ELECTRICAL ENGINEERING (EEEN)

EEEN 5311 Dynamics and Control Systems I
3 Semester Credit Hours (3 Lecture Hours)
This course is designed to prepare students with the study of the intersection between dynamic systems and how to control them. Dynamics is a section of mechanics that deals with the accelerated motion of a body or system. Dynamics can be presented in two parts: kinematics (geometric aspects of motion) and kinetics (analysis of forces causing the motion). In order to analyze an enable dynamics on mechanical systems control systems theory can be implemented. Control systems consist of subsystems and processes assembled for the purpose of obtaining a desired output with desired performance, given and specified inputs. Control theory then enables the student with the knowledge to enable a desired output on dynamic systems based on inputs. Topics cover Planar Kinematics and Kinetics of a Rigid Body, Three-Dimensional Kinematics and Kinetics of a Rigid Body and Vibrations. That will be done with the complementary analysis and utilization of control systems tools such as Multidomain Modeling (frequency and time), Reduction of Multiple Subsystems, Stability, Steady-State Errors and Root Locus Techniques. (Cross-listed with MEEN 5311 Dynamics and Control Systems I.)

EEEN 5312 Mechatronics
3 Semester Credit Hours (3 Lecture Hours)
This course introduces a multidisciplinary field that combines electrical engineering, mechanical engineering, control systems and computer science. It presents key aspects in the design of systems, devices and products and it aims at the analysis of the behavior and control of the systems. Topics covered in this course bring together different areas of technology involving actuation systems, computer-aided design, sensors, signal conditioning, data acquisition, and programming. Course includes hands-on activities related to acquiring experience with electronics, computer-aided design, programming, and control systems. (Cross-listed with MEEN 5312 Mechatronics.)
Prerequisite: EEEN 5311.

EEEN 5313 Linear Systems
3 Semester Credit Hours (3 Lecture Hours)
This course is designed to introduce graduate students to the fundamental state space concepts needed for the analysis and design of linear systems. Modeling, analysis, and design of continuous-time control systems using the state space approach will be covered. Other topics involve Vector spaces, linear operators, and linear equation solution theory are used to describe system solutions and their stability, controllability, and observability properties. State observers and state feedback control will be developed, along with an introduction to linear quadratic optimal control.
Prerequisite: EEEN 5311.

EEEN 5314 Robotics and Autonomous Systems
3 Semester Credit Hours (3 Lecture Hours)
Robots and Autonomous Systems are projected to benefit our society as new technologies are being developed. This course involves an introduction and survey of contemporary robotic mechanisms or systems, and field applications. This course includes the understanding of basic principles of robotics such as embedded systems in automated systems, manipulator kinematics and design, and principles of unmanned ground, aquatic, surface, and aerial vehicles. The student will be introduced to the Robotic Operating System (ROS) environment and its application in modern robotics. Also, there will be a survey in multi-agent modeling and its application on multi-robot systems. Other topics to be discussed are path-planning for navigation, task allocation and decision making, machine learning and artificial intelligence technologies with the complement of multi-sensor data fusion that can currently enable certain levels of autonomy in robots. (Cross-listed with MEEN 5314 Robotics and Autonomous Systems.)
Prerequisite: EEEN 5311.

EEEN 5321 Materials Devices and Micro-electrical-mechanical Systems
3 Semester Credit Hours (3 Lecture Hours)
This course deals with the analysis and design of electronic devices. In order to analyze and design these devices, detailed knowledge of semiconductor physics is needed. Therefore, the course will begin with treatment of semiconductor physics. The second part of the course will focus on applying knowledge of semiconductor physics to electronic devices. Devices that will be covered include diodes, field-effect transistors and bipolar junction transistors. Device physics will be used to relate internal charged-carrier behavior with external terminal characteristics of the devices. Electronic devices are used in circuits to make complex analog and digital functions such as amplifiers (for audio, high-frequency, wireless, etc.) and microprocessors. This course is fundamental to electrical engineering and will benefit persons in all areas of concentration especially solid-state devices and materials, electronics engineering, computer engineering, and mechanical engineering. This course will be complemented with the introduction of Micro-electro-mechanical Systems and its function in the development of modern Inertial Measurement Units for sensing of dynamic phenomena.

EEEN 5322 Embedded Systems
3 Semester Credit Hours (3 Lecture Hours)
This course covers the study and operation of embedded computer systems which include a microcomputer with mechanical, chemical, and electrical devices attached to it. Such systems are programmed for a specific purpose and package up as a complete system. The class is enabled by the utilization of the TI MSP432 ARM Cortex-M based microcontroller. The class is mainly focused on the programming and implementation of C based programs (with some assembly language as necessary) with the microcontroller. Topics covered in this course are Introduction to Computing, C for Embedded Systems, Input/output Programming, LCD and Keyboard interfacing, UART Serial Port Programming, Timer Programming, Interrupt and Exception Programming, ADC, DAC, and Sensor Interfacing, SPI Protocol and DAC interfacing, I2C Protocol and RTC Interfacing, and several Motors/Actuators interfacing.

EEEN 5331 Signal Processing I
3 Semester Credit Hours (3 Lecture Hours)
Discrete time signals & systems, z-transform, discrete Fourier transform, flow graph and matrix representation of digital filters, digital IIR and FIR filter design techniques and computation of the fast Fourier transform (FFT). In addition, linear predictive coding, LMS filtering, Wiener filters, adaptive filters will be covered. MATLAB and/or C programming tools will be used in this course.
Prerequisite: ENGR 5401.

EEEN 5332 Machine Vision and Image Processing
3 Semester Credit Hours (3 Lecture Hours)
This course covers machine vision systems, system components, design criteria including lighting and camera specifications, as well as testing and measurements with such systems. In addition, fundamentals of image processing are introduced. Topics include image processing and analysis of color and gray scale images in spatial and frequency domain. Topics also include other transform domains, filtering, segmentation, object detection, recognition, tracking, and introduction to machine learning for image segmentation.
Prerequisite: EEEN 5331.

EEEN 5333 Random Signal Processes
3 Semester Credit Hours (3 Lecture Hours)
This course extends in the study of random processes as a natural extension of random variables when dealing with signals. This will enable students to study signals as random rather than deterministic. This topic is essential into the study of non-ideal characteristics of signals and the development of noise mitigation techniques. Topics covered in this class are survey of probability fundamentals, Random Variables, Statistical Averages, Wide-Sense Stationary and Multiple Random Processes, Random Processes and Linear Systems, Power Spectral Density of Stationary Processes and a Sum Process, Gaussian Processes, White Processes and Filtered Noise Processes.
Prerequisite: EEEN 5331.