Graduate Courses
Electrical and Computer Engineering
Fall 2022
Classes begin 9/1/2022

UMass Dartmouth
COLLEGE OF ENGINEERING

Department contact info: 508.999.9164
Dr. Antonio H. Costa, Chairperson
Dr. Liudong Xing, Graduate Program Director

ECE 471 **Communication Theory**
P. Gendron (pgendron@umassd.edu)
Tuesday, Thursday 11:00 AM - 12:15 PM, SENG-212

ECE 513 **Fundamentals of Optics and Photonics**
T. Manzur (tariq.manzur@navy.mil)
Friday 2:00-5:00 PM, TBA

ECE 531 **RF Photonics**
Y. Li (yli2@umassd.edu)
Tuesday, Thursday 5:00-6:15 PM, SENG-212

ECE 532 **Radar Engineering**
D. Kasilingam (dkasilingam@umassd.edu)
Tuesday, Thursday 3:30-4:45 PM, SENG-222

ECE 533 **VLSI Design**
D. Rancour (drancour@umassd.edu)
Monday, Wednesday, Friday 10:00-10:50 AM, TBA

ECE 544 **Fault Tolerant Computing**
L. Xing (lxing@umassd.edu)
Monday, Wednesday 3:30-4:45 PM, TBA

ECE 549 **Network Security**
H. Liu (hliu@umassd.edu)
Tuesday 3:30-6:30 PM, TBA

ECE 551 **Acoustic and Electromagnetic Waves**
D. Brown (dbrown@umassd.edu)
Monday, Wednesday 3:00-4:50 PM, TBA

ECE 565 **Operating Systems**
H. Liu (hliu@umassd.edu)
Tuesday, Thursday 11:00-12:15 PM, TBA

ECE 574 **Discrete-Time Signal Processing**
P. Gendron (pgendron@umassd.edu)
Monday, Wednesday 5:00-6:15 PM, SENG-212

ECE 577 **Artificial Intelligence**
L. Fiondella (lfiondella@umassd.edu)
Wednesday, Friday 2:00-3:15 PM, SENG-222

ECE 621 **Multimedia Communications**
H. Wang (hwang1@umassd.edu)
Tuesday, Thursday 12:30-1:45 PM, TBA

Course Descriptions

ECE 471 three credits
Communications Theory
3 hours lecture
Prerequisites: ECE 321 and ECE 384
Probability theory, signals and linear networks, Fourier transforms, random processes and noise are reviewed. Analog communications including amplitude and frequency modulation with and without noise are studied. Digital communications including baseband pulse modulation, quantization, sampling theory, digital pulse shaping, matched filter, Nyquist criterion and error rates due to noise are covered.

ECE 513 three credits
Fundamentals of Optics and Photonics
3 hours lecture
Geometric optics is the study of light in its simplest form by treating light as rays. Light rays travel in straight lines until they encounter an interface (such as a mirror or a lens) where they may be redirected by reflection and refraction. This course describes the physical principles that determine how rays behave at various interfaces. These principles are then used to model simple optical systems with varying degrees of fidelity. Natural optical phenomena (rainbows, mirages, total-internal reflection, etc.) and classic optical systems (prisms, telescopes, cameras, etc.) will be analyzed throughout the course. Linear systems will be introduced to analyze more complex optical systems. This course provides the fundamentals needed for optical engineering and optical system design.

ECE 531 three credits
RF Photonics
3 hours lecture
Photonics technologies for radio frequency applications. Principles of radio frequency (RF) photonics are illustrated through their applications in advanced radar, wired/wireless communications, and electronic sensing. Key RF photonics devices including 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 considered and analyzed.

ECE 532 three credits
Radar Engineering
3 hours lecture
Fundamentals of microwave radar engineering and radar system analysis. The course covers the radar equation, radar detection theory, noise analysis, radar cross-section, continuous wave and pulsed systems, moving target indicators, pulse compression, radar transmitters and receivers. Also covered are radar systems such as pulsed Doppler radar, synthetic aperture radar (SAR), inverse synthetic aperture radar (ISAR), polarimetric radar and interferometric radar. Applications include target detection, radar remote sensing, satellite oceanography, and terrain mapping.

