GRADUATE COURSES

Electrical and Computer Engineering

UMass Dartmouth
COLLEGE OF ENGINEERING

Spring 2025

Classes begin 1/21/2025

Department contact: 508.999.9164
Dr. Dayalan Kasilingam, Chairperson
Dr. Paul J. Gendron, Graduate Program Director

ECE 521 **Random Signals and Systems I**
P. Gendron (pgendron@umassd.edu)
Monday, Wednesday 5:00-6:15 PM
SENG-212

ECE 530 **Intro. Advanced Electronics & Optoelectronics**
Y. Li (yifei.li@umassd.edu)
Fridays 10:00-12:30 PM
SENG-222

ECE 535 **Analog Integrated Circuit Design**
D. Rancour (drancour@umassd.edu)
Tuesday, Thursday 5:00-6:15 PM
SENG-212

ECE 548 **Cyber Threats and Security Management**
H. Liu (hliu@umassd.edu)
Monday 3:30-6:15 PM
SENG-222

ECE 562 **Advanced Computer Architecture**
S. Goren (sgoren@umassd.edu)
Wednesday, Fridays 3:30-4:45 PM
SENG-222

ECE 591-01 **Topics in ECE**
Topic: Array Processing
J. Buck (jbuck@umassd.edu)
Tuesday, Thursday 5:00-6:15 PM
TBA

ECE 591-02 **Topics in ECE**
Topic: Digital Forensics
B. Morrissette (u_bmorrisset@umassd.edu)
Tuesday, Thursdays 5:00-6:15 PM
SENG-222

ECE 591-03 **Topics in ECE**
Topic: Medical Ultrasonics
D. Brown (dbrown@umassd.edu)
Monday, Wednesday 3:00-4:15 PM
TBA

ECE 591-04 **Topics in ECE**
Topic: Systems Dependability
S. Cookinham (scookinham@umassd.edu)
Monday, Wednesday 6:30-7:45 PM
TBA

ECE 591-05 **Topics in ECE**
Topic: Photonic Devices
T. Manzur (tmanzur@umassd.edu)
Fridays 2:00-4:50 PM
TBA

COURSE DESCRIPTIONS

ECE 521 three credits
Random Signals and Systems I
3 hours lecture
Prerequisites: ECE 384 (or equivalent) and ECE 321 (or equivalent)
Random variables and probabilistic description of signals and systems. The course provides the analytical tools for studying random phenomena in engineering systems and provides graduate students with an extensive treatment of probability theory, Bayes theorem, random variables, distribution and density functions, conditional distributions, moments, functions of random variables, characteristic functions, stochastic processes, Gaussian processes, stationary processes, correlation functions, power spectral density, response of systems to random inputs, mean square error estimation, filtering and prediction, and noise analysis. The course prepares students for a wide range of courses in communications, signal processing, acoustics, control, and other areas of engineering in which random signals and systems have an important role.

ECE 530 three credits
Introduction to Advanced Electronics & **Optoelectronics**
3 hours lecture
Illustration of principles of advanced electronics and photonics by showing their applications in advanced radar, wired/wireless communications, and electronic sensing. Key electronics/photonics devices including high speed transistors, diodes, lasers, high frequency modulators, photodetectors, amplifiers, and passive circuitries are discussed. System applications including advanced radar system, radio over fiber, and millimeter wave /THz signal generation and processing are deliberated and analyzed.

ECE 535 three credits
Analog Integrated Circuit Design
3 hours lecture
Introduction to the design of CMOS analog integrated circuits (IC's), with occasional references to bipolar IC's to make comparisons. Required readings from the current literature lead to a formal written report on recent developments in analog IC's. Students are required to complete the design of a complex IC and make a class presentation of its design methodology and simulation results.

ECE 548 three credits
Cyber Threats and Security Management
3 hours lecture
Prerequisites: Graduate standing in computer engineering or permission of instructor Fundamentals and practices in information assurance (IA) and cyber defense (CD). This course covers threats in the cyber realm, design principles to create trustworthy systems, and security lifecycle. Topics include threat models, attack surface, social engineering, vulnerability identification, risk assessment, and fail secure system design. Hands-on exercises will demonstrate the interaction between security and system usability as well as the effects of security mechanisms in specific scenarios.

