

**Auburn University**  
**Department of Electrical and Computer Engineering**  
**Electrical Engineering Electives**

ELEC 4200. Digital System Design (3). Pr. ELEC 2220. Hierarchical, modular design of digital systems, synchronous and asynchronous sequential circuit analysis and design, programmable logic devices and field programmable gate arrays, and circuit simulation for design verification and analysis.

ELEC 4800. Instrumentation Engineering (3). Lec. 2, LAB. 3. Pr., ELEC 3040 or ELEC 3050. Study and application of sensors, instrumentation, and computer technology to research and industrial process control.

ELEC 4970. Special Topics in Electrical Engineering (Credit To Be Arranged, 1 to 5). Pr., departmental approval. May be taken more than one semester.

ELEC 4980. Special Projects in Electrical Engineering (Credit To Be Arranged, 1 to 3). Pr., departmental approval. May be taken more than one semester

ELEC 4997. Honors Thesis (1 to 6). Pr., department head approval. Individual student endeavor consisting of directed research and writing of honors thesis. (ELEC Honors College students only. May be repeated once for a maximum of six total credit hours.)

ELEC 5100. Wireless Communications Systems (3) Lec. 3. Pr., ELEC 3400, ELEC 3320. Introduction to mobile cellular radio and wireless personal communications, cellular concept, mobile radio propagation, modulation techniques, multiple access techniques, wireless systems and standards.

ELEC 5110, Wireless Networks (3). Pr., ELEC 3400. Introduction to evolution of technologies from 2G to 3G wireless networks, wireless broadband, satellite communication, wireless local area networks, mobile Internet protocol, wireless network security, wireless network planning, design and management.

ELEC 5120, Telecommunication Networks (3). Pr., ELEC 3400. Introduction to public and private telecommunications systems, including switched telephone networks, circuit and packet switching, voice and data networks, transmission technologies and protocols, switching protocols and architectures, and network management.

ELEC 5130, RF Devices and Circuits (3). Pr., ELEC 3700. Introduction to RF semiconductor devices and circuits targeted for wireless applications.

ELEC 5150, Information Security (3). Pr., Senior standing and departmental approval. Emerging protocols, standards and technologies of information security; Design of information network security, firewall, virtual private networks and secured applications.

ELEC 5200. Computer Architecture and Design (3) Lec. 3. Pr., ELEC 4200. Structural organization and hardware design of digital computers; register transfers; micro-operations, control units and timing; instruction set design; input/output devices, multiprocessors, automated hardware design aids.

ELEC 5210. Personal Computer System Design (3) Lec. 3. Pr., ELEC 2220 or COMP 3350. Personal computer hardware components, microprocessors, motherboard design, cache and main memory technologies and subsystems, standard expansion buses and interfacing. Design of selected peripheral subsystems, including floppy and hard disks, CDROMs, graphics displays, input devices, and multimedia hardware.

ELEC 5220. Information Communication (3) Lec. 3. Pr., ELEC 2220 or COMP 3350. Architectures, protocols, standards and technologies of information networks; Design and implementation of information networks based on requirements; Applications of information networks for data, audio and video communications.

ELEC 5230. Parallel Processing (3) Lec. 3. Pr., ELEC 2220 or COMP 3350. Hardware components of multiprocessor systems including processor, interconnection, memory, and control architectures; Software elements of parallel processing including inter-processor communication, task partitioning, task mapping and scheduling, load balancing, programming languages, and parallel algorithms.

ELEC 5240. Neural Networks (3) Lec. 3. Pr., ELEC 2120. Principles, architectures, and technologies of neural networks; design and implementation of neural networks using electronics and optics; applications of neural networks.

ELEC 5250. Computer-Aided Design of Digital Circuits (3) Lec. 3. Pr., ELEC 2220 or COMP 3350. Computer-automated design of digital logic circuits, using discrete gates, programmable logic devices, and standard cells, hardware description languages, circuit simulation for design verification and analysis, fault diagnosis and testing.

ELEC 5260. Embedded Computing Systems (3). Pr. ELEC 2220 or COMP 3350. The design of systems containing embedded computers. Microcontroller technology, assembly language and C programming, input/output interfacing, data acquisition hardware, interrupts, and timing. Real-time operating systems and application programming. Embedded system application examples.

ELEC 5270. Low Power Design of Electronic Circuits. (3)Pr.. ELEC 2210 or Departmental approval. Design of digital circuits and systems for reduced power consumption, power analysis algorithms, low-power MOS technologies, low-power design architectures for FPGA, memory and microprocessor, reduction of power in testing of circuits.

ELEC 5310. Design of Antennas and Antenna Systems (3) Lec. 3. Coreq., ELEC 3320. Application of Electromagnetic and Circuit concepts to the design of practical antennas and antenna systems.

ELEC 5320. Electromagnetic Compatibility and Interference (3) Lec. 3. Pr., ELEC 3320, ELEC 3700. Electromagnetic noise coupling, designing for electromagnetic compatibility (EMC), EMC regulation, noise sources, standard techniques for eliminating noise, circuit layout for reduced electromagnetic interference (EMI).

ELEC 5330. Optical Waveguides and Electro-Optics (3) Lec. 3. Pr., ELEC 3320, ELEC 3700. Fundamentals of optical systems and electro-optics as applied to modern engineering problems including optical wave propagation, optical materials, fiberoptics, integrated optics, lasers, optical detectors, optical modulators, and optical communications systems.

