ELECTRICAL AND COMPUTER ENGR (EECE)

EECE 2100 Circuits I Lab (1 semester hour)
Laboratory experiments on electric circuits. This is a companion laboratory course to the course EECE 2110 Circuits I. Prerequisite: MATH 131. Corequisite: EECE 2110. Electrical/Computer Engineering and Applied Physics Majors only.

EECE 2110 Circuits I (3 semester hours)
Introduction to the principles of electric circuit analysis, DC, AC, transient and steady-state response of electric circuits; operational amplifiers; electric power. Prerequisite: MATH 131. Corequisite: EECE 2100. Electrical/Computer Engineering and Applied Physics majors only.

EECE 2112 Electric Sensors and Measurements (2 semester hours)
Introduction to the principles of electric circuit analysis, DC, AC, electric sensors, electronics, instrumentation amplifiers and applications. Prerequisite: MATH 131

EECE 2210 Circuits II (4 semester hours)
Second-order circuits; three-phase circuits and power; magnetically coupled circuits; response of frequency-dependent systems; Laplace transform and its circuits application; introduction to Fourier analysis; two-port networks. Prerequisite: EECE 2110; MATH 246 or concurrent enrollment. Electrical Engineering, Computer Engineering, or Applied Physics majors only.

EECE 2212 ENGR. Prob. & Stat. (2 semester hours)
This course introduces the fundamentals of probability and statistics theory. Topics include set operations, probability theorems, Bayesian probability, CDF, PDF, and PMF of random variables, multi-variate random variables, joint distributions, Gaussian random variables, central limit theorem, samples and sampling distributions, parameter estimation, maximum likelihood estimation, confidence interval. Prerequisite: MATH 132. Electrical/Computer Engineering majors only.

EECE 2220 Instrumentation and Measurement (4 semester hours)
Introduction to the principles of electric circuit analysis in DC, principles of AC that apply to instrumentation, electric power, electric sensors, instrumentation amplifiers and applications, data acquisition, basic microcontroller programming. Laboratory exercises focused on troubleshooting and analyzing circuits for measurement and data acquisition using oscilloscopes and microcontrollers. Prerequisite: MATH 131. Corequisite: MECH 2200. Mechanical Engineering majors only.

EECE 2240 Introduction to Digital Systems (4 semester hours)
This course introduces the student to the design and analysis of digital systems. The topics covered include: number systems, Boolean algebra, combinational and sequential logic design, minimization and analysis techniques as well as basic computer architecture. Electrical/Computer Engineering, Mechanical Engineering, and Applied Physics majors only.

EECE 2242 Logic and Computer Design (4 semester hours)
A study of computer architecture including the design and analysis of functional computer subsystems. Machine instructions and instruction formats, assemblers and assembly languages. Various microarchitectures are compared and contrasted. Advanced topics in pipelining, micro-coding, cache memory, virtual memory and I/O systems are introduced. Prerequisite: CMSI 2210 and CMSI 2820. Computer Science majors only.

EECE 2998 Special Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 2999 Independent Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 3100 Junior Lab I (4 semester hours)
Introduction to the use of contemporary lab equipment and techniques of measurement and experimentation; introduction to technical report writing; class is used to provide a laboratory experience related to sophomore and junior level courses. Prerequisites: EECE 2210, EECE 2240, EECE 3130 or concurrent enrollment. Electrical Engineering, Computer Engineering, or Applied Physics majors only.

EECE 3130 Electronics (4 semester hours)
This course provides the fundamentals of semiconductor devices and their applications in electronic circuits. Topics include diodes and their applications, transistors and their applications in operational amplifiers, feedback techniques and feedback stability. It provides the introduction to engineering design methods utilized in the synthesis of contemporary analog electronic circuits including extensive use of CAD tools. Prerequisite: EECE 2210. Electrical Engineering, Computer Engineering, or Applied Physics majors only.

EECE 3140 Microprocessor and Microcontroller Systems (4 semester hours)
This course introduces the student to the basic concepts in the design and organization of microprocessor/microcontroller systems. The student will learn assembly and C programming languages for solving applications and interfacing with peripheral devices. Prerequisite: EECE 2240 or EECE 2242. Electrical/Computer Engineering, Mechanical Engineering, Applied Physics and Computer Science majors only.

