EEL 4510 - Introduction to Digital Signal Processing Fall 2007

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Office Hours: Tuesday and Thursday 10:30 AM – 11:45 AM

SUMMARY:
Introduction to the basic concepts in Digital Signal Processing. Previous knowledge of Linear, Time-Invariant system in the continuous-time domain is used to build understanding of the analysis and design of discrete-time systems. The basic analytical tools, such as the Z transform and the Discrete Time Fourier Transform (DFT) and Fast Fourier Transform (FFT) are developed. Basic Discrete time system (filter) design is introduced.

COURSE OUTLINE:

I) Overview of Digital Signal Processing (DSP)
- Importance and uses of DSP

II) Interface of digital and analog signals and systems
- Analog and Digital Signals
- Analog-to-Digital Conversion (ADC)
- Quantization in Time: Sampling
- Quantization in Amplitude
- Digital-to-Analog Conversion (DAC)
- The Sampling Theorem
- Oversampling

III) Frequency Representation of Discrete-Time Signals
- Fourier Series and Fourier Transform
- The Discrete Fourier Transform (DFT) and its properties
- The Fast Fourier Transform (FFT)
- Other Discrete Transforms

IV) The Z-Transform and Applications to the study of DSP systems
- Definition and Properties
- Applications in Digital Signal Processing
- Transfer Function and Pole-Zero Description of Discrete Time Systems
- Frequency Response
- Difference Equation Description of Discrete Time Systems
- Impulse Response of Discrete Time Systems

V) Correlation and Convolution
- Correlation: Auto- and Cross-Correlation
- Applications of Correlation
- Convolution
- Properties and Methods
- Calculation of the output sequence for an arbitrary input sequence
- Convolution methods

Deconvolution

VI) Finite Impulse Response (FIR) Digital Filters
- Frequency-selective digital filtering
- Types of Digital Filters: Finite- and Infinite Impulse Response Filters
- Filter Design General Steps
- FIR Filters: General Characteristics
- FIR Coefficient Calculation Methods
- Examples

VII) Infinite Impulse Response (IIR) Digital Filters

- IIR Filters: General Characteristics
- Design Stages for IIR Filters
- IIR Coefficient Calculation by Pole-Zero Placement
- IIR Coefficient Calculation through the Bilinear Z-Transform
- Special Considerations for IIR Filters
- Practical Realization Structures for IIR filter implementation.

GRADING:

Quizzes & Homeworks:	15%
TEST 1:	30%
Project(s):	20%
FINAL (Comprehensive)	35%
Overall Grade	100%

96 <= A <= 100	80 <= B- < 84	65 <= D+ < 68
92<= A- < 96	76 <= C+ < 80	62 <= D < 65
88 <= B+ < 92	72 <= C < 76	60 <= D- < 62
84 <= B < 88	68 <= C- < 72	F: Below 60

Missed Test Regulations:
1. Notify Instructor or secretary (348-2807, Pat) BEFORE class, bring written proof to instructor
2. Make-up test will be harder, and will include all material up to the date of the make-up.
3. Make-up test BEFORE next class meeting. See instructor before next class.

Department Regulations Concerning Incomplete Grades:

To qualify for an Incomplete, a student:
1. Must contact (e.g., phone, e-mail, etc.) the instructor or secretary before or during missed portion of class.
2. Must be passing the course prior to that part of the course that is not completed.
3. Must have documented circumstances beyond his/her control.
4. Must make up the incomplete work through the instructor of the course.
5. Must see the Instructor. All missed work must be finished before last two weeks

of the following term.

REFERENCES:

Textbook:

a) Digital Signal Processing: A Practical Approach, 2nd. Edition;
Emmanuel C. Ifeachor & Barrie W. Jervis
Prentice Hall, 2002. ISBN: 0-201-59619-9

Suggested References:

a) First Principles of Discrete Systems and Signal Processing
Robert D. Strum & Donald E. Kirk
Addison-Wesley Publishing Co., 1989. ISBN: 0-201-09518-1
b) Discrete-Time Signal Processing, 2nd Edition
Alan V. Oppenheim, Ronald W. Schafer & John R. Buck
Prentice-Hall Signal Processing Series, 1999. ISBN: 0-13-754920-2

SOME ASSIGNMENTS MAY REQUIRE PROGRAMMING SIMULATIONS. Working knowledge of a high-level language (C, Fortran, etc.) or a simulation environment (MATLAB, etc.), will be needed for those.