ELECTRICAL AND COMPUTER ENGINEERING (ECE)

Subject-area course lists indicate courses currently active for offering at the University of Louisville. Not all courses are scheduled in any given academic term. For class offerings in a specific semester, refer to the Schedule of Classes (https://csprd.louisville.edu/psp/ps_class/EMPLOYEE/PSFT_CS/c/COMMUNITY_ACCESS.CLASS_SEARCH./x/?state=62dab551a0d600a5e8237359c50704e59007&duo_code=sjUx2OSTj21TNVEnQ3ZTNBjHmfxqmV).

500-level courses generally are included in both the undergraduate- and graduate-level course listings; however, specific course/section offerings may vary between semesters. Students are responsible for ensuring that they enroll in courses that are applicable to their particular academic programs.

Course Fees

Some courses may carry fees beyond the standard tuition costs to cover additional support or materials. Program-, subject- and course-specific fee information can be found on the Office of the Bursar website (https://louisville.edu/bursar/tuitionfee/university-fees/).

ECE 100. Special Topics in Electrical and Computer Engineering **1 Unit**
Grading Basis: Pass/Fail
Term Typically Offered: Spring Only
Prerequisite(s): ENGR 100, Freshman standing, consent of instructor.
Fee: An additional $20.00 is charged for this course.
Description: Provides an enrichment experience for freshman engineering students in an advanced topic in Electrical and Computer Engineering.
Note: Does not count toward a major in Electrical Engineering.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 210. Logic Design **3 Units**
Term Typically Offered: Fall, Spring, Summer
Corequisite(s): ECE 211.
Description: Enrollment restricted to Electrical and Computer Engineering and Computer Engineering and Computer Science students only, or with permission of the Electrical and Computer Engineering Department Chair. Number systems, base conversions, and codes. Complementary arithmetic, boolean algebra, logic gates, IC logic families, MSI applications, flip-flops, registers, counters, memories, arithmetic circuits, and analysis and synthesis of combinational and sequential circuits.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 211. Logic Design Laboratory **1 Unit**
Term Typically Offered: Fall, Spring, Summer
Corequisite(s): ECE 210.
Description: Design-oriented experiments on combinational and sequential logic circuits, using integrated circuit components.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 220. Network Analysis I **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): PHYS 299; ENGR 205 (or concurrent).
Corequisite(s): ECE 221.
Fee: An additional $60.00 is charged for this course.
Description: Enrollment restricted to Electrical and Computer Engineering students only, or with permission of the Electrical and Computer Engineering Department Chair. Topics include basic circuit laws, circuit solving methods, independent and dependent sources, resistance, inductance, capacitance, introduction to operational amplifiers, Thevenin's Theorem, superposition, first and second order circuits, power, energy, AC circuit analysis using impedance, phasors, and the power triangle, and balanced three-phase power, and critical thinking. Note:Tablet PC required.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 221. Network Analysis I Laboratory **1 Unit**
Term Typically Offered: Fall, Spring
Prerequisite(s): PHYS 299, ENGR 205 (or concurrent).
Corequisite(s): ECE 220.
Fee: An additional $20.00 is charged for this course.
Description: Enrollment restricted to Electrical and Computer Engineering students only, or with permission of the Electrical and Computer Engineering Department Chair. An introductory laboratory with experiments in the use of measurement instruments and the measurement of network characteristics.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 252. Introduction to Electrical Engineering **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ENGR 201 (or concurrent).
Fee: An additional $60.00 is charged for this course.
Description: DC/AC circuits. Linear network analysis. Impedance. Phasors. Complex Power. Transformers. Three-phase. Resonance. Solid-state devices. Integrated circuits. Op-amps. Electrical safety. RC filters. Sensors. Motors. Batteries.
Note: This course is for non-ECE students only.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 288. Electrical & Computer Engineering Cooperative Education Seminar **0 Units**

Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CHEM 201, ECE 210, ECE 211, ENGL 101, ENGR 110, student must be in Good Standing with GPA of 2.25 or higher; CSE 130, ECE 220, ECE 221.
Corequisite(s): CSE 130, ECE 220, ECE 221.
Description: Discussion of the policies and procedures for cooperative education and instruction in job search techniques, including resume preparation, forwarding letters,and behavioral interviewing. The student performance appraisal is explained,along with how to be successful in the workplace. The job market is discussed along with company descriptions and the requirements for the Co-op Report are explained. Question and answer sessions are included with returning co-op students and co-op employers. The student also receives training in the use of University Career Services Management System.
Note: This seminar is a prerequisite for the first cooperative education term.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 289. Electrical & Computer Engineering Cooperative Education I **1 Unit**

Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CECS 130, ECE 220, ECE 221 and ECE 288.
Fee: An additional $300.00 is charged for this course.
Description: Full-time technical work experience related to the student's academic program.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 320. Network Analysis II **3 Units**

Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 220 and ENGR 205.
Fee: An additional $60.00 is charged for this course.
Description: A continuation of ECE 220. Topics include Laplace transforms, network theorems, transfer functions, time-domain analysis, frequency response, operational amplifier circuits, filters, Bode plots, resonance, two-port networks, mutual inductance and transformers.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 322. Introduction to ECE Computing Tools **1 Unit**

Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CECS 130 (or concurrent).
Fee: An additional $20.00 is charged for this course.
Description: Introduction to scientific programming in MATLAB: numerical variables, control structures, arrays, functions, file input/output, plotting. Software reporting standards. Introduction to Python programming: variables, expressions, statements, conditional execution, function, iteration, strings, files, lists, tuples, object-orientated programming, etc. Critical thinking skills.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 333. Electronics I **3 Units**

Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 220 and ECE 221.
Corequisite(s): ECE 320 and ECE 334.
Fee: An additional $60.00 is charged for this course.
Description: Introduction to electronic devices and the basic circuits. The course deals with the op-amp, the diode, the bipolar junction transistor, and the field-effect transistor. Biasing, small-signal and large signal analysis and the principles employed in the design of electronic circuits are included in the course.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 334. Electronics I Lab **1 Unit**

Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 221.
Corequisite(s): ECE 320 and ECE 333.
Fee: An additional $20.00 is charged for this course.
Description: Weekly laboratory to illustrate experimental analysis and design principles of electronic circuits.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 360. Probabilistic Methods in Electrical and Computer Engineering **3 Units**

Term Typically Offered: Fall, Spring
Prerequisite(s): ENGR 201; ECE 320 (or concurrent).
Fee: An additional $60.00 is charged for this course.
Description: An introductory treatment of probability theory including distribution and density functions, moments and random variables. Applications of normal and exponential distributions. Estimation of means, variances. Correlation and spectral density functions. Random processes and response of linear system to random inputs.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 389. Electrical & Computer Engineering Cooperative Education II **1 Unit**

Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 289.
Fee: An additional $300.00 is charged for this course.
Description: Full-time technical work experience related to the student's academic program.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 400. Special Topics in Electrical & Computer Engineering **1-6 Units**

Fee: An additional $120.00 is charged for this course.
Description: Exploration of one or more ECE topics not covered in the regular course offerings.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 405. Undergraduate Project in Electrical & Computer Engineering **1-6 Units**

Prerequisite(s): Approval of a faculty sponsor.
Fee: An additional $120.00 is charged for this course.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 412. Introduction to Embedded Systems **3 Units**

Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 210 and Junior standing, or faculty consent.
Fee: An additional $60.00 is charged for this course.
Description: Introduction to embedded systems; assembly language programming; parallel and serial data transfer; polling, interrupts, and servicing of interrupts; software and hardware timing; analog-to-digital and digital-to-analog conversion. Projects on interfacing, system design, and implementation.
Note: Cross-listed with CSE 412.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 420. Signals and Linear Systems **3 Units**

Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 320 and ECE 322.
Fee: An additional $60.00 is charged for this course.
Description: Analysis of continuous-time and discrete-time, discrete-parameter, time-invariant, linear systems based upon the convolution integral, Fourier series and transform, Laplace transform, Z-transform, and state-space methods. Topics include the impulse response, transfer function, energy spectra, filtering, sampling, and applications to networks, communications, and controls.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 473. Introduction to Electromagnetic Fields and Waves **3 Units**

Term Typically Offered: Fall, Summer
Prerequisite(s): ENGR 205 and PHYS 299.
Fee: An additional $60.00 is charged for this course.
Description: Electrostatic and magnetostatic fields; Faraday's law; Maxwell's equations, electromagnetic properties of matter, uniform plane waves.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 489. Electrical and Computer Engineering Cooperative Education III **1 Unit**

Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 389.
Fee: An additional $300.00 is charged for this course.
Description: Full-time technical work experience related to the student's academic program.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 493. Independent Study in Electrical & Computer Engineering **1-6 Units**

Prerequisite(s): Approval of a faculty sponsor.
Fee: An additional $120.00 is charged for this course.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 496. Professional Issues and Current Topics Seminar **2 Units**

Term Typically Offered: Fall, Spring
Prerequisite(s): Junior standing.
Fee: An additional $40.00 is charged for this course.
Description: Students receive instruction in making oral and written presentations to professional and technical audiences. Topics include ethical issues in engineering, and a selection of technical topics of current interest that promote the understanding of global, economic, environmental, sustainability, and societal impacts of engineering and critical thinking skills.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 497. Capstone Design in ECE - CUE **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 412 and Senior standing; ECE 420 (or concurrent), ECE 496 (or concurrent), and ECE 5xx/5xx elective & lab (or concurrent); or permission of instructor.
Fee: An additional $60.00 is charged for this course.
Description: Students work in teams to design, build, test, and document an electrical, electronic, or electro-mechanical device or system, subject to realistic constraints,thus demonstrating their grasp of the concepts of electrical and computer engineering by successful completion of this culminating design experience.
Course Attribute(s): CUE - This course fulfills the Culminating Undergraduate Experience (CUE) requirement for certain degree programs. CUE courses are advanced-level courses intended for majors with at least 90 earned credits/senior-level status., CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 500. Special Topics in Electrical Engineering **1-6 Units**
Term Typically Offered: Fall, Spring, Summer
Description: Exploration of one or more ECE topics not covered in the regular course offerings.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 505. Graduate-Professional Project in Electrical Engineering **1-6 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): Approval of a faculty sponsor.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 510. Computer Design **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 210.
Corequisite(s): ECE 511.
Description: Review of logic design and elementary computer organization. Design of the central processing unit, memory, control, and input-output portions of a computer. The VHDL hardware design language will be used.
Note: Cross-listed with CSE 510.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 511. Computer Design Laboratory **1 Unit**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 210.
Corequisite(s): ECE 510 or CECS 510.
Description: Experiments in the design of the central processing unit, memory, control, and input-output portions of a computer using VHDL for software simulation.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 514. Introduction to VLSI Systems Laboratory **1 Unit**
Term Typically Offered: Occasionally Offered
Prerequisite(s): ECE 510 (or concurrent) or CECS 510 (or concurrent) or consent of instructor.
Corequisite(s): ECE 515.
Description: Design of logic circuits and subsystems using CAD tools: layout, verification, parameter extraction, circuit- and logic-level simulation.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 515. Introduction to VLSI Systems **3 Units**
Term Typically Offered: Occasionally Offered
Prerequisite(s): ECE 510 (or concurrent) or CECS 510 (or concurrent) or consent of instructor.
Corequisite(s): ECE 514.
Description: MOS devices and circuits, electrical and logic design principles. Fabrication steps, design rules, electrical parameters, extraction, delays. Logic/switch arrays, dynamic precharge logic, precharge forms, finite state machines, registers, memories, subsystem design examples.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 516. Microcomputer Design **4 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 412 or CECS 412 or consent of instructor.
Description: Design and construction of microcomputers with microprocessors and digital integrated circuits. Breadboarding, hardware design and software design are emphasized. The class is separated into groups and each group designs, breadboards and tests a complete microcomputer system including interfaces to peripheral devices.
Note: Cross-listed with CECS 525.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 518. Fundamentals of Computer Communications and Networks **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 360 or IE 360, and CSE 412.
Description: Data communications: The exchange of data between devices is covered. The key aspects of transmission interfacing, link control, and multiplexing are examined. Data communication networking: Examines the internal mechanisms by which communication networks provide a data transfer service for attached devices.
Note: Cross-listed with CSE 516.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 520. Digital Signal Processing **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 420.
Corequisite(s): ECE 521.
Description: Discrete time signals and systems; Discrete Fourier Transforms, FFT algorithms, flow graph and the matrix representation of digital filters; FIR and IIR filter design techniques; quantization effects; spectral estimation; current applications of digital signal processing.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 521. Digital Signal Processing Laboratory **1 Unit**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 420.
Corequisite(s): ECE 520.
