Provides the student the opportunity to obtain practice in application of engineering principles by employment in an engineering-related job integrating course work with a planned and supervised professional experience. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Students must enroll concurrently in a minimum of 6 hours of course work including this course in addition to a minimum of 20 hours per week at their Co-op assignment. Offered Cr/NCr only. Prerequisites: junior standing and approval by appropriate faculty sponsor.


ECE 492. Electronic Circuits I (3). Introduces semiconductor devices and applications in discrete and integrated circuit design. Applications include, but are not limited to, op-amp circuits, rectification, and transistor amplifiers. Corequisite: ECE 284.


Courses for Graduate/Undergraduate Credit

ECE 577. Special Topics in Electrical and Computer Engineering (1-4). New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

ECE 585. Electrical Design Project I (2). 3L. A design project under faculty supervision chosen according to the student’s interest. Prerequisites: COMM 111 and departmental consent. May not be counted toward a graduate electrical major.

ECE 586. Introduction to Communication Systems (4). 3R; 3L. Fundamentals of communication systems; models and analysis of source, modulation, channel, and demodulation in both analog and digital form. Reviews Fourier Series, Fourier Transform, DFT, Probability, and Random Variables. Studies in Sampling, Multiplexing, AM and FM analog systems, and additive white Gaussian noise channel. Additional topics such as PSK and FSK digital communication systems covered as time permits. Prerequisites: ECE 383 and either STAT 471 or IEN 254.

ECE 588. Advanced Electric Motors (3). Introduces advanced electric motor applications and theory. Includes single-phase motors, adjustable speed ac drive applications, and stepper motors. Prerequisites: ECE 488 and 492.

ECE 594. Microprocessor Based System Design (4). 3R; 1L. Presents development of microprocessor based systems. Studies interfacing the address bus, data bus, and control bus to the processor chip. Memory systems and I/O devices interfaced to the appropriate busses. Vendor-supplied, special purpose chips, such as interrupt controller, programmable I/O devices, and DMA controllers, integrated into systems designed in class. Lab gives hands-on experience. Prerequisites: ECE 394, or 238 and 294.

ECE 595. Electrical Design Project II (2). 3L. A continuation of ECE 585. Prerequisite: ECE 585. Will not count toward a graduate electrical engineering degree.

ECE 598. Electric Power Systems Analysis (3). Analysis of electric utility power systems. Topics include analysis and modeling of power transmission lines and transformers, power flow analysis and software, and an introduction to symmetrical components. Prerequisite: ECE 282.

ECE 616. Introduction to Wireless Communications (3). Introduces students to the basic principles and issues related to wireless communication. We will consider not only the basic technical aspects of the wireless communications, but also the market issues, social and cultural impact of the wireless communications, deregulation issues as well as political issues relating to the development and wide popularity of wireless communications. The level of the course will be applicable to junior or senior undergraduates as well as beginning graduate students. Prerequisites: ECE 383, IE 254.

ECE 636. Telecommunications (3). Topics in circuit and packet switching, layered communication architectures, state dependent queues, traffic engineering, call processing, software organization, routing, and common channel signaling. Prerequisite: ECE 586 or departmental consent.

ECE 644. Advanced Digital Lab (2). An open laboratory experience for computer engineering students. Gives the student an opportunity to use state-of-the-art devices and equipment in designing complex digital systems. Will not count towards an electrical engineering degree. Prerequisites: ECE 394 and 594.

ECE 666. Computer Forensics (3). Computer crimes include security violations and unauthorized access and theft of sensitive information. In this course, we discuss procedures for the identification, preservation, and extraction of electronic evidence that can be legally used when a computer crime is committed. From the network perspective, we discuss auditing and investigation of network and host intrusions. Forensic tools and resources for system administrators and information system security officers will also be covered. Legal issues related to computer and network forensics will be discussed. There will be about eight programming-related laboratory exercises in this class. This course is intended for senior undergraduate students and graduate students majoring in ECE and computer science. Prerequisites: ECE 138 and CS 540. In addition, good programming skills in one of the languages (C, C++, or Java), familiarity with the operating systems (UNIX/Windows) are required.

ECE 684. Introductory Control System Concepts (3). An introduction to system modeling and simulation, dynamic response, feedback theory, stability criteria, and compensation design. Prerequisite: ECE 383.

ECE 688. Power Electronics (4). 3R; 3L. Deals with the applications of solid-state electronics for the control and conversion of electric power. Gives an overview of the role of the thyristor in power electronics application and establishes the theory, characteristics and protection of the thyristor. Presents controlled rectification, static frequency conversion by means of the DC-DC link converter and the cyclo converter, emphasizing frequency, and voltage control and harmonic reduction techniques. Also presents requirements of forced commutation methods as applied to DC-DC control and firing circuit requirement and methods. Introduces applications of power electronics to control AC and DC motors using new methods such as microprocessor. Prerequisite: ECE 492.

ECE 691. Integrated Electronics (3). A study of BiMOS and MOS analog and digital integrated circuits. Includes BiT, BiMOS, and MOS fabrication; application specific semi-custom VLSI arrays; device performance and characteristics; and integrated circuit design and applications. Prerequisites: ECE 194 and 493 or departmental consent.

