EECE 340

Signals and Systems

Catalogue description

- Signals and systems, linear time-invariant systems, review of Fourier series representation of periodic signals, Fourier transform and its applications, discrete-time Fourier transform, Time and frequency characterization of signals and systems, sampling, introduction to communication systems, review of the Laplace transform, the Z-Transform. .

Required or Elective

- Required for CCE and EE

Prerequisites by Topic

Calculus, Differential Equations, Matrices, Fourier Series, Fourier transform, and Laplace transform. Computer Simulation skills using Matlab, or similar packages.

Textbook

C.L. Phillips, J.M. Parr, and E.A. Riskin, Signals, Systems, and Transformers, Prentice Hall, 4rd Edition, 2008.

Course objectives

- To introduce students to the general field of communication engineering.
- To develop in students mathematical, scientific, and computational skills relevant to communication systems.
- To teach students analysis techniques when formulating and solving communication problems.
- To cultivate skills pertinent to the communication engineering design and synthesis.
- To foster effective interaction skills and teamwork communication.

Topics covered

1. Topics for Continuous-Time (CT) Signals and Systems.

- Introduction to Signals and Systems
- Overview of CT signals and their properties
- Special functions: unit step and impulse functions
- System Impulse response
- Systems and their properties

Topics covered

- Convolution Integral for linear-time invariant systems
- Review of the Laplace Transform
- Transfer functions
- Pole-Zero representations
- Interconnected Systems
- Signal Flow Graphs (construction, and reduction)
- Stability

Topics Covered

- Review of the Fourier Transform
- Frequency analysis of systems and Bode plots (magnitude and phase)
- Analog Communications: (AM and FM)
- Circuits as examples of dynamic systems
- State-Space representations

Topics covered

2. Topics for discrete-time (DT) signals and Systems

- - Overview of DT signals and their properties
- - DT Convolution
- - Sampling Theorem
- - Sampling of Sinusoids
- - Discrete-Time Fourier Transform
- - Aliasing

Topics Covered

- - Z-transform
- - Difference equations and their solution using Z-transform
- - Causality and Stability
- - System representations (Direct Form I and II)
- - State-Space representation of DT systems
- - Discrete-Fourier Transform (DFT)
- - Fast-Fourier Transform (FFT)
- - Effect of zero-insertion
- - Introduction to filter design (FIR,

Class/laboratory schedule

- three 50-minute lectures per week

Course outcomes

- Students are knowledgeable in the field of continuous-time signals and systems.
- Students are able to apply Laplace transform for the representation and analysis of continuous-time systems
- Students have a basic understanding of control stability problem.

Course outcomes

- Students are able to apply Fourier series and transforms for the analysis and representation of LTI continuous-time signals and systems
- Students are able to apply Fourier analysis as a tool for understanding analog communication systems.
- Students are able to represent LTI continuous-time system in state-space representations.

Course outcomes

- Students understand the sampling phenomena and are able to apply it under all conditions.
- Students are knowledgeable in the field of Discrete-time signals and systems.
- Students are able to apply z-transform transform for the representation and analysis of continuous-time systems.

Course outcomes

- Students are familiar with the different methods for representation of LTI Discrete-time systems.
- Students are able to apply Fourier series and transforms for the analysis and representation of LTI Discrete-time systems
- Students demonstrate knowledge of the Discrete-time Fourier analysis for periodic signals.

Course outcomes

- Students demonstrate knowledge in computing the DFT and the FFT for non-periodic signals.
- Students are able to represent LTI discrete-time system in state-space representations.
- Students will demonstrate an ability to interact and communicate effectively with peers and teams.
- Students are introduced to filter design (FIR, IIR

Resources of the course

- Textbook,
- Class notes
- previous exams
- Moodle

Evaluation methods

- Assignments (5 %)
- Quiz I (25%)
- Quiz II (25 %)
- Final Exam (40 %)
- Project (5 %)
- Extra Project: up to 5 grades

Attendance Policy

- Regular Attendance is expected in this class.
- A Student who, for any reason attends less than two-thirds of the lectures, will be required to withdraw from the course with a grade of W.
- Final grade takes into consideration the number of absences according to the following equation

If n is the number of absences, then

$$\text{Final Grade} = \text{Old Grade} - 0.75(n-4)$$

Computer usage

- Matlab

Instructor

- Karim Kabalan

Bechtel, ECE Department

Ext: 3528

Email: kabalan@aub.edu.lb

Office Hours

- By appointment