

Electrical and Computer Engineering (ECE)

Courses

ECE 5508 Advanced Digital Logic Design: 3 semester hours.

Apply modern tools for behavioral and RTL modeling of digital logic circuits. Cover the systematic design of advanced digital systems using FPGA design flow, including functional verification, test-bench generation, timing analysis and design verification of combinational and sequential circuits including finite state machine for datapath control. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PREREQ: EE 2274 and EE 2274L.

ECE 5513 Techniques of Computer-Aided Circuit Analysis and Design: 3 semester hours.

Automatic formulation of equations and fundamental programming techniques pertinent to computer-aided circuit analysis, design, modeling. May include sensitivity calculations, system analogies, optimization. PREREQ: ECE 3300.

ECE 5515 RF Engineering: 3 semester hours.

Applied approaches to RF Engineering with project-based emphasis on design and full-wave simulation of transmission lines, filters, waveguides, and antennas. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. Prerequisites: ECE 3325 or permission of instructor.

ECE 5516 Applied Engineering Methods: 3 semester hours.

Applied discrete and continuous probability, random variables, probability distributions, sampling, data description, parameter estimation, hypothesis testing, inference, correlation and linear and multiple regression. P

ECE 5517 Probabilistic Signals and Systems: 3 semester hours.

Introductory probability theory. Density functions, moments, random variables. Normal, exponential distributions. Estimation of mean and variance. Correlation, spectral density. Random processes, response of linear systems to random. PREREQ: ECE 3310.

ECE 5518 Communication Systems: 3 semester hours.

Basic principles of analysis and design of modern analog and digital communication systems, including transmission and reception. PREREQ: ECE 3320 and ECE 3310.

ECE 5519 Digital Control Systems: 3 semester hours.

Design of advanced control algorithms topics include: observers and state estimation, linear quadratic regulator, frequency-domain techniques for robust control, and an introduction to multivariable and nonlinear control. PREREQ: ECE 5510 or ECE 4410.

ECE 5520 Advanced Electronics: 3 semester hours.

Introduction to operational amplifiers and their applications, current mirrors, active loads, differential amplifiers, feedback and stability, filters, oscillators, Schmitt triggers, power amplifiers and voltage regulators. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PREREQ: ECE 3320 and ECE 3310.

ECE 5520L Advanced Electronics Laboratory: 1 semester hour.

Laboratory course emphasizing transistor biasing, amplifiers and other basic analog circuit designs. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PRE-COREQ: ECE 5520.

ECE 5522 Mixed Signal Design and Synthesis: 3 semester hours.

Analog IC design. Passive components, parasitic elements, component matching, IC layout techniques, amplifiers, current sources, comparators, op amps, noise, switched capacitor circuits. Includes lab work using design tools. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PREREQ: ECE 4421 or ECE 5532.

ECE 5525 Mechatronics: 3 semester hours.

Basic kinematics, sensors, actuators, measurements, electronics, microprocessors, programmable logic controllers, feedback control, robotics and intelligent manufacturing. Equivalent to ME 5525. PREREQ: MATH 3360, and ECE 3300.

ECE 5532 Introduction to VLSI Design: 3 semester hours.

Photolithography, CMOS fabrication, MOSFET operation, CMOS passive elements, design rules and layout, CAD tools for IC design, invertors, static logic and transmission gates, dynamic logic. PREREQ: ECE 3320.

ECE 5551 Embedded Systems Engineering: 2 semester hours.

Integration of algorithms, software and hardware to design real-time and embedded systems for signal processing and control. COREQ: ECE 5572L

ECE 5551L Embedded Systems Engineering Laboratory: 1 semester hour.

Lab activities include the complete process of design and implementation of embedded signal processing and control systems through the integration of algorithms, software, and hardware. COREQ: ECE 5527.

ECE 5560 Advanced Computer Architecture: 3 semester hours.

Design, implementation, and performance evaluation of modern computer systems; instruction sets; datapath and control optimizations; single-cycle, multiple-cycle, and pipelined processors; hazard detection and resolution; memory hierarchies; peripheral devices. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PREREQ: ECE 2250.

ECE 5560L Advanced Computer Architecture Laboratory: 1 semester hour.

Design, modeling and simulation of a RISC processor. Implementation of the processor using FPGAs. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PRE-or-COREQ: ECE 5560.

ECE 5561 Computer and Network Security: 3 semester hours.

This is an introduction to computer and network security. Topics covered include network security, authentication, security modeling, key management, intrusion detection. Additional topics as time permits include biometrics, web security, privacy, anonymity and other emerging topics. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus.

ECE 5573 Automatic Control Systems: 3 semester hours.

Study of continuous-time and control systems using both frequency-domain and state-space techniques; topics include design methodology, performance specifications, analysis and design techniques. PREREQ: ECE 3310, ME 5505 or ME 4405.

ECE 5574 Advanced Circuit Theory: 3 semester hours.

Methods of analog electrical circuit analysis and synthesis. Topics include signal flow graphs, multi-port networks, simulation techniques, and topological methods for formulation of network equations. PREREQ: ECE 3300.

ECE 5575 Digital Signal Processing: 3 semester hours.

