ELECTRICAL AND COMPUTER ENGINEERING (ECE)

ECE 5101. Introduction to System Theory. (3 Credits)
Modeling and analysis of linear systems. Introduction to functions of a complex variable. Linear algebra with emphasis on matrices, linear transformations on a vector space, and matrix formulation of linear differential and difference equations. State variable analysis of linear systems. Transform methods using complex variable theory, and time-domain methods including numerical algorithms.
Enrollment Requirements: Recommended preparation: ECE 3101.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205101)

ECE 5151. Underwater Acoustics and Sensing Systems. (3 Credits)
The fundamentals of ocean acoustics, including the acoustic wave equation, ray theory, acoustic arrays and filters, ambient noise, scattering, absorption, an introduction to normal mode theory, and sonar equations. Computer simulation emphasizes acoustic ray tracing and propagation loss predictions.
Enrollment Requirements: Recommended preparation: Undergraduate courses in Calculus Based Physics; MATLAB or equivalent for computer simulations.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205151)

ECE 5201. Electromagnetic Wave Propagation. (3 Credits)
Engineering application of Maxwell's field theory to electromagnetic wave propagation in various media. Reflection, refraction, diffraction, dispersion, and attenuation. Propagation in sea water and in the ionosphere.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205201)

ECE 5211. Semiconductor Devices and Models. (3 Credits)
Band theory, conduction in semiconductors, carrier statistics, deep levels, impurities with multiple charge states, heavy doping effects, non-uniform doping. Non-equilibrium processes, carrier scattering mechanisms, the continuity equation, avalanche multiplication, carrier generation, recombination, and lifetime. P-n junctions, non-abrupt junctions, various injection regimes, and device models. Metal semiconductor junctions, current transport mechanisms, and models. BJT, JFET, MESFET, and MOSFET, and device models.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205211)

ECE 5212. Fundamentals of Opto-Electronic Devices. (3 Credits)
Absorption and emission mechanisms in direct and indirect semiconductors. Semiconductor optoelectronic devices such as light-emitting diodes, injection lasers, photocathodes, solar cells, and integrated optics.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205212)

ECE 5223. Nanophotonics. (3 Credits)
Principles and applications of nanophotonics with focus on optical metamaterials, plasmonics, and photonic bandgap crystals. Topics covered include electric plasma, magnetic plasma, optical magnetism, negative index matematerials, localized and non-localized surface plasmon polaritons, photonic bandgap structures, superlens, optical cloaking, surface enhanced Raman spectroscopy, transformation optics, plasmonic sensors, plasmonic waveguides.
Enrollment Requirements: ECE 3223 or consent of instructor.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205223)

ECE 5225. Electron Device Design and Characterization. (3 Credits)
Design and evaluation of micro/nano electronic devices using state-of-the-art computer simulation tools, experimental electrical characterization of semiconductor devices and overview of modern electronic devices such as high-performance MOSFETs, TFTs, solar cells, non-volatile memories, CCDs, thermoelectric power generators. The electronic device (such as nanometer scale field effect transistor) design project will involve use of Synopsys tools to simulate the fabrication process, device simulation and performance evaluation.
Enrollment Requirements: Recommended preparation: ECE 4211.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205225)

ECE 5232. Optoelectronic Devices. (3 Credits)
Optoelectronic devices as applied to fiber optic communications, optical switching and interconnects. Semiconductor laser devices, including dc, ac smallsignal, ac large signal, and noise with emphasis upon analytical models. Vertical cavity devices and technology. Semiconductor optical amplifiers, waveguide and vertical cavity modulators, photodetectors, optical switches, receivers and transmitters. Techniques for OE integration and the relevance of bipolar and field-effect devices for monolithic integration. Technologies for optoelectronic integration for telecom and datacom optical interconnect. WDM techniques for optical networks.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205232)

ECE 5242. Micro-Optoelectronic Devices and IC Fabrication. (3 Credits)
Semiconductor wafer characterization using Hall effect, X-ray diffraction, and Photoluminescence; Semiconductor wafer processing using Diffusion, Oxidation, Epitaxial growth and/or Qdot self-assembly, Photolithographic techniques; Project work including design, modeling and fabrication of solar cells, FETs, Memory, LED and Lasers, sensors, and IC building blocks for digital and analog circuits.
Enrollment Requirements: ECE 3221 and 4211. Not open for credit for students who have passed ECE 4242.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205242)