ECE 562 three credits
Advanced Computer Architecture
3 hours lecture
Prerequisites: ECE 456 (or equivalent)
Advanced computer design, emphasizing fundamental limitations and tradeoffs in designing high performance computer systems. Students develop an understanding of the theoretical foundations in both hardware and software by studying parallel computer models; program partitioning, granularity, and latency; processor architectures and interconnects; and memory hierarchy, interleaving and bandwidth. Specific architectures such as shared memory multi-processors, message passing multi-computers, and superscalar, supervector, VLIW and dataflow designs will be explored.

ECE 591-01 three credits
Topics in Electrical and Computer Engineering
Topic: Array Processing
3 hours lecture
Prerequisite: Permission of instructor
Fundamentals of signal processing for sensor arrays, including beam pattern design, space-time random processes, array shading, deterministic nullsteering, adaptive beamformers and sparse arrays. Applications include sonar, radar, and communications systems. Special emphasis on transferring intuition from classical discrete-time signal processing to narrowband array processing for uniform linear arrays.

ECE 591-02 three credits
Topics in Electrical and Computer Engineering
Topic: Digital Forensics
3 hours lecture
Prerequisite: Permission of instructor
Digital Forensics: Practical applications, methods and scope; Legal parameters and boundaries; File Systems & Windows Forensics; Mobile Device Forensics - Android OS; Mobile Device forensics - iOS (Apple); Social Media Applications / Cloud Data Forensics / SQLite Breakdowns; Cell Site Location Information Network Analysis & Cellular Records Analysis; Evidence Management & Lab fundamentals; Practical Usage of Tools/Programs/Readers

ECE 591-03 three credits
Topics in Electrical and Computer Engineering
Topic: Medical Ultrasonics
3 hours lecture
Prerequisite: Permission of instructor
Underlying principles and engineering adaptations of ultrasound, including generation, propagation, detection of sound, transducers, clinical methods, and techniques used in a variety of medical acoustic applications including imaging- sonography, lithotripsy, acoustophoresis filtration, therapeutic and surgery, and cleaning.

ECE 591-04 three credits
Topics in Electrical and Computer Engineering
Topic: Systems Dependability
3 hours lecture
Prerequisite: Permission of instructor
Understanding the framework of a system is key to the overall success of a project, product or system. A multi-disciplined approach is required to understand all of the facets and complexities each unique system requires. Every system in existence started out with some type of need or purpose, which then is broken down into manageable capabilities, functions and requirements. Before system development can take place, designs need to be produced. Before systems can be designed, requirements need to be generated. Linking system requirements to the end operation of a system is systems engineering. This course will introduce the fundamentals of systems engineering and how to apply them to projects and product development. The idea of systems engineering looks at the life cycle of a system as a whole from its inception until it no longer serves a purpose or a need. Critical thinking of understanding the true need of why we need a particular system is the foundational framework to system success. Applying scientific analysis helps to guide the overall design and development of systems to accommodate the usefulness of a system, its reliability and the overall effectiveness of its operation. Ideally, once a system has accommodated the overall intended purpose with minimal to no re-work and operated for the planned lifecycle of the system, it has been deemed successful. This course will provide an overview of what systems engineering is and the analysis of applying systems engineering to project and product design, and system development.

ECE 591-05 three credits
Topics in Electrical and Computer Engineering
Topic: Photonic Devices
3 hours lecture
Prerequisite: Permission of instructor
Electromagnetic analysis of guided-wave optical devices and systems, including transmission properties of optical fibers, photonic crystal waveguides, grating structures, and coupled-wave components; soliton propagation in fibers; Erbium-doped and Raman fiber amplifiers; semiconductor light sources and photodetectors; wavelength-division multiplexed systems. Introduction to nano-photonic devices. Topics to be covered: light and photons, statistical properties of photon sources, temporal and spatial correlations, light-matter interactions, optical nonlinearity, atoms and quantum dots, single- and two-photon devices, optical devices, and applications of nanophotonic devices in quantum and classical computing and communication.