Description: Focuses on the implementation of common digital signal processing functions using state-of-the-art DSP devices and software. Introduction to fundamentals of discrete-time signal processing and digital signal processor architectures and applications. Emphasis on laboratory experience involving generation of deterministic and random signals; digital filter design; quantization effects; FFT computation; linear system analysis; speech processing.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 523. Introduction to Biometrics **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 420 and Senior standing.
Description: Biometric approaches aim at identification based on a physical characteristic. Survey of biometric techniques with focus on non-intrusive approaches. Topics covered include image formation, sensors, motion tracking, and face recognition algorithms.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 526. LabVIEW for Electrical Engineers **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 420 (or concurrent) or permission from the instructor.
Description: Introduction to capabilities of LabVIEW software for electrical engineers. Weekly labs build mastery of LabVIEW applications such as: data acquisition and analysis, instrumentation, and DSP programming.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 528. Deep Learning and AI Tools **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): ENGR 330 or ENGR 307.
Corequisite(s): ECE 529.
Description: Machine learning basics. Supervised and unsupervised learning. Feedforward networks, error back propagation algorithm; linear, nonlinear, logistic and softmax regression, regularization. Autoencoders, sparsity and feature learning under constraints. Convolutional nets. Recurrent networks, backpropagation through time, LTSM.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 529. Deep Learning and AI Tools Laboratory **1 Unit**
Term Typically Offered: Spring Only
Prerequisite(s): ENGR 330 or ENGR 307.
Corequisite(s): ECE 528.
Description: Lab course for ECE 528 Deep Learning and AI Tools
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 530. Introduction to Random Processes and Estimation Theory **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ENGR 330; ECE 360 or IE 360; and ECE 420.
Description: Introduction to the theory and applications of random processes, a nonmeasure-theoretic approach to the study of random variables, functions of random variables, least square estimation, convergence, stochastic representation, stationarity, ergodicity, Gaussian processes, Poisson processes, Markov chains, and random fields.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 531. Power Electronics **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 333, ECE 334, and ECE 420.
Description: Topics in power electronics including: power semiconductor devices; converter topologies and their applications; switched-mode DC and uninterruptible power supplies; motor drives; EMI concerns and remedies for interfacing to electric utilities.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 532. Electromechanical System Designs for Home Appliances **4.5 Units**
Term Typically Offered: Fall, Spring, Summer
Description: An integrated study of advanced electrical engineering and software engineering fundamentals and their application to technologies associated with the design, development, and production of modern major household appliances. This class is designed for GE Appliances Edison students or GE Appliances employees enrolled in the ECE program.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 533. Integrated Circuit Design **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): ECE 333.
Corequisite(s): ECE 534.
Description: Analysis and design of analog integrated circuits. Bipolar, JFET, and MOS-FET devices. The technology of IC fabrication. Transistor connections, current sources, active loads, and output stages. Integrated amplifier and MOS circuit design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 534. Integrated Circuit Design Laboratory **1 Unit**
Term Typically Offered: Spring Only
Prerequisite(s): ECE 333.
Corequisite(s): ECE 533.
Description: Laboratory to illustrate design principles in ECE 533.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 539. Industrial Software for Home Appliances **4.5 Units**
Description: This course provides electrical engineering graduate students working in the major home appliance industry with an understanding of industrial software engineering fundamentals and their application to technologies associated with the design, development, and production of major household appliances such as refridgerators, washers, dryers, cooking products and dishwashers.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 542. Semiconductor Device Fundamentals **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ENGR 205 or MATH 405.
Description: Semiconductor fundamentals, energy bands, carrier transport theory, continuity equations, PN junction diodes, Zener diodes, MOS capacitors, MOSFETs, microelectronic fabrication, and select other topics.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 543. Fundamentals of Microfabrication and MEMS **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): Senior standing.
Description: Microfabrication techniques including cleanroom technology, lithography, thermal oxidation, diffusion, ion implantation, film deposition, etching, micromachining, wafer-level bonding/polishing, and packaging yield. Microtechnology measurement and analysis techniques. Process simulation. CAD device-layout. MEMS (microelectromechanical systems) and microelectric technology and applications. Material issues for MEMS/microelectronics.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 544. Microfabrications/MEMS Laboratory **1 Unit**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 543 (or concurrent).
Fee: An additional $250.00 is charged for this course.
