Electrical and Computer Engineering 5630  
Digital Signal and Image Processing  
Elective

Course Description:  
Theory and applications of digital signal and image processing, including filter design, multi-rate processing, filter banks, array processing, and 2D systems, signals and transforms. Some lab and computational work required.

Prerequisites:  
ECE 3640 or equivalent. Not available to pre-majors.

Textbooks:  


References:  


Course Outcomes:  
1. Demonstrated understanding of the sampling process, including the concepts of aliasing, the Nyquist rate and quantization.
2. Demonstrated understanding of the concepts of time invariance, stability, discrete convolution and discrete correlation.
3. Demonstrated ability to perform forward and inverse z-transforms and to use them in performing convolution and analysis of discrete-time systems, both casual and non-casual.
4. Demonstrated understanding of Discrete-time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT) and their uses in the analysis of discrete-time systems.
5. Demonstrated understanding of common Fast Fourier Transform (FFT) algorithms.
6. Demonstrated ability to design both FIT and IIR digital filters.
7. Demonstrated understanding of multi-rate processing concepts such as band-pass sampling, decimation and interpolation for sample rate conversion and oversampling converters.

Topics Covered:

- IIR and FIR filter design techniques
- The Discrete Cosine Transform (DCT)
- Fast-Fourier Transform (FFT) algorithms
- Fourier analysis
- The Discrete Hilbert Transform
- Cepstrum analysis and homomorphic deconvolution
- Filter banks and multi-rate processing
- Array processing
- 2D signals and systems
- 2D (image) transforms
- 2D sampling and reconstruction
- Image perception and color processing

Outcome Assessments (Grades):

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<thead>
<tr>
<th>Assessment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm 1</td>
<td>20%</td>
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<tr>
<td>Midterm 2</td>
<td>20%</td>
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<tr>
<td>Homework and Quizzes</td>
<td>20%</td>
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<tr>
<td>Computer Assignments</td>
<td>20%</td>
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<tr>
<td>Final</td>
<td>20%</td>
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Class Schedule:

Class Twice a week for one hour and fifteen minutes.

Contribution of course to meeting the requirements of Criterion 5:

3 credit hours of Engineering Topics and contains significant engineering design content

Relationship of course to student outcomes:

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
e. An ability to identify, formulate, and solve engineering problems.
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Instructor:

Scott Budge, Associate Department Head and Associate Professor
August 2013