ECE 3101: Signals and Systems

Credits and contact hours: 3 Credits (Two 75-minute lectures per week)

Instructor: Monty A. Escabí

Textbook: Signal Processing and Linear Systems, B.P. Lathi (2000)

a. *Other supplemental materials*: none

***Specific course information*:**

a. *Catalog Description*: Representation of signals in the time and frequency domains. Fourier series. Fourier and Laplace transform methods for analysis of linear systems. Introduction to state space models. Introduction to sampling and discrete systems analysis via z transforms.

b. *Prerequisite*: ECE 2000 or 2001

c. *Required, elective, or selected elective:* Required

***Specific goals for the course*:**

a. *Specific outcomes of instruction*: The student will be able to apply principles of time and frequency domain analysis to the analysis and design of continuous and discrete-time linear systems.

b. *EAC Criterion 3 Student Outcomes addressed by the course*:

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Students learn to apply time domain (e.g., convolution) and frequency domain (Fourier, Laplace, and z-transforms) approaches for solving engineering problems and for analyzing data.

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

n/a

(3) an ability to communicate effectively with a range of audiences

Students write a project report to communicate engineering analysis, design, and results.

(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must

consider the impact of engineering solutions in global, economic, environmental, and societal contexts

n/a

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

n/a

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Students work on a computer-based project to implement digital filters networks (lowpass, bandpass, highpass) that are used to process speech, music and/or biomedical signals and are required to meet specific design criteria. Students are also required to analyze the various signals and interpret the results.

(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Students use the web, library databases, and other resources to find material for their project.

Topics covered:

- Time domain solutions of linear systems
- Convolution
- Fourier series
- Fourier transform
- Laplace transform
- Frequency domain solutions of linear systems
- Analog filter design
- Applications for audio and communications
- The sampling theorem
- Solutions to discrete time linear systems
- Discrete convolution
- Discrete time Fourier transform
- Z-transform
- Frequency domain solutions to discrete time systems
- Discrete time filter design