Description: Laboratory to illustrate microfabrication processes, semiconductor measurement techniques, MEMS microstructure fabrication, and MEMS testing. Cleanroom activity required.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 545. Optical Signal Processing **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 420 or consent of instructor.
Description: Scalar diffraction theory and equivalence to linear filtering. Fourier transform properties of lenses. The modulation transfer function.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 546. Introduction to Medical Imaging **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 420.
Description: Focuses on the foundation of modern medical imaging at an introductory level with emphasis placed on concepts: X-ray, CT, MRI, PET, and Ultrasound will be discussed. Students interested in in-depth treatment of these topics should register for ECE 641.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 550. Communication and Modulation **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): ECE 360 or IE 360, and ECE 420.
Corequisite(s): ECE 551.
Description: Modulations such as AM, FM, PAM, PPM, PDM, single sideband, vestigial sideband. Coherent and noncoherent detection, heterodyne action, performance and distortion, circuits for modulation and demodulation
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 551. Communication Systems Laboratory **1 Unit**
Term Typically Offered: Spring Only
Prerequisite(s): ECE 420.
Corequisite(s): ECE 550.
Description: Laboratory exercises involving the design and analysis of electronic communication systems for the transmission of analog and digital data at radio frequencies.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 555. Digital Image Processing **3 Units**
Term Typically Offered: Fall, Spring
Prerequisite(s): ECE 520 and ECE 521, or ECE 420 and departmental consent.
Corequisite(s): ECE 556.
Description: Introduction to the theory and applications of 2-D signal and image processing: 2-D signals and systems analysis, 2-D sampling and quantization, 2-D signals and image transforms, 2-D FIR filter design; image formation; image enhancement; image restoration; image coding; image reconstruction from projections; image compression; color image processing; current applications.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 556. Digital Image Processing Laboratory **1 Unit**
Term Typically Offered: Fall, Spring
Corequisite(s): ECE 555.
Description: Laboratory experiments in software are assigned to test the concepts covered in ECE 555, Digital Image Processing. Projects include: Image Representation and Transformation, Image Enhancement in the spatial and frequency domain and Image Restoration. Time permitting, projects on image compression and image segmentation will also be assigned.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 560. Control Systems Principles **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 420.
Corequisite(s): ECE 561.
Description: Basic concepts of linear control systems. Formulation of the linear control problem by classical and state space methods. Frequency response and time response analysis and synthesis techniques. Stability and system performance specifications.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 561. Control Systems Laboratory **1 Unit**
Term Typically Offered: Fall, Spring, Summer
Corequisite(s): ECE 560.
Description: Laboratory exercises involving identification, analysis and design of closed-loop control systems.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 564. Fundamentals of Autonomous Robots **3 Units**
Term Typically Offered: Fall Only
Prerequisite(s): Senior standing, or permission of instructor.
Corequisite(s): ECE 565.
Description: Fundamentals of autonomous robots: sensors, path planning, machine perception, basic principles of AI, modeling, control and architecture. Case studies in industry and medicine will be discussed.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 565. Fundamentals of Autonomous Robots Lab **1 Unit**
Term Typically Offered: Fall Only
Prerequisite(s): Senior standing, or permission of instructor.
Corequisite(s): ECE 564.
Description: An autonomous robots laboratory experience in which the student becomes familiar with designing and building autonomous robots, using sensors, applying robotic paradigms and controller design. A final robotic competition will be held at the end of the semester.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 569. Intermediate Electromagnetic Fields and Waves **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 473.
Description: General curvilinear coordinates. Electromagnetic energy transmission. The wave equation, Poynting theorem and plane wave propagation in media. Transmission lines and impedance matching.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 581. Electric Machines and Drives **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 473.
Description: Operating principles and characteristics of DC, induction, synchronous motors/generators. AC/DC electric-machine drives for speed/position control. Integrated discussion of electric machines, power electronics, and control systems. B and H in ferromagnetic materials. Magnetic circuits. Transformers. Dynamic equations of magnetic systems.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 582. Power System Analysis **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ECE 473.
Description: Three-phase circuits. Inductance and capacitance of transmission lines. Circuit models. Per-unit representation. Network methods. Load-flow studies. Load-flow control. Economic dispatch. Symmetrical three-phase faults.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 593. Independent Study in Electrical Engineering **1-6 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): Approval of a faculty sponsor.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

ECE 595. Graduate/Professional Seminar in Electrical & Computer Engineering **1 Unit**
Term Typically Offered: Fall, Spring, Summer
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)