MAE 143A
Signals and Systems (4 units)

Class/Laboratory Schedule: four hours of lecture, eight hours of outside preparation.
12 hours/week total

Course Coordinator(s): Mamadou Diagne

Textbooks/Materials:
1. Signals and Systems using Matlab (3rd edition), Luis Chaparro, Academic Press 2018

Catalog Description: Dynamic modeling and vector differential equations. Concepts of state, input, output. Linearization around equilibria. Laplace transform, solutions to ODEs. Transfer functions and convolution representation of dynamic systems. Discrete signals, difference equations, z-transform. Continuous and discrete Fourier transform.

Prerequisites: MATH 20D or 21D, MATH 20E, MATH 18 or 20F or 31AH, or consent of instructor.

Course Type: Required

Performance Criteria:
Objective 1
1.1   Students will demonstrate understanding of the distinction between the representation of a signal in transform domain and the systems which operate upon them.
1.2   Students will demonstrate the ability to use transform domain techniques to solve for signal properties via filtering.

Objective 2
2.1   Students will be able to demonstrate, using standard computational tools, the ability to compute, display and interpret modified signals and system properties connected with realistic Engineering problems such as low-pass filtering and down sampling.
2.2   Students will formulate criteria for the solution of industrial signal conditioning problems and then develop solutions.

Objective 3
3.1   Students will demonstrate understanding of the application of Matlab software to the analysis of signals.
3.2 Students will demonstrate an understanding of the application of signals to analyze systems.

Course Objectives:

1. To teach students the basic principles of physical signals and of the systems which modify or manipulate them.

2. To train students to formulate and to solve Engineering problems using representations and techniques of both time and frequency domain.

3. To introduce the students to the concepts and some techniques of the computational analysis of signals and systems using Matlab.

Course Topics:
1. Computational analysis of signals using Matlab
2. Dynamical modeling and ordinary differential equations
3. Linearization and linear systems
4. Time domain properties of solutions, convolution
5. Laplace transforms, transfer functions
6. Fourier transforms, frequency response, spectra
7. Sampling discrete signals, aliasing
8. Z-transform, discrete Fourier transform
9. Elements of filtering

Last Updated: March 2025