EECE 3200 Junior Lab II (4 semester hours)
This course is a continuation of EECE Junior Lab I with emphasis on design of both analog and digital systems. It also introduces design, programming, implementation, and testing of microcontroller-based systems. Prerequisites: EECE 3100, EECE 3140, EECE 3120 or concurrent enrollment. Electrical Engineering and Computer Engineering majors only.

EECE 3210 Signals and Linear Systems (4 semester hours)
Time and frequency domain analysis of continuous and discrete-time signals and systems; Laplace transform, Z-transform, and Fourier transforms; sampling theorem; applications to communications: amplitude modulation, angle modulation, PCM; state variable analysis and feedback control. Prerequisites: EECE 2210. Electrical Engineering, Computer Engineering, and Applied Physics majors only.

EECE 3220 Electromagnetics (4 semester hours)
Review of vector analysis, fundamental laws in electromagnetics, solution of basic electrostatic and magnetostatic problems, introduction to Maxwell's equations, wave propagation, partial differential equations and boundary value problems with emphasis on wave equations, transmission line theory. Prerequisites: MATH 234, PHYS 201. Electrical Engineering majors only.

EECE 3998 Special Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 3999 Independent Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 4100 Senior Lab I (4 semester hours)
Students will be introduced to design methodology and information literacy by means of the senior project. Student teams will be responsible for proposing a project and initiating its execution. Students will also develop professional project-oriented skills, including understanding the customer, requirements definition, communication, team management, creative problem solving, interpersonal management and leadership skills. Prerequisite: EECE 3200. Corequisite: EECE 4280. Electrical Engineering and Computer Engineering majors only.

EECE 4110 Analog and Digital Communication Systems (4 semester hours)
This course is divided into four main parts. The first one is an introduction to the analysis of digital communication systems. The second part is an introduction to the theory of probability, random processes, and spectral analysis. The third part builds on this theory in order to perform the analysis of analog and digital communication systems. Finally, the fourth part is an introduction to information theory and channel coding. The detailed topics covered in each part and the corresponding number of class lectures are as follows. Prerequisite: EECE 3210. Electrical Engineering majors only.

EECE 4200 Senior Lab II (4 semester hours)
This course is a continuation of the senior projects initiated in EECE 4100 Senior Lab I. Students will continue to apply design methodology and develop professional skills including communication, team management, creative problem solving, and interpersonal-management and leadership skills. Senior projects are used to apply these professional skills to the solution of a design problem. Periodic design reports and design reviews are presented to, and critiqued by faculty and industry customer. Prerequisite: EECE 4100. Electrical Engineering and Computer Engineering majors only.

EECE 4280 Senior Seminar (1 semester hour)
This course will cover ethics in engineering and invite speakers from industry partners to give presentations to the graduating class on various topics including but not limited to ethics and technology. Corequisite: EECE 4100. Electrical Engineering and Computer Engineering majors only.

EECE 4998 Special Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 4999 Independent Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 5120 Microwave Engineering and Antennas (4 semester hours)
Studies of the theories of microwave engineering and antennas for applications in high-frequency systems and wireless communications. Topics include fundamental electromagnetic theories, waves and propagation, microwave circuit theory, transmission lines, waveguides, scattering parameters, ABCE parameters, network analysis, impedance transformation and matching, radiation, antenna characteristics such as radiation pattern, directivity, gain, input impedance, polarization, effective area, bandwidth, and antenna temperature, Friis transmission equation and radar range equation, typical antennas such as line, loop, microstrip, horn, and reflector antennas, antenna arrays and mutual coupling. Use of EDA software for analysis and design of high-frequency devices will be included. Prerequisite: EECE 3220.

EECE 5140 Computer Architecture with VHDL (4 semester hours)
Students will first be introduced to the organization, functionality, and operation of hardware and instruction sets of modern microprocessor systems. Students will then design computing systems that meet desired functionalities. Finally, students will be introduced to VHDL to implement the designed computer architectures. Topics include memory systems, pipelining, instruction-level parallelism, and multicore processors. Prerequisite: EECE 3140.