ECE 533 three credits
VLSI Design
3 hours lecture
Prerequisite: ECE 311
Design of Very Large-Scale Integrated Circuits (VLSI), taught at the transistor level. Computer tools are used to create and simulate integrated circuit layouts. Levels of design automation covered include Full Custom layout, Schematic Driven layout, Standard Cells, and fully automated synthesis of HDL code. Required readings from the current literature lead to a formal written report on recent developments in VLSI. Students are required to complete and present at least one project. Some designs may be fabricated.

ECE 544 three credits
Fault Tolerant Computing
3 hours lecture
Techniques for designing and analyzing dependable and fault-tolerant computer-based systems. Topics addressed include fault, error, and failure cause-and-effect relationships; fault avoidance techniques; fault tolerance techniques, including hardware redundancy, software redundancy, information redundancy, and time redundancy; fault coverage; time-to-failure models and distributions; reliability modeling and evaluation techniques, including fault trees, cut-sets, reliability block diagrams, binary decision diagrams, and Markov models. In addition, availability modeling, safety modeling, and trade-off analysis are presented.

ECE 549 three credits
Network Security
Prerequisite: Graduate standing in computer engineering
3 hours lecture
Principles and practices of security in computer networks. This course covers the theoretical foundations of securing computer networks including cryptography and models. It steps through the practical process of defending networking resources. It also reveals various case studies, large and small, to familiarize the techniques that attackers use. An Internet Testbed is facilitated for students to experiment attacks and defenses.

ECE 551 three credits
Acoustic and Electromagnetic Waves
3 hours lecture
Principles of oscillations, radiation, and propagation of waves in acoustics and electromagnetics for bounded and unbounded media. Introduction to the derivation of the wave equation from Maxwell's equations in electromagnetics and vibration theory in acoustics and the application of the wave equation to wave propagation in SONAR and RADAR environments. Examples include acoustic and electromagnetic propagation in air and ocean environments, waveguides and optical fibers, transducers and antennas, radiation and reception of signals, dispersion, phase and group velocity, attenuation, reflection, refraction, and scattering.

ECE 565 three credits
Operating Systems
3 hours lecture
Operating system design and implementation using the specifics of current operating systems. The course covers file, process, memory, and Input/Output management; multitasking, synchronization, and deadlocks; scheduling, and inter-process communication. Projects include team system's programming assignments to investigate the kernel interface, files, processes, and inter-process communication for a current operating system.

ECE 574 three credits
Discrete-Time Signal Processing
3 hours lecture
Representation, analysis and design of discrete signals and systems. Topics include a review of the z-transform and the discrete-time Fourier transform, the fast Fourier transform, digital filter structures, digital filter design techniques, quantization issues and effects of finite word-length arithmetic, sampling and oversampling, decimation and interpolation, linear prediction, the Hilbert transform, and the complex cepstrum. Students gain experience in analyzing and designing digital signal processing systems through computer projects.

ECE 577 three credits
Artificial Intelligence
3 hours lecture
An introduction to artificial intelligence and expert systems. Topics covered include state-space representations and search methods; problem-reduction representation and search methods; Bayes networks; theorem proving using predicate calculus; natural languages; expert system design using Lisp or Prolog; and an introduction to neural networks and pattern recognition.

ECE 621 three credits
Multimedia Communications
3 hours lecture
Principles of multimedia communications systems and their design. Students will learn how to design multimedia communication systems and develop research on advanced and newly emerging techniques. The course will provide surveys and a comprehensive introduction of current topics related to multimedia communications. It will focus on the fundamentals of multimedia communication systems such as multimedia processing in communication, distributed multimedia systems, multimedia communication standards, multimedia communication across networks, and audio-visual integration.