

EEO301: Signals & Systems Fall 2016

2016-2017 Catalog Description:

Provides an introduction to continuous-time and discrete-time signals and linear systems. Topics covered include time-domain descriptions (differential and difference equations, convolution) and frequency-domain descriptions (Fourier series and transforms, transfer function, frequency response, Z transforms, and Laplace transforms). (4 credits)

Course Designation: Required

Text Book: Edward W. Kamen and Bonnie S. Heck, "Fundamentals of Signals and Systems (Using the Web and Matlab)", Prentice-Hall, 3rd Edition, 2006.

Prerequisites: EEO 271 (Circuits) and Differential Equations

Instructor: Mark Fowler

Goals: Thus the goals of this course are: (i) understand and be able to apply mathematical system models, (ii) understand and be able to apply mathematical signal models, and (iii) understand the interplay between these system and signal models

Objectives: After completing this course, the student should have the ability to

1. Manipulate and plot complex numbers and complex-valued functions
2. Apply mathematical operations to time-function signal models and interpret the results.
3. Determine system characteristics (e.g., causality, linearity, time-invariance, etc.).
4. Determine & apply differential equation models for linear time-invariant systems.
5. Use convolution to determine the zero-state response of a linear time-invariant system
6. Calculate & plot Fourier series expansions for periodic continuous-time signals.
7. Use Fourier series to determine the response of a continuous-time, LTI system.
8. Use the Fourier transform and inverse Fourier transform to analyze signals.
9. Obtain frequency response of a system or circuit through analytical means.
10. Use Fourier transform methods for analysis of linear systems.
11. Use Laplace transform methods for analysis of continuous-time linear systems
12. Use Z-transform methods for analysis of discrete-time linear systems

Topics Covered:

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| Week 1 | CT Signals and Properties. DT Signals and Properties. Examples of some important signals. System Properties. CT System Model. DT System Model. |
| Week 2 | DT Recursion. DT Convolution |
| Week 3 | CT Convolution. System Examples. |
| Week 4 | Review of Complex Numbers. Fourier Series. |
| Week 5 | Concept of Fourier Transform. Examples. |
| Week 6 | Using Fourier Transform Properties. |
| Week 7 | Frequency Response. Ideal Filters |
| Week 8 | Sampling of Signals. Motivation of DTFT |
| Week 9 | DTFT Details. Transition to DFT. Connections between CTFT, DTFT, and DFT |
| Week 10 | DTFT System Analysis. Introduction to Laplace Transform |
| Week 11 | Using LT for System Analysis |
| Week 12 | Frequency Response and Bode Plots |
| Week 13 | Z Transform |
| Week 14 | Using ZT for System Analysis |

Class/laboratory Schedule: Asynchronous Video Lectures equivalent to 3 lecture hours and 1 recitation hour per week.

Student Outcomes and Assessment

**%
contribution**

- ✓ (a) an ability to apply knowledge of mathematics, science and engineering 50
- (b1) an ability to design and conduct experiments
- (b2) an ability to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multi-disciplinary teams
- ✓ (e) an ability to identify, formulate, and solve engineering problems 25
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- ✓ (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice 25

Any other outcomes and assessments?

Document Prepared by: Mark Fowler on 6/19/2017