ECE 5261. Memory Device Technologies. (3 Credits)
Current and future digital solid-state memory device technologies including DRAM, SRAM, flash memory, ferroelectric memory, magnetoresistive memory, phase-change memory and resistive memory, with an emphasis on the underlying physical mechanisms.
Enrollment Requirements: This course and ECE 4261 may not both be taken for credit.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205261)

ECE 5401. Advanced Digital Systems Design. (3 Credits)
Microarchitecture and design of hardware acceleration for domain-specific applications. Topics include gate-level design, register-transfer-level (RTL) design, microarchitecture, instruction set architecture, compilers, programming languages, and algorithms. Focus on both efficient software for embedded applications and the design of efficient hardware systems for such applications.
Enrollment Requirements: Recommended preparation: coursework in digital design.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205401)

ECE 5402. Computer Architecture. (3 Credits)
Provides an in-depth understanding of the inner workings of modern digital computer systems. Traditional topics on uniprocessor systems such as performance analysis, instruction set architecture, hardware/software pipelining, memory hierarchy design and input-output systems will be discussed. Modern features of parallel computer systems such as memory consistency models, cache coherence protocols, and latency reducing/hiding techniques will also be addressed. Some experimental and commercially available parallel systems will be presented as case studies.
Enrollment Requirements: Recommended preparation: CSE 4302 or equivalent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205402)

ECE 5510. Power System Analysis. (3 Credits)
Fundamentals of power system planning, operation, and management. Power generation and distribution. Modeling of AC generator, AC and DC motors, transformer and cable. Power flow solution. Modern power system monitoring/control, fault analysis, and transient stability analysis using computer tools. Use of power system simulation tools for power system planning and design.
Enrollment Requirements: ECE 2001 or equivalent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205510)

ECE 5512. Power Distribution. (3 Credits)
Principles of distribution system planning, automation and real-time operation with applications. Concepts of AC/DC Electricity. Three-phase power distribution as well as DC and Hybrid circuits. Load flow calculations, fault analysis, and reliability evaluation. Distributed power resources. Distribution system protection and reconfiguration. Smart distribution technologies. Efficient and resilient energy utilization.
Enrollment Requirements: ECE 3231.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205512)

ECE 5520. Advanced Power Electronics. (3 Credits)
Advanced converter and inverter topologies for high efficiency applications. Non-ideal component characteristics. Necessary components such as gate drive circuits and magnetic component design (that are not covered in introductory power electronics courses).
Enrollment Requirements: ECE 3211.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205520)

ECE 5530. Modeling and Control of Electric Drives. (3 Credits)
Several topics related to modeling and control of electric drives. Fundamental equations related to inductance and flux variations in a rotating machine, leading to torque production. Reference frame theory and transformations for modeling purposes. Dynamic models of three-phase induction and permanent-magnet synchronous machines. Basic modeling of power electronic converters for electric drives, with focus on three-phase DC/AC inverters. Various control strategies with focus on vector control and different power electronic switching schemes in electric drives.
Enrollment Requirements: ECE 3212.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205530)

ECE 5540. Electrical System Protection and Switchgear. (3 Credits)
Methods to sense voltage and current in medium and low voltage applications. Voltage sensing techniques include differential voltage amplifiers, shunt voltage measurement, and potential transformers. Current sensing techniques include current transformers, Rogowski coils, series voltage measurement, and Hall-effect sensors. Solid-state and mechanical relays and timing functions. Fuses and circuit breakers at medium voltage levels with focus on ratings, application-specific selection, and response time. Protection methods, e.g. differential protection, of transformers, generators, and cables with focus on distance relays and specialized devices.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205540)

