ECE 308 - Signals and Systems

Time and frequency domain representation of continuous and discrete time signals. Introduction to sampling and sampling theorem. Time and frequency domain analysis of continuous and discrete linear systems. Fourier series, convolution, transfer functions. Fourier transforms, Laplace transforms, and Z-transforms.
Prerequisite(s): [(ECE 213 and MATH 333*)] An asterisk (*) designates a course which may be taken concurrently.
(3-0-3)

Enrollment: Required course for EE majors; elective course for CPE majors.
Coordinator: G. Williamson, Professor of ECE

Course goals:
After completing this course, the student should be able to do the following:
1. Represent a continuous or discrete time signal as a linear combination of basis signals, including step functions, ramp functions, and sinusoidal signals.
2. Determine the response of a linear system to a given signal using time domain analysis techniques.
3. Determine the response of a linear system to a given signal using frequency domain analysis techniques.
4. Determine the response of a linear system to a given signal using transform domain analysis techniques.
5. Choose representations for signals and systems appropriate for addressing given questions about system behavior, and apply these in signal and system analysis.
6. Use computer-based analysis and design tools (such as Matlab software) in the analysis of signals and systems.

Prerequisites by topic:
1. Basic principles of physics.
2. Fundamentals of calculus.
3. Linear ordinary differential equations.
5. Introduction to Laplace transforms.
6. Complex variable analysis.

Lecture schedule: Three 75-minute sessions per week

Topics:
1. Signal fundamentals (0.5 weeks)
2. System fundamentals (1 week)
3. Time domain discrete-time and continuous-time system responses using convolution (2.5 weeks)
4. Fourier series analysis (1 week)
5. Fourier transform analysis (1.5 weeks)
6. Discrete-time Fourier transform analysis (1 week)
7. Discrete Fourier Transform (1 week)
8. Frequency response in continuous and discrete time, and ideal filters (1.5 weeks)
9. Laplace transforms, continuous time system response, and solution of differential equations (2 weeks)
10. Z-transforms, discrete time system response, and solution of difference equations (1.5 weeks)
11. Exams (1.5 weeks)
Computer usage:
Use of Matlab for computation and graphical representation; programming in Matlab.

Laboratory topics:
None.

Relationship of ECE 308 Course Goals to Student Outcomes:

<table>
<thead>
<tr>
<th>Student Outcomes</th>
<th>Course Goals</th>
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<tbody>
<tr>
<td>a Apply knowledge of math, engineering, science</td>
<td>1, 2, 3, 4, 5</td>
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<td>b Design and conduct experiments / Analyze and interpret data</td>
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<td>c Design system, component, or process to meet needs</td>
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<td>d Function on multi-disciplinary teams</td>
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<tr>
<td>e Identify, formulate, and solve engineering problems</td>
<td>2, 3, 4, 5</td>
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<td>f Understand professional and ethical responsibility</td>
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<td>g Communicate effectively (written / oral)</td>
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<td>h Broad education</td>
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<td>i Recognize need for life-long learning</td>
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<td>j Knowledge of contemporary issues</td>
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<td>k Use techniques, skills, and tools in engineering practice</td>
<td>6</td>
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Prepared by: Geoffrey A. Williamson      Date: November 1, 2013