EECE 5141 Embedded Systems (4 semester hours)
Introduction to the design and analysis of computational systems that interact with physical processes. Case studies and applications in selected areas such as medical devices and systems, consumer electronics, toys and games, assisted living, traffic control and safety, automotive systems, process control, energy management and conservation, environmental control, aircraft control systems, communication systems, defense systems, manufacturing, and smart structures. Prerequisite: EECE 3140.

EECE 5150 Machine Learning (4 semester hours)
Fundamental mathematical concepts of data science and their implementation in various programming languages. Methods for obtaining and massaging data. Data life cycle, optimization, cost functions, and stochastic gradient descent. Prerequisite: MATH 245 or permission of instructor.

EECE 5151 Machine Learning (4 semester hours)
Machine Learning (ML) amounts to the ability to recognize and react to new patterns of data more or less automatically. In this course, students are introduced to the concepts and methods of ML and tools and technologies that can be used to implement and deploy ML solutions. We will cover methods for supervised ML, whereby human beings are able to guide learning algorithms to improve their effectiveness through feedback and guidance, and unsupervised ML, which is essentially the ability to process data patterns without any examples of what one is looking for. Students will learn to work with the language R, which is rapidly becoming the lingua-franca for data science and ML. We will work through many ML problems in real-world situations, and see how R can be used to implement a solution. We cover many areas of ML application such as spam filtering, pharma, healthcare, and stock market. Graduate standing required.

EECE 5160 Optical Engineering (4 semester hours)
The objective of this course is to study the fundamentals of photonics. The concepts that are covered in the course include basics of optical science, ray optics, wave optics, beam optics, Fourier optics, electromagnetic optics, polarization of light, guided wave optics, fiber optics, and electro-optics. The applications studied in the course include design of free space optical imaging systems, design of optical waveguides, optical computing, optical sensing, etc. Students also have two workshops on two software packages used in industry to design optical systems. Prerequisites: EECE 3130, EECE 3210.

EECE 5210 Random Processes (4 semester hours)
Studies of the fundamental theories of probability, random variables, and stochastic processes at a level appropriate to support graduate coursework/research and practice in the industry in electrical and computer engineering. Selected topics include basic probability concepts, total probability and Bayes theorems, independence, probability functions, expectation, moments of random variables, multiple random variables, functions of random variables, central limit theorems, basic stochastic process concepts, wide-sense stationary processes, autocorrelation function, power spectral density, and important processes such as Gaussian, Markov, and Poisson. Applications of the theories to engineering and science problems will be emphasized. Both analytical study and simulation work will be carried out. Prerequisite: EECE 4110 or permission of instructor.

EECE 5211 Digital Signal Processing (4 semester hours)
The representation, analysis, and processing of discrete signals are discussed. Topics include sampling, quantization, Z-transform of signal, discrete Fourier and fast Fourier transforms, analysis and design of digital filters, and spectral estimation of random digital signals. Prerequisite: EECE 3210.

EECE 5240 Digital System Design with VHDL (4 semester hours)
Computer aided design of digital VLSI (Very Large Scale Integrated) systems using Very High Speed Integrated Circuits (VHSIC) Hardware Description Language (VHDL). Prerequisite: EECE 3140.

EECE 5241 Introduction to Digital VLSI Design (4 semester hours)
Custom and semi-custom design of VLSI circuits using standard cells, design methodologies of advanced complementary metal-oxide-semiconductor (CMOS) circuits, and simulation of designed circuits will be emphasized. At the end of the semester, circuits designed by the students will be sent for fabrication and tested by the students for functionality. Prerequisite: EECE 3140.

EECE 5270 Wireless Networks (4 semester hours)
This course is an introduction to wireless networks. It is divided into three main parts: wireless communications, computer networking, and wireless networking. The focus is on wireless networking mainly, which covers cellular networks and wireless local area networks. Students will understand the fundamental theories of transmission, antennas, and propagation, be able to identify the sources of received-signal impairments in wireless communication systems, be able to design basic bit and packet error detection and correction techniques, understand the protocol stack in packet-switched networks, and be able to identify the appropriate protocol standards and corresponding wireless-network technologies according to given application scenarios.

