EEE 233 ADVANCED DIGITAL SIGNAL PROCESSING

Elective Course **Date:** May 25, 2007

Course Area: Communications

Course Coordinator: Warren D. Smith, EEE.

Catalog Description: EEE 233. Advanced Digital Signal Processing. Advanced signal processing topics include: multirate signal processing, adaptive filter design and analysis, spatial filtering and the application of FIR filter theory to beamforming. Applications of digital signal processing in communication systems, radar systems, and imaging systems are covered. Hardware and software topics, including current products and the incorporation of VLSI are included. Lecture. Prerequisite: EEE 174, EEE 181 or equivalent. 3 units.

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Text: Schilling, Edgar J., and Harris, George W., Fundamentals of Digital Signal Processing using MATLAB, Thompson, 2005.

Additional Resources: Class handouts; computer manuals; library materials.

Course Objectives: The course is project-based. The students do three assigned projects and then an individual project. Each project requires the design of digital signal processing algorithms and then the use of MATLAB to demonstrate and analyze the performance of these algorithms. Lecture time is used to provide the students with theoretical background and methods of algorithm implementation for their projects. The assigned projects involve signal digitization and digital signal processing algorithms for frequency analysis, fixed and adaptive filtering, and power spectral density estimation leading to joint time-frequency analysis.

Prerequisites by Topic:

1. Continuous- and discrete-time signals and systems
2. Continuous- and discrete-time signal spectra
3. Analog-to-digital conversion and digital computation for signal processing

Topics Covered:

1. Review of continuous- and discrete-time signals and systems and signal spectra
2. Review of analog-to-digital conversion and digital computation for signal processing
3. Design of digital signal processing filtering algorithms
4. Design of digital signal processing estimation algorithms
5. Individual student digital signal processing algorithms

Evaluation: Student performance in this course is evaluated on the basis of written reports for three assigned projects (75%) and a written report and oral presentation for an individual project (25%). Typical projects include designing and using MATLAB to demonstrate and analyze the performance of digital signal processing algorithms for spectral analysis, FIR, IIR, and adaptive filtering, joint time-frequency analysis, and image processing.

Course Outline/Schedule

Week	*Topic*	*Text Reference*
1	Introduction. Begin Exercise #1: Digital representation of signals and digital spectral analysis. Begin self-directed familiarization with software.	1-27 (selected)
2	Digital representation of signals and digital spectral analysis (cont.)	28-50 (selected)
3	Digital representation of signals and digital spectral analysis (cont.) Written report for Exercise #1, part A, due	77-102 (selected)
4	Digital representation of signals and digital spectral analysis (cont.)	103-141 (selected)
5	Written report for Exercise #1, part B, due Digital representation of signals and digital spectral analysis (cont.)	168-221 (selected)
6	Written report for Exercise #1, parts C and D due Begin Exercise #2: Design of DSP filtering algorithms	330-377 (selected)
7	Design of DSP filtering algorithms (cont.)	427-457 (selected)
8	Design of DSP filtering algorithms (cont.)	554-602 (selected)
9	Written report for Exercise #2 due Begin Exercise #3: Design of DSP estimation methods	624-687 (selected)
10	Design of DSP estimation methods (cont.)	204-234 (selected)
11	Design of DSP estimation methods (cont.)	260-305 (selected)
12	Written report for Exercise #3 due Begin Individual DSP Projects	Handouts on JTFA
13	Joint time-frequency analysis using short-time Fourier transform Continue DSP Project	Handouts on STFT
14	Joint time-frequency analysis using wavelet transforms Continue DSP Project	Handouts on wavelets
15	Class presentations of Individual DSP Projects	
	Class presentations of Individual DSP Projects (cont.)	