EE 353 (was EE 317) - Signals and Systems: Continuous and Discrete-Time

Designation: Required for Computer Engineering students.

Catalog Data:
Fourier series and Fourier transform; discrete-time signals and systems and their Fourier analysis; sampling; z-transform.

Prerequisites: CMPSC 201 (or CMPSC 121/CSE 103), EE 210, Math 250

Prerequisites by topic:
1. Computer programming and PC operating system fundamentals.
2. Introduction to EE signals and circuits (e.g. phasors, linear networks, and electrical circuit analysis)
3. Introduction to ordinary differential equations, integral calculus, and series.

Course Objectives:
This course, intended for computer engineering students, provides a detailed overview of both continuous-time and discrete-time linear systems. It prepares students for various applications that arise in communications, signal processing, images processing and control systems. Upon completion of this course, students should be able to:
1. Understand the mathematical representation of continuous-time and discrete-time signals.
2. Understand the various classifications of continuous-time and discrete-time systems.
3. Understand sampling from both a theoretical standpoint as well as a practical standpoint.
4. Understand continuous-time frequency domain analysis techniques, particularly the Fourier transform, and understand how these techniques are useful in communication system analysis.
5. Understand discrete-time frequency domain analysis techniques, particularly the z-transform and Discrete-time Fourier Transform (DTFT), and understand how these techniques can be used in applications such as digital filtering.

Topics:
1. Continuous-time signals and systems: signal characteristics and transformations, singularity functions, systems, system properties. (8 classes)
2. Continuous-time linear time-invariant systems: impulse response, convolution, system properties, relation to differential equations, response to singularities. (5 classes)
3. Fourier series: definition, properties, system analysis. (4 classes)
4. Fourier transform: definition, properties, system analysis. (5 classes)
5. Applications involving the Fourier transform: convolution, modulation, filtering, transmission. (3 classes)
6. Sampling and Reconstruction, Nyquist sampling theory, aliasing. (3 classes)
7. Discrete-time signals and systems: signal characteristics and transformations, relation to continuous-time signals, systems, system properties. (3 classes)
8. Discrete-time linear time-invariant systems: impulse response, convolution, system properties, relation to difference equations, block diagrams. (3 classes)

9. Fourier analysis of discrete-time signals/systems, DTFT. (3 classes)
10. Z-transforms: definitions, properties, digital filtering applications. (6 classes)
11. Midterm exams (2 classes)

Class Schedule:
Three 50-minute lectures per week

Computer Usage:
1. Introductory MATLAB problems assigned with early homework assignments.
2. MATLAB-based design problems in later homework assignments.

Relationship to program outcomes:
N/A since this course is not taken by Electrical Engineering students.