Discrete, fast Fourier and Z-transforms, correlation, convolution, finite and infinite impulse response digital filter design, spectral analysis and adaptive digital filters. COREQ: ECE 5584. PREREQ: ECE 3310.

ECE 5576 Semiconductor Processing and Fabrication: 3 semester hours.

Silicon semiconductor processing and basic integrated circuit fabrication. Physics, chemistry, and technology in basic processing steps in production of integrated circuits. PREREQ: PHYS 2211, PHYS 2212, and MATH 1170 or equivalent

ECE 5578 Semiconductor Devices: 3 semester hours.

Operating principles of basic building blocks of modern silicon-based semiconductor devices to include p-n junctions, field effect transistors and bipolar junction transistors. PREREQ: PHYS 2212 or equivalent.

ECE 5579 Advanced Semiconductor Devices: 3 semester hours.

Review of semiconductor band theory. Opto-electronics, quantum mechanics, hetero junctions, power and microwave semiconductor devices. PREREQ: ECE 5578 or equivalent.

ECE 5582 Principles of Power Electronics: 3 semester hours.

Introduction to steady state converter modeling and analysis. Principles of converter dynamics and control including controller design. COREQ: ECE 5573. PREREQ: ECE 3320.

ECE 5584 Signal Processing Laboratory: 1 semester hour.

Design finite and infinite response digital filters in digital signal processing system applications. COREQ: ECE 5575.

ECE 5599 Experimental Course: 1-6 semester hours.

The content of this course is not described in the catalog. Title and number of credits are announced in the Class Schedule. Experimental courses may be offered no more than three times with the same title and content. May be repeated.

ECE 6627 Critical Infrastructure Protection and CPS: 3 semester hours.

Cyber-physical systems principles and methods for critical infrastructure protection including resilience. Practices, standards, and applications. Prerequisites: ECE 4427, ECE 4429, and CS 4416; or permission of instructor.

ECE 6635 Antenna Design: 3 semester hours.

Antenna fundamentals, radiating systems, line sources, wire antennas, and additional topics including helical antennas, horn antennas, antenna arrays, etc. as time permits. Prerequisites: ECE 3325.

ECE 6640 Microwave Engineering: 3 semester hours.

Theoretical approaches to transmission lines, waveguides, micro-strip lines, Smith chart, microwave network analysis, impedance matching, filters. Prerequisites: ECE 3325; or permission of instructor.

ECE 6650 Thesis: 1-9 semester hours.

Thesis research must be approved by the student's advisory committee. Six credits may be used to satisfy the research requirements for the degree. Graded S/U. May be repeated.

ECE 6652 Special Problems: 3 semester hours.

Special experimental, computational, or theoretical investigation leading to development of proficiency in some area of engineering. Formal report required. PREREQ: Project Approval Required by an Engineering Faculty. May be graded S/U. May be repeated.

ECE 6653 Applied Cryptography: 3 semester hours.

A comprehensive introduction to Modern Cryptography. The cryptographic primitives covered include pseudorandom functions, symmetric encryption (block ciphers), hash functions, message authentication codes, asymmetric encryption, digital signatures, and authenticated key exchange. PREREQ: Permission of instructor.

ECE 6655 Advanced VLSI Systems: 3 semester hours.

Principles and advanced techniques in nanometer-scale VLSI analysis, synthesis, and performance measurement, including signal integrity. Case studies of FinFET and multi-dimensional RAM systems. Prerequisites: ECE 4432; or permission of instructor.

ECE 6658 Mach.Learning in Cybersecurity: 3 semester hours.

Advanced topics in securing machine learning models and their applications to solve security/privacy threats. Topics include adversarial machine learning, encrypted machine learning, and attacks on/using machine learning models and countermeasures. PREREQ: Permission of instructor.

ECE 6660 Special Project: 1-9 semester hours.

A significant project, involving engineering applications, toward the completion of M.S. program with non-thesis option. Includes a report and oral examination. Graded S/U. May be repeated.

ECE 6661 Security and Privacy in Smart Grid: 3 semester hours.

This course introduces emerging security and privacy concerns and solutions in power systems. Topics covered include introduction to smart grid, attacks and defenses at physical layer, communication layer, and application layer of smart grid. Additional topics as time permits include application of deep learning in securing smart grid.

ECE 6662 SCADA System and SDN: 3 semester hours.

Fundamentals of SCADA and evolving application of SDN and cloud in the functionality and robustness of SCADA in the context of cyber security. Prerequisites: ECE 4473 and CS 4416; or permission of instructor.

ECE 6673 Nonlinear Control: 3 semester hours.

Lyapunov methods, energy methods, perturbation theory, or study in relationship with nonlinear and time varying systems. PREREQ: MATH 3360 or permission of instructor.

ECE 6699 Experimental Course: 1-6 semester hours.

The content of this course is not described in the catalog. Title and number of credits are announced in the Class Schedule. Experimental courses may be offered no more than three times with the same title and content. May be repeated.

ECE 8850 Doctoral Dissertation: 1-24 semester hours.

Research toward completion of the dissertation for the Ph.D. in Engineering and Applied Science. Variable credits. May be repeated. Graded S/U.