ECE 698. Principles of Power Distribution (3). The distribution system is a vital contributor to the overall power system function of providing quality electrical service.
Provides an overall view of the engineering fundamentals of distribution systems. Discusses distribution system planning and automation, primary and secondary distribution networks. Presents voltage regulation, protection, and reliability. Prerequisite: ECE 598 or departmental consent.

ECE 726. Digital Communication Systems I (3). Presents the theoretical and practical aspects of digital and data communication systems. Includes the modeling and analysis of information sources as discrete processes; basic source and channel coding; multiplexing and framing; spectral and time domain considerations related to ASK, PSK, QPSK, BFSK, MSK, and other techniques appropriate for communicating digital information in both base-band and band-pass systems; intersymbol interference; effects of noise on system performance; optimum systems; and general M-ary digital systems in signal-space. Prerequisites: ECE 586 and 754.

ECE 736. Data Communication Networks (3). Presents a quantitative performance evaluation of telecommunication networks and systems. Includes fundamental digital communications system review; packet communications; queuing theory; OSI, s.25, and SNA layered architectures; stop-and-wait protocol, go-back-N protocol, and high-level data link layer; network layer flow and congestion control; routing; polling and random access; local area networks (LAN); integrated services digital networks (ISDN); and broad band networks. Prerequisites: ECE 383 or departmental consent.

ECE 737. Wireless Networking (3). Covers topics ranging from physical layer to application layer in the wireless and mobile networking fields. Explores physical layer issues of wireless communications, wireless cellular telephony, ad-hoc networks, mobile IP and multicast, wireless LAN (IEEE 802.11), security, Bluetooth and WAP, etc. Imparts general knowledge about wireless communication technologies and ongoing research activities. Prerequisite: ECE 736.

ECE 738. Embedded Systems Programming (3). A study of the requirements and design of embedded software systems. Application of the C programming language in the implementation of embedded systems emphasizing real-time operating systems, interfacing to assembly and high-level languages, control of external devices, task control, and interrupt processing. Prerequisite: ECE 594 or equivalent.

ECE 744. Introduction to VHDL (3). An introduction to VHDLIC hardware description language. Includes different types of modeling techniques using state-of-the-art CAD tools. Covers extensively behavioral modeling, structural modeling, and data-flow modeling. Design assignments include design and simulation of both combinational and sequential circuits using VHDL. Prerequisites: ECE 138 and 394.

ECE 754. Probabilistic Methods in Systems (3). A course in random processes designed to prepare the student for work in communications controls, computer systems information theory, and signal processing. Covers basic concepts and useful analytical tools for engineering problems involving discrete and continuous-time random processes. Discusses applications to system analysis and identification, analog and digital signal processing, data compression parameter estimation, and related disciplines. Prerequisites: ECE 383 and either STAT 471 or IEN 254.

ECE 764. Routing and Switching I (4). 3R: 3L. An introductory course which studies different hardware technologies, like ethernet and token ring. Discusses VLSM. Introduces different routing protocols. Includes hands-on experience in the ECE department’s routing and switching lab. Prerequisite: ECE 736 or departmental consent.

ECE 765. Routing and Switching II (4). 3R: 3L. Discusses different bridging techniques, including SRB, RSRB, and DLSW. Also includes advanced routing protocols, like OSPF and EIGRP, and route redistribution. Includes hands-on experience in the ECE department’s routing and switching lab. Prerequisite: ECE 764 or departmental consent.

ECE 766. Information Assurance and Security (3). Provides basic concepts in information assurance and security including encryption, digital certificates, security in networks, operating systems, and databases. Topics in intrusion detection, legal and ethical issues in security administration will also be discussed. Prerequisites: ECE 736 or 764, or departmental consent.

ECE 777. Selected Topics in Electrical Engineering (1-4). New or special courses presented on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

ECE 781. Analog Filters (3). A detailed study of analog filter design methods. Includes both passive and active filters. Discusses analog filter approximations; covers sensitivity and noise analyses. Prerequisite: ECE 383 and 492.

ECE 782. Digital Signal Processing (3). Presents the fundamental concepts and techniques of digital signal processing. Time domain operations and techniques include difference equations and convolution summation. Covers Z-transform methods, frequency-domain analysis of discrete-time signals and systems, discrete Fourier transform, and fast Fourier transform. Emphasizes the frequency response of oligotime systems and the relationship to analog systems. Prerequisite: ECE 383 or departmental consent.

ECE 790. Independent Study in Electrical Engineering (1-3). Arranged individual, independent study in specialized content areas in electrical engineering under the supervision of a faculty member. Repeatable for credit. Prerequisite: departmental consent.


ECE 797. Computer Application to Power System Analysis (3). Describes the use of power system component models and efficient computational techniques in the development of a new generation of computer programs representing the steady and dynamic states of electric power systems and informs of methods currently employed in the electric utility industry. Emphasizes algorithms suitable for computer solution of power systems problems such as power flows and system voltages during normal and emergency conditions and transient behavior of the system resulting from fault conditions and switching operations. Prerequisite: ECE 598.

ECE 798. Advanced Electric Power Systems Analysis (3). Advanced topics in analysis and operation of electric utility power systems. Topics include faulted system analysis, economic dispatch, generator modeling, power system stability, and system protection. Prerequisite: ECE 598. Please see the Graduate Catalog for courses numbered 800 and above.