Graduate Courses
Electrical and Computer Engineering
Spring 2021
Classes begin 1/19/2021

UMass Dartmouth
COLLEGE OF ENGINEERING

Department contact: 508.910.6619
Dr. Antonio H. Costa, Chairperson
Dr. Liudong Xing, Graduate Program Director

ECE 521 **Random Signals and Systems I**
P. Gendron (pgendron@umassd.edu)
Tuesday 11:00-12:15 PM & Thursday 3:30-4:45 PM

ECE 527 **Active Remote Sensing of the Environment**
D. Kasilingam (dkasilingam@umassd.edu)
Tuesday, Thursday 9:30-10:45 AM

ECE 530 **Intro. Advanced Electronics & Optoelectronics**
D. Rancour (drancour@umassd.edu)
Tuesday, Thursday 5:00-6:15 PM

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

ECE 560 **Computer Systems Performance Evaluation**
L. Xing (lxing@umassd.edu)
Wednesday, Friday 11:00-12:15 PM

ECE 562 **Advanced Computer Architecture**
H. Wang (hwang1@umassd.edu)
Tuesday, Thursday 12:30-1:45 PM

ECE 591.01 **Topics in Electrical and Computer Engineering**
Topic: Array Signal Processing
J. Buck (jbuck@umassd.edu)
Monday, Wednesday 5:00-6:15 PM

ECE 591.02 **Topics in Electrical and Computer Engineering**
Topic: Software Defined Radio
R. Zhou (rzhou@umassd.edu)
Tuesday 3:30-6:15 PM

ECE 591.03 **Topics in Electrical and Computer Engineering**
Topic: Photonic Devices
T. Manzur (tariq.manzur@navy.mil)
Friday 2:00-5:00 PM

ECE 597 **Underwater Acoustics I**
D. Brown (dbrown@umassd.edu)
Monday, Wednesday 3:00-5:00 PM

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 527 three credits
Active Remote Sensing of the Environment
3 hours lecture
Principles and applications of active remote sensing techniques. Course focuses on microwave and millimeter wave radar techniques.Â Topics include radar equation, detection theory, scattering from targets and natural surfaces, and imaging systems. The following sensors are covered: synthetic aperture radar (SAR), radar scatterometers, altimeters, polarimetric radars and interferometric radars. Applications include ocean wave and wind measurements, soil moisture measurements, biomass measurements, measurement of land topography, and precipitation studies. Course also includes laboratory computer exercises for analyzing and processing real sensor data.

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 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 560 three credits
Computer Systems Performance Evaluation
3 hours lecture
Prerequisites: MTH 331 (or equivalent) and graduate standing
Development of a broad working knowledge of probability, queuing theory, petri-nets, simulation and empirical modeling as applied to computer systems hardware and software performance modeling and assessment. The course is oriented toward a practical application of theory and concepts with an emphasis placed on the use of computer tools to model performance and to perform tradeoff analysis.

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 Signal Processing
3 hours lecture
Prerequisites: ECE 574 and ECE 521 or permission of instructor
Fundamentals of signal processing for sensor arrays, including beam pattern design, space-time random processes, array shading, deterministic null-steering, 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: Software Defined Radio
3 hours lecture
Prerequisites: ECE 320 (or equivalent) or permission of instructor
Introduction to the principles and practice of software defined radio (SDR). The course focuses on developing and building SDR communications systems using different software platforms and hardware solutions of SDR. The course is a mixture of hands-on project work and standard presentation of material and examples so the concepts and theory can be instantly translated to practice. The course presents the concept of SDR, software platforms including Matlab/Simulink and GNURadio, hardware solutions including PLUTO and Universal Software Radio Peripheral (USRP), and the development of SDR. Analog modulation and digital modulation schemes will be reviewed. Different wireless communication systems will be designed, built, and implemented using software platforms and hardware solutions of SDR. The course culminates in a class-wide radio competition.

ECE 591-03 three credits
Topics in Electrical and Computer Engineering
Topic: Photonic Devices
3 hours lecture
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.

ECE 597 three credits
Underwater Acoustics I
3 hours lecture
Production, propagation, and reception of underwater sound. Topics include plane, spherical and cylindrical wave propagation, transmission loss, normal mode theory, waveguides, ray acoustics, active and passive sonar equations, properties of transducers and arrays including transmit and receive sensitivity, beam patterns, directivity, spatial aperture functions and their Fourier transform pairs, equivalent electrical circuits, and calibration of underwater projectors and hydrophones.