ECE 5550. Microgrids. (3 Credits)
Advanced modeling, control, resilience and security technologies useful for the grid modernization from a unique angle of microgrid design, analysis and operation. Smart inverters, microgrid architectures, distributed energy resources modeling, microgrid hierachical control, microgrid stability, fault management, resilient microgrids through programmable networks, reliable networked microgrids, and cyber security.
Enrollment Requirements: ECE 3231 or instructor consent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205550)

ECE 5552. Communication Systems in Smart Grids. (3 Credits)
Analysis and design of communications systems to support emerging smart power systems, including transmission and distribution grids. Topics include communication system concepts and principles, control and communication system enhancements, smart grid architecture and applications with different requirements, wide area network (WAN) and field area network (FAN) technologies and data management, smart grid security assessment with operational technologies, robust advanced metering infrastructure (AMI) applications in communication networks design.
Enrollment Requirements: ECE 3231.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205552)

ECE 5554. Distribution Management Systems. (3 Credits)
Role of Distribution Management Systems (DMS) in smart distribution, standards and regulations, static and dynamic models, advanced DMS applications (topology processor, Volt/VAR control, fault detection, isolation, restoration, state estimation, three-phase power flow, short circuit analysis, feeder reconfiguration, optimal capacitor placement, protection coordination, maintenance and outage planning), power quality analysis, electric vehicle charging/discharging, active distribution network under high penetration of distributed energy resources (DERs), aggregation of DERs for DERMS.
Enrollment Requirements: ECE 3231 or instructor consent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%205554)

ECE 6094. Seminar. (1 Credit)
Presentation and discussion of advanced electrical engineering problems. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).
May be repeated for a total of 8 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206094)

ECE 6095. Special Topics in Electrical and Systems Engineering. (1-3 Credits)
Classroom and/or laboratory courses in special topics as announced in advance for each semester.
May be repeated for a total of 15 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206095)

ECE 6099. Independent Study in Electrical Engineering. (1-6 Credits)
Individual exploration of special topics as arranged by the student with an instructor of his or her choice.
May be repeated for a total of 36 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206099)

ECE 6111. Applied Probability and Stochastic Processes. (3 Credits)
Statistical methods for describing and analyzing random signals and noise. Random variables, conditioning and expectation. Stochastic processes, correlation, and stationarity. Response of linear systems to stochastic inputs. Applications.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206111)

ECE 6121. Information Theory. (3 Credits)
Basic concepts: entropy, mutual information, transmission rate and channel capacity. Coding for noiseless and noisy transmission. Universal and robust codes. Information-theoretic aspects of multiple-access communication systems. Source encoding, rate distortion approach.
Enrollment Requirements: ECE 6111.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206121)

ECE 6122. Digital Signal Processing. (3 Credits)
Discrete-time signals and systems. The z-transform. The Discrete Fourier Transform (DFT). Convolution and sectioned convolution of sequences. IIR and FIR digital filter design and realization. Computation of the DFT: The Fast Fourier Transform (FFT), algorithms. Decimation and interpolation. Parametric and nonparametric spectral estimation. Adaptive filtering. Finite word length effects.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206122)

ECE 6125. Digital Image Processing. (3 Credits)
(Also offered as BME 6125.) Problems and applications in digital image processing, two-dimensional linear systems, shift invariance, 2-D Fourier transform analysis, matrix Theory, random images and fields, 2-D mean square estimation, optical imaging systems, image sampling and quantization, image transforms, DFT, FFT, image enhancement, two-dimensional spatial filtering, image restoration, image recognition, correlation, and statistical filters for image detection, nonlinear image processing, and feature extraction.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206125)

ECE 6126. Fundamentals of Optical Imaging. (3 Credits)
(Also offered as BME 6126.) Learning optical imaging fundamentals. Topics include: review of two-dimensional linear system theory; scalar diffraction theory, wave optics, Fresnel and Fraunhofer diffraction; imaging properties of lenses; image formation; optical resolution in imaging, frequency analysis of optical imaging systems; imaging with coherent and incoherent sources, coherent transfer function; optical transfer function, point spread function, fundamentals of microscopy, two-dimensional spatial filtering; coherent optical information processing; frequency-domain spatial filter synthesis; holography.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206126)

