ECE-314, Fall 2008
Signals and System

Overview

Course Catalog Description: Linear systems analysis. Signal spectra: Fourier series and the Fourier transform, analog filter design, applications to modulation, Nyquist sampling theorem; discrete-time signals, discrete Fourier series and the discrete-time Fourier transform, elements of the Z-transform, Block diagrams and signal flow graphs for LTI systems.

Prerequisites: EECE—213 and Math 264L

Textbook:
Simon Haykin and Barry VanVeen, "Signals and Systems," Second Edition, John Wiley and Sons Inc, 2003.

Additional Reference:
Oppenheim, Wilsky, and Nawab, "Signals and Systems," Second edition, Prentice Hall Inc, Upper Saddle River, NJ, 1997.

Class Goals: To impart the student with the fundamentals of signal and system analysis, motivate system analysis with applications of signal processing to analog/digital modulation, and to provide students with the needed mathematical analysis tools. Theoretical techniques are supplemented with MATLAB exercises to reinforce concepts.

Course Coordinator: Professor Balu Santhanam.

Recitation Section:

In response to mathematical and prerequisite deficiencies measured by the knowledge probe administered in the first day of class, one recitation hour per week is conducted by the graduate student assistant assigned to the class. The purpose of this extra hour is to enable students to ask questions pertaining to their deficiencies identified in the knowledge probe. Problems will be worked out to illustrate the methodology of solving problems pertaining to the prerequisite material.

Table 1: Objectives, Implementation, and Assessment

Outcomes		Implementation	Assessment	A	B	C	D	E	F	G	H	I	J	K
1	Classification of signals and systems	2 weeks	HW-1	√		√		√						
2	Linear Time-Invariant Systems and convolution	2.5 weeks	HW-2, Quiz 1	√		√		√						√
3	Fourier Series Representation	2.0 weeks	HW-3, Exam-1, Quiz 2	√				√						
4	CTFT and Properties and the DTFT	2.5 weeks	HW-4, Exam-2	√				√						
5	Frequency Response Bode plots and Analog filter design	1.0 week	HW-5, Exam-1,2	√		√		√						√
6	Nyquist Sampling Theorem	2 weeks	HW-6 Exam 2	√		√		√						√
7	The Zee Transform and Properties	2 weeks	HW-7, Quiz 3, Final	√				√						
8	Block Diagrams and Signal Flow Graphs for LTI systems	1 week	HW-7 Final Quiz 4	√		√		√						√

Recommended Course Schedule

Week	Date	Lect.	Topic	Assignment
1	1		Classification of Signals	
1	2		Classification of Systems	
1	3		Elementary signal processing operations	
2	4		Examples of signal/system classification	
2	5		Singularity functions	HW1, Q1
2	6		Continuous-time LTI systems, convolution integral.	
3	7		Examples of evaluating the convolution integral	
3	8		Discrete—time LTI systems and the convolution sum	
3	9		Examples of evaluating the convolution sum	
4	10		Properties of LTI systems	HW2, Q2,
4			Exam I	
4	11		Continuous—time Fourier series representation	
5	12		Properties of the CT--Fourier series	
5	13		Discrete—time Fourier series representation/properties	
5	14		Fourier series and eigen-functions of LTI systems	HW3, Q3
6	15		CTFT Representation and properties	
6	16		CTFT examples	
6	17		DTFT representation and properties	
7	18		DTFT examples	
7	19		DFT/FFT	
7	20		Applications to modulation/demodulation	HW4, Q4
8	21		Spectrum and frequency response	
8	22		Bode plots and analog filter design	
8	23		Examples of multistage analog filter design	
9	24		Digital filters : FIR/IIR, Window design	HW5, Q5,
9			Exam II	
9	25		Nyquist Sampling theorem	
10	26		Signal reconstruction / aliasing	
10	27		Multirate operations	
10	28		Quantization process	HW6, Q6
11	29		Zee-transform definition and examples	
11	30		ROC and causal/anti-causal sequences	
11	31		Properties of the Zee-transform	
12	32		Inverse Zee-transform and examples	HW7, Q7
12	33		System functions and stability	
12	34		Block diagrams and signal flow graphs	
13	35		Structures for continuous—time LTI systems	
13	36		Structures for discrete—time LTI systems	
13	37		Feedback and Mason's grain formula	
14	38		Examples of Mason's gain rule.	HW8, Q8
14	39		Application of Signal Processing: DTMF design	
14	40		Application of Signal Processing: Channel equalization	