ENEE 425 DIGITAL SIGNAL PROCESSING
Spring 2010, Tu Th 3:30–4:45
Classroom: EGR 3106

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Text: Alan V. Oppenheim and Ronald W. Schafer, *Discrete-Time Signal Processing*, 3rd Ed., Prentice Hall, 1999.

Other DSP Books:
Maurice Bellanger, *Digital Processing of Signals*, Wiley, 1984.

Leland B. Jackson, *Digital Filters and Signal Processing*, Kluwer Academic Publishers, 1996.

Boaz Porat, *A Course in Digital Signal Processing*, Wiley, 1997.

John G. Proakis and Dimitris G. Manolakis, *Digital Signal Processing*, second edition, Macmillan, 1992.

S.A. Tretter, *Introduction to Discrete-Time Signal Processing*, Wiley, 1976.

Homework and Projects

Homework will be assigned periodically. It will not be collected. Solutions will be discussed at the beginning of the class period after the one in which the homework was assigned. **I STRONGLY URGE YOU TO DO THE HOMEWORK BEFORE THE SOLUTIONS ARE PRESENTED!** Practice solving problems is an excellent way to learn the material and test whether you fully understand it. There is no substitute for the mental processes you have to go through to solve the problems on your own. As Seniors, I assume you have reached the maturity level to independently do the work required to learn the course material.

A few computer oriented projects will be assigned and collected. You must turn in the projects or else you will get an "I" (incomplete) grade. You can use your favorite programming language for the projects. However, MATLAB is a very convenient programming environment to use. It is available on the GLUE SUN work stations, many PC labs like the Jasmine lab on the second floor of AVW, and student versions are available in the book store at a reasonable price for PC's and MAC's. It's integrated graphics are very convenient for plotting signals. MATLAB has become a popular tool in industry for simulations.

Exams

There will be two exams during the semester and a comprehensive final exam. All exams will be **closed book**.

	Topics	**Percent of Grade**
EXAM 1	I through V	25
EXAM 2	VI through VIII	25
FINAL EXAM	Comprehensive	40
PROJECTS		10

FINAL EXAM DATE: Wednesday, May 19   10:30am–12:30pm

COURSE OUTLINE

I. Introduction

II. Uniform Sampling (Chapter 4)

   A. Sampling as a Modulation Process and Aliasing (4.1–2)
   B. Ideal Impulse Sampling (4.2–2)
   C. The Sampling Theorem (4.3)
   D. Sampling Band-Pass Signals (12.4)

III. Data Reconstruction by Polynomial Interpolation and Extrapolation

   A. The Zero-Order Hold (4.8.4),(7.8.2)
   B. The First-Order Hold
   C. The Linear Point Connector

IV. The Z-Transform (Chapter 3)

   A. Definition of the Z-Transform (3.1–2)
   B. The Inverse Z-Transform (3.3)
   C. Useful Transform Relationships (3.4)
   D. Parseval's Theorem (2.9.5)
   E. Difference Equations and the Unilateral Z-Transform (2.5)

V. Analysis of Sampled-Data Systems by Transform Methods (Chapter 5)

   A. Transfer Functions for Discrete-Time Systems (3.4.7),(5.1)
   B. Sinusoidal Steady-State Frequency Response (5.1–7)
   C. Structures for Realizing Transfer Functions (Chapter 6)
   D. Stability (2.2.5),(2.4),(5.2.1)
   E. Decimation and Interpolation (Multi-rate Systems) (4.6–7)

VI. The Design of Transfer Functions for Digital Filtering (Chapter 7)

   A. The Bilinear Transformation Method for IIR filters (7.2.2)
   B. Fourier Series and Window Function Method for FIR Filters (7.5–6)
   C