EECE 340: Signals and Systems

Catalogue Description
This course covers basic concepts and methods related to continuous and discrete-time signals and systems. The course includes: signals and systems and their properties, linear time-invariant systems, stability analysis, sampling of continuous-time signals, z-transform, discrete Fourier transform, time and frequency domain representations of discrete-time signals and systems, and introductory concepts in communications.

Credit hours: 3 credits

Required or elective:
Required for CCE and ECE students

Prerequisites
By topics: Calculus, differential equations, matrices, knowledge of Fourier series, Fourier and Laplace transforms and their use in circuit and system analysis. Computer simulation skills using Matlab, or similar packages.

Textbook and References

Course Objectives
1. Coverage of continuous and discrete-time signals and systems, their properties and representations.
2. Emphasis on the concepts and methods that are necessary for the analysis of continuous and discrete-time signals and systems.
3. Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and discrete convolution, etc.
4. Knowledge of frequency-domain representation and analysis concepts as they relate to frequency response, z-transform, transfer function, etc.
5. Mathematical and computational skills needed in application areas like communications, signal processing and control, which will be taught in other courses.
Course Topics

1. **Topics for continuous-time (CT) Signals and Systems:** CT signals and systems and their properties. Stability analysis of linear time-invariant (LTI) CT systems. Block diagram representation of LTI-CT systems (Direct form I and II). State-Space representation of LTI-CT systems. Analog communication principles and examples. Sampling of CT signals


Course Learning outcomes

1. Know the concepts of energy, power, analog and discrete-time signals.
2. Know the concepts of linearity, causality, time-invariance, and stability for continuous-time systems.
3. Know block diagram representation of a LTI continuous-time system described by a differential equation.
4. Know how to represent LTI continuous-time system in state-space representations.
5. Understand the concepts of signal modulation and transmission.
6. Understand the sampling process as a means for converting analog signals into discrete ones and the Nyquist criterion of sampling.
7. Know the concepts of linearity, causality, time-invariance and stability for discrete-time systems.
8. Know how to characterize LTI discrete-time systems in the time domain using impulse response and difference equations.
9. Know how to use the impulse response of a LTI discrete-time system and discrete convolution to obtain the system output including the transient and the steady-state responses.
10. Know how to characterize LTI discrete-time systems in the frequency domain by transfer function using Z-transform and by frequency response using discrete-time Fourier transform.
11. Know how to use the transfer function of a LTI discrete-time system and the inverse Z-transform to obtain the system output including the transient and the steady-state responses.
12. Know block diagram representation of a LTI discrete-time system described by a differential equation.
14. Demonstrate knowledge of the DFT for finite duration signals and its computation using FFT.
Resources of the course
Textbook, references, course notes, homework sets and solutions, previous exams and solutions, e-reserve material.

Professional components
Engineering topics: 70%
Mathematics and basic sciences: 30%

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