EECE 5998 Special Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 5999 Independent Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 6110 Digital Image Processing (4 semester hours)
This course covers the basic and advanced topics related to the techniques and applications of digital image processing (DIP). Topics include DIP fundamentals; edge detection; object shape recognition and classification. Upon completion of this course, the student will learn fundamental theories of digital image processing, practical algorithms of digital image enhancement, recognition and retrieval, and programming skills needed for implementation of DIP algorithms. Graduate standing required.

EECE 6111 Information Theory and Coding (4 semester hours)
The concepts of information measures and channel capacity are introduced. The applications of Shannon theory to evaluate the effectiveness of practical communication links is developed. Error correction coding and its application in reliable communications are emphasized in this class. Prerequisite: EECE 5210. Graduate standing required.

EECE 6112 Optimization Techniques in Signal Processing (4 semester hours)
An introduction to the theory, analysis, and design of optimal signal processing systems in both discrete and continuous time. Topics include spectral factorization, least-mean-square theory and estimation algorithms, linear signal estimation, Wiener and Kalman filtering, linear prediction, spectral estimation, and matched filtering. Access to computer with MATLAB, Python, C/C++, or other high level language compiler for assignments is required. Graduate standing required.

EECE 6140 Digital VLSI Design (4 semester hours)
Topics in computer-aided design of digital VLSI systems. Topics include: custom and semi-custom design, design methodologies of advanced CMOS circuits, and simulation of designed circuits. Circuits designed will be fabricated for testing by student. Prerequisite: EECE 5241. Graduate standing required.

EECE 6150 Machine Learning (4 semester hours)
Machine Learning (ML) amounts to the ability to recognize and react to new patterns of data more or less automatically. In this course, students are introduced to the concepts and methods of ML and tools and technologies that can be used to implement and deploy ML solutions. We will cover methods for supervised ML, whereby human beings are able to guide learning algorithms to improve their effectiveness through feedback and guidance, and unsupervised ML, which is essentially the ability to process data patterns without any examples of what one is looking for. Students will learn to work with the language R, which is rapidly becoming the lingua-franca for data science and ML. We will work through many ML problems in real-world situations, and see how R can be used to implement a solution. We cover many areas of ML application such as spam filtering, pharma, healthcare, and stock market. Graduate standing required.

EECE 6170 Internet of Things (4 semester hours)
This course provides an overview of the IoT ecosystem and how value is created with IoT products. It is an introduction to key IoT concepts and technologies and a survey of important IoT companies and their products. Students will learn how to turn ideas into new products that create value for customers. Students will also learn how to work together in cross functional teams, deal with fast, ambiguous, and rapidly changing projects. In addition, students will learn to identify and resolve cybersecurity threats in IoT solutions. Graduate standing required.

EECE 6210 Motion Capture Laboratory (4 semester hours)
Students will learn how to set up motion capture systems using two different technologies: (1) infra-red cameras and reflective markers, (2) wearable wireless networks. The motion capture systems will be interfaced to a computer to log all motion-capture data and process it using digital-signal-processing and data-classification algorithms. Graduate standing required.

EECE 6211 Satellite Communication Systems (4 semester hours)
This course provides an introduction to the practical and theoretical analysis of the performance of satellite communications links. Topics in link design, satellite orbit dynamics, antenna gain and coverage, frequency and time division multiple access, component and subsystem nonlinearity, signal format, and error correction coding will be discussed. Graduate standing required.

EECE 6220 Wireless Communication and Propagation (4 semester hours)
Studies of the fundamentals of radio-frequency wireless communications and the associated wave propagation. Topics include concepts of cellular ratio, radio-wave propagation principles, stochastic wireless channels, small- and large-scale fading, propagation models, wideband channel characterizations, fading-combat techniques, orthogonal frequency division multiplexing (OFDM), spatial diversity and multiplexing, and multiple-input-multiple-output (MIMO) technique. Students will perform theoretical analysis based on learned theories, and also carry out simulations by programming in MATLAB, C, or FORTRAN. Graduate standing required.

EECE 6221 Radar Engineering (4 semester hours)
Radar fundamentals will be covered including radar applications, frequency allocation, radar space-time coordinates, target and clutter scattering, radar range performance and signal/target detection and location. Also, waveform and non-coherent/coherent signal processing design and analysis will be treated for targets embedded in various types of clutter. The course will also address simple antenna and transmitter/receiver design and performance. A sample radar system design problem will be accomplished. Graduate standing required.

