ECEn 487. Introduction to Discrete-Time Signal Processing

Catalog Description:	**ECEn 487. Introduction to Discrete-Time Signal Processing.** (4:3:3) W Digital signal processing, fast Fourier transforms, digital filter design, spectrum analysis. Applications in speech processing, SONAR, communications, etc.	
Course Type:	Engineering Topics	
Prerequisites:	ECEn 370, 380	
Textbooks and/or other required materials	*Discrete Time Signal Processing, Second Edition*, A.V. Oppenheim and R.W. Schafer with John R. Buck, Prentice Hall	
Topics Covered:	1. Review of z-Transform and its properties. 2. Inverse z-Transform using contour integration 3. Sampling and multirate signal processing 4. DFT, circular convolution, linear convolution from DFT 5. The Fast Fourier Transform. 6. Frequency response for rational system functions 7. Relationship between magnitude and phase, all-pass systems, minimum phase, generalized linear phase. 8. Filter design by impulse invariance and bilinear transform. 9. Windowed design of FIR filters. 10. Optimal approximations for FIR filter design. 11. Discrete Hilbert Transforms. 12. Hilbert Transforms by complex bandshift. 13. Time-dependent Fourier Transform. 14. Speech, SONAR, Adaptive Filtering, etc.	
Course Competencies:	Application of integral calculus, discrete math, and complex variables, and transform theory to discrete-time signal processing.	Outcome 1
	Ability to apply probability theory in using histograms to estimate power spectral densities.	Outcome 1
	Ability to perform experiments with real-time DSP systems, including discrete-time filters, spectrum analyzer, adaptive filter, etc.	Outcome 2
	Completion of real-time DSP design projects, including discrete-time filters, spectrum analyzer, adaptive filter, etc.	Outcome 3
	Familiarity with basic DSP functions and algorithms (i.e. FIR filters, IIR filters, polyphase systems, windows, FFT's, etc.)	Outcome 5
	Ability to use basic DSP functions and algorithms (i.e., FIR filters, IIR filters, polyphase systems, windows, FFTs, etc.) to formulate and solve engineering problems.	Outcome 5
	Ability to use Matlab, C, and Code Composer Studio as tools to design, implement, and debug DSP functions.	Outcome 11
Schedule:	Lectures: One hour MWF Laboratory: Three hours per week TA Recitations: (None)	
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