ECE 6141. Neural Networks for Classification and Optimization. (3 Credits)
This course provides students with an understanding of the mathematical underpinnings of classification techniques as applied to optimization and engineering decision-making, as well as their implementation and testing in software. Particular attention is paid to neural networks and related architectures. The topics include: Statistical Interference and Probabilty Density Estimation, Single and Multi-layer Perceptions, Radial Basis Functions, Unsupervised Learning, Preprocessing and Feature Extraction, Learning and Generalization, Decision Trees and Instance-based Classifiers, Graphical Models for Machine Learning, Neuro-Dynamic Programming.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206141)

ECE 6151. Communication Theory. (3 Credits)
Design and analysis of digital communication systems for noisy environments. Vector representation of continuous-time signals; the optimal receiver and matched filter. Elements of information theory. Quantization, companding, and delta-modulation. Performance and implementation of common coherent and non-coherent keying schemes. Fading; intersymbol interference; synchronization; the Viterbi algorithm; adaptive equalization. Elements of coding.
Enrollment Requirements: ECE 6111.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206151)

ECE 6171. Mobile Robotics. (3 Credits)
Coordinate transformation, kinematics and dynamics, sensor modeling, specifics of camera sensors, inertial measurement unit (IMU) sensor, simultaneous localization and mapping (SLAM), EKF-SLAM, Monte Carlo localization, SLAM observability, robot control, specifics of vision-based control, and aspects of Human-robot interaction; class project with a project report.
Enrollment Requirements: Recommended preparation: MATH 2410Q, MATH 3160 or STAT 3345, ECE 3111 and familiarity with MATLAB programming.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206171)

ECE 6243. Nanotechnology. (3 Credits)
Nanoelectronic and optoelectronic devices: Quantum confinement in 1D, 2D and 3D (quantum wells, wires, and dots) structures; density of states and carrier density in low-dimensional structures; fabrication methodology for quantum wire transistors and lasers; single-electron transistors/tunneling devices; growth and characterization of nanostructured materials with grain sizes in the range of 10-50 nm. Organic monolayers: Langmuir-Blodgett monolayers, Self-Assembled monolayers, Multi-layer structures, technological applications of organic thin films.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206243)

ECE 6244. Nanotechnology - II (Laboratory Course). (3 Credits)
Growth and characterization of carbon nanotubes using vapor phase nucleation; Growth of cladded quantum dots using liquid and/or vapor phase techniques; Characterization using AFM and TEM and Dynamic scattering techniques; Nano-device processing highlighting E-Beam lithography, and self assembly techniques; Project work involving fabrication of devices including LEDs, FETs and memor, detectors and sensors using quantum dots and nanotubes/wires.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206244)

ECE 6421. Advanced VLSI Design. (3 Credits)
Advanced concepts of circuit design for digital VLSI components in state of the art MOS technologies. Emphasis is on the circuit design, optimization, RTL design, synthesis, and layout of either very high speed, high density or low power circuits and systems for use in applications such as micro-processors, signal and multimedia processors, memory and periphery. Other topics include challenges facing digital circuit designers today and in the coming decade, such as the impact of scaling, deep submicron effects, interconnect, signal integrity, power distribution and consumption, and timing.
Enrollment Requirements: Recommended preparation: ECE 3421 and ECE 3302 (or equivalent).
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206421)

ECE 6437. Computational Methods for Optimization. (3 Credits)
Computational methods for optimization in static and dynamic problems. Ordinary function minimization, linear programming, gradient methods and conjugate direction search, nonlinear problems with constraints. Extension of search methods to optimization of dynamic systems, dynamic programming.
Enrollment Requirements: ECE 5101.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206437)

ECE 6439. Estimation Theory and Comp Algorithms. (3 Credits)
Estimation of the state and parameters of noisy dynamic systems with application to communications and control. Bayesian estimation, maximum-likelihood and linear estimation. Computational algorithms for continuous and discrete processes, the Kalman filter, smoothing and prediction. Nonlinear estimation, multiple model estimation, and estimator Kalman, multiple model estimation, and estimator design for practical problems.
Enrollment Requirements: ECE 5101 and 6111.
View Classes (https://catalog.uconn.edu/course-search/?details&code=ECE%206439)