EECE 6230 Analog VLSI Design (4 semester hours)
Topics in computer-aided design of analog VLSI systems. Topics include: custom and semi-custom design, design methodologies, and simulation of designed circuits. Circuits designed will be fabricated for testing by student. Prerequisite: EECE 5241. Graduate standing required.

EECE 6240 Parallel Computing (4 semester hours)
Parallel computing is the process of solving computing problems using several processing units simultaneously, which requires breaking a problem into several subproblems that can be solved simultaneously. Students are first introduced to the hardware architecture of many-core and memory systems. Then, students learn how to decompose problems into subparts that can be solved in parallel using Graphical Processing Units and various programming models. The course consists of lectures and laboratory assignments that consider applications in areas such as augmented and virtual reality. Graduate standing required.

EECE 6250 Deep Learning Applications (4 semester hours)
This course will cover deep-learning models, including recursive and convolutional neural networks. The course also covers different areas of applications of deep learning such as natural language processing, speech recognition, and computer vision. A significant component of the course will be a project in which student groups implement a solution using deep learning to real-world problems. Graduate standing required.

EECE 6260 Applications of Optical Engineering (4 semester hours)
The objective of this course is to study applications of photonics in different fields of engineering, medicine and fundamental sciences. The concepts that are covered in the course include optical telecommunication systems, optical amplifiers, photo detection, fundamentals of Lasers and Laser manufacturing, fundamentals of nonlinear optics, and optical signal measurement. The applications studied in the course include ultrafast imaging, ultrafast spectroscopy, Laser Doppler vibrometry, optical coherence tomography, wideband data conversion, optical communications, optical computing, optical sensing, etc. Graduate standing required.

EECE 6270 Wireless Sensor Networks (4 semester hours)
This course is an introduction to the programming and implementation of wireless sensor networks (WSN). This course follows a hands-on approach. For every meeting time, students will receive a short lecture on programming concepts, which will be followed by laboratory assignments. In the lab assignments, students will apply the concepts introduced in the lecture to program wireless sensors with the objective of having them collaborate with each other to form a WSN. Graduate standing required.

EECE 6901 Graduate Capstone Project I (2 semester hours)
Project-based seminar in which students will be required to select, research, write about, and discuss some aspect of a broad area of current interest to electrical and computer engineers. Graduate standing and approval of academic advisor required.

EECE 6902 Graduate Capstone Project II (2 semester hours)
Project-based seminar in which students will be required to select, research, write about, and discuss some aspect of a broad area of current interest to electrical and computer engineers. Graduate standing and approval of academic advisor required.

EECE 6911 Certificate Capstone Project (2 semester hours)
Project-based seminar in which students will be required to select, research, write about, and discuss some aspect of the certificate area of emphasis. Graduate standing and approval of academic advisor required.

EECE 6994 Thesis I (2 semester hours)
Graduate students electing the thesis option must obtain a thesis advisor before departmental consent will be considered and comply with the Frank R. Seaver College of Science and Engineering Master's Thesis Requirements. Graduate standing and approval of academic advisor required. Credit/No Credit only.

EECE 6995 Thesis II (2 semester hours)
Graduate students electing the thesis option must obtain a thesis advisor before departmental consent will be considered and comply with the Frank R. Seaver College of Science and Engineering Master's Thesis Requirements. Graduate standing and approval of academic advisor required. Credit/No Credit only.

EECE 6996 Thesis III (2 semester hours)
Graduate students electing the thesis option must obtain a thesis advisor before departmental consent will be considered and comply with the Frank R. Seaver College of Science and Engineering Master's Thesis Requirements. Graduate standing and approval of academic advisor required. Credit/No Credit only.

EECE 6997 Thesis IV (2 semester hours)
Graduate students electing the thesis option must obtain a thesis advisor before departmental consent will be considered and comply with the Frank R. Seaver College of Science and Engineering Master's Thesis Requirements. Graduate standing and approval of academic advisor required. Credit/No Credit only.

EECE 6998 Special Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.

EECE 6999 Independent Studies (1-4 semester hours)
Electrical Engineering and Computer Engineering majors only.