INEL 5309 Digital Signal Processing
Spring Semester 2020

Professor: Shawn Hunt
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Textbook: S. Mitra, Digital Signal Processing - A Computer Based Approach, 4/e.

Exams:
There will be 3 partial exams and 1 final exam.
Exam dates: March 4, April 3, and may 6.
MAKE UP EXAMS WILL BE GIVEN ONLY FOR MEDICAL EXCUSES.
If there is a medical reason for missing an exam, you must certify this in order to request a make up. This must be done no later than the first day back after the medical leave.

Homework:
Computer work: There will be 3 computer homeworks to be done in matlab. Instructions on how to do the matlab homework are on the web page. This work is to be done in groups of two students. Select the students for your group and **inform me in writing before the end of the second week of class**. Choose your partner carefully, there will be no changing of group members without first consulting with me. The work must be done by each group individually. Do not copy the homework. Do not talk about the homework with other groups. Homework from two or more groups that are the same will mean a **negative** grade. Due dates will be given with the homework. Late homework will not be accepted.

Homework problems: Homework problems for each topic are given below. The homework is for you to practice doing problems before coming to the exams. To maximize its effectiveness, the problems must be done individually. If you need help, come to the office hours and talk to me, or you may ask for help from other students. The homework problems are not to be handed in.

Grading:
Your Final Grade will be computed as a percentage of 520 total points: 300 points for the partial exams (100 pts for each partial exam), 20 points for homework, and 200 points for the final.

A - 90%-100%
B - 80%-89%
C - 70%-79%
D - 60%-69%
F - below 60%

Your grade may improve due to attendance and class participation. I will not lower your grade if you do not participate in class, but will consider attendance and participation if you only need a few points to reach the next letter grade.

Topics			Sections in Book	Problems
1. Introduction to DSP			1.1-1.5	
2. Discrete Signals	Representation	Definition of a sequence	2.1	
	Operations on Sequences	Product,Addition, Scalar Multiplication, time reversal, delay	2.2	2.3,26,28
	Classification	Length, symmetry, periodicity, bounded	2.3.3	2.24,27
	Common Signals	Unit impulse, unit step, exponential and sinusoidal.	2.4.1	2.4,21
	Sampling		2.5	2.50,class problems
3. Discrete Systems	Representation	Definition	4.1	
	Classification	Linear, Shift invariant, causal, stable	4.2	4.7,8,9
	LTI Systems: Time-domain Characterization	(Definition, Convolution), Finite dimentional Difference equations,cascade&parallel [Stability and causality for LTI]	4.4-4.8	(2.18,21,22,23,28,30,31) 4.27,30,42,43,44,class problems [4.32,34, class problems]
4. Discrete Time Fourier Transform (DTFT)	Definition		3.2	class problems
	∞ sums			
	Properties	Convolution, periodicity, symmetry	3.2.2-3.3	3.5,6,15,16,18,21,23,33,42,53
	What DTFT is used for	Examples and DTFT of cosine	3.8	class problems
5. Discrete Fourier Transform (DFT)	Definition	From DTFT, sampling of	5.2,5.3	class problems
	Matrix Relations		5.2.3	
	Properties	Circular shift, symmetry	5.6,5.7	5.42,54,60,44,45
	Circular Convolution		5.4	
	Linear Convolution using DFT		5.10.1	5.76,77,class problems
6. Spectral analysis	Definition	What it is, how to do it, and why its good; zero padding, windowing		5.18, class problems
7. Z Transform	Definition		6.1	class problems
	Region of Convergence		6.3	6.5,2,8,9,10,17
	Inverse Z transform		6.4-6.4.4	6.25,27,30
	Properties/General use		6.5	6.35,class problems
8. Frequency Representation of Systems	Frequency Response	Frequency response, concept of filtering, group delay, linear phase	4.8-4.9	class problems, 4.55,57,62,64,73,68 class problems
	Transfer Function		6.7	class problems, 6.42,43,44,45,46,47
	Stability and Causality	of LTI systems using TF	6.7.5	
9. Sampling and Reconstruction	In Time		2.5	class problems
	In Frequency		3.8,3.9	
10.Filter Specifications		Lp,hp,bp,bs, with demos	9.1	
11. IIR filter design	IIR Analog filter design	LP, butterworth	A1.2	class problems
	IIR Digital filter design	Bilinear Transformation, HP design	9.2-9.4	class problems
12. FIR filter design	FIR digital filter design	Impulse response truncation	10.2-10.5	class problems