ELEC 5340. Microwave Engineering (3) LEC. 3. Pr., ELEC 3320, ELEC 3700. Application of Electromagnetic and electronic concepts to the design of practical microwave devices and circuits typically used in wireless communications.

ELEC 5350. RADAR and SONAR Principles (3) LEC. 3. Pr., ELEC 3320, ELEC 3800. Study of the fundamentals of RADAR systems including detection of nondeterministic signals in noise, and introduction to the principles of wave acoustics with emphasis on SONAR systems.

ELEC 5410. Digital Signal Processing (3) Lec. 3. Pr., ELEC 3800. Digital processing of signals, sampling, difference equations, discrete-time Fourier transforms, discrete and fast Fourier transforms, digital filter design.

ELEC 5420. Wireless Communications Systems (3). Lec. 3., Pr., ELEC 3400, ELEC 3320. Introduction to mobile cellular radio and wireless personal communications, cellular concept, mobile radio propagation, modulation techniques, multiple access techniques, wireless systems and standards.

ELEC 5430. Digital Image Processing (3) Lec. 3. Pr., ELEC 3400, ELEC 3800. Digital image processing principles and applications such as enhancement, restoration and compression.

ELEC 5510. Modeling and System Identification (3) Lec. 3. Pr., ELEC 3500 and ELEC 3800 or departmental approval. Development of physical models (linear and nonlinear) from first principles and estimation of model parameters from experimental data. System identification in closed loop. Data collection under output feedback.

ELEC 5520. Discrete Embedded Control Systems (3) Lec. 3. Pr., ELEC 3500. Discrete state equation models, control system characteristics, pole placement design and implementation, estimator design and implementation.

ELEC 5540. Modern Controller Technology (3). LEC. 2, LAB. 3. Pr., ELEC 3500, or COI. Controller technologies used in industrial and research practice. PID, auto-tuning PID, programmable logic controllers, personal-computer based controllers, microcontrollers, digital signal processors.

ELEC 5610. Power Electronics (3) Lec. 3. Pr., ELEC 3600, ELEC 3700. Power electronic circuits, components, and devices.

ELEC 5620. Power System Control (3) Lec. 3. Pr., ELEC 3600 or departmental approval. Power flow analysis, economic dispatch and automatic generation control of electric power systems.

ELEC 5630. Electromagnetic Machines (3) Lec. 3. Coreq., ELEC 3600. Fundamentals of the electromagnetic-mechanical energy conversion process. Principles of operation, application, and control of ac and dc motors and generators.

ELEC 5650. Power System Protection (3) Lec. 3. Pr., ELEC 3600. Fault analysis using symmetrical components. Power switchgear, including switches, disconnects, fuses, relays and circuit breakers. Fundamentals of electric power system protection, including bus, transformer, and line protection.

ELEC 5700. Semiconductor Fundamentals (3) Lec. 3. Pr., ELEC 3700. An introduction to semiconductors: crystal structure, energy band theory, equilibrium electron and hole statistics, doping, generation and recombination processes, carrier drift and diffusion, transport equations.

ELEC 5710. Semiconductor Devices (3) Lec. 3. Pr., ELEC 3700. An introduction to semiconductor devices: pn junctions, junction diode based devices, optoelectronic devices, bipolar

ELEC 5730. Microelectronic Fabrication (3) Lec. 3. Pr., ELEC 2210 or departmental approval. This course develops an understanding of the basic processes used in fabrication of bipolar and MOS integrated circuits and practices actual fabrication in the microelectronics laboratory.

ELEC 5740. Electronics Manufacturing, (3) Lec. 2, LAB. 3. Pr., ELEC 3700 or departmental approval. This course examines the materials and processes used to manufacture electronic products. Particular attention is given to substrate technology and electronics assembly.

ELEC 5750. Introduction to Plasma Engineering (3) Lec. 3. Pr., ELEC 3320 or departmental approval. Electrical breakdown and discharges in gases, basic plasma theories, applications of plasmas, plasma processing for microelectronic fabrication.

ELEC 5760. Solid-State Sensors (3) Lec. 3. Pr., ELEC 3700 or departmental approval. Theory, technology and design of micro-mechanical sensors, electrochemical microsensors, photodetectors, and integrated smart sensors.

ELEC 5770. VLSI Design (3) Lec. 3. Pr., ELEC 2210, ELEC 2220. Review of MOS transistor fundamentals, CMOS logic circuits; VLSI fabrication and design rules; clocking strategies and sequential design; performance estimation; memories and programmable arrays; standard cell design methodologies; computer aided design (CAD) tools.

ELEC 5780. Analog Circuit Design (3) Lec. 3. Pr., ELEC 3700 or departmental approval. This course explores the circuit design techniques used for implementing analog integrated circuits in both CMOS and bipolar technologies. Differential amplifiers, operational amplifiers, current sources, data converters, circuit layout and device modeling are topics central to this course.

ELEC 5800. Advanced Computational Techniques for Electrical Engineers (3) Lec. 3. Pr., ELEC 2120, ELEC 3320. Introduction to high level programming techniques in electrical engineering applications; topics include linear systems analysis, system identification, nonlinear dynamic systems, and electromagnetic applications.

ELEC 5810. Computed Imaging Systems (3) Lec. 3. Pr. ELEC 2120 or departmental approval. Introduction to computed imaging systems such as magnetic resonance imaging (MRI), computed tomography (CT), and synthetic aperture radar (SAR).

ELEC 5970. Special Topics in Electrical Engineering (Credit To Be Arranged, 1 to 5). Pr., departmental approval. May be repeated for up to 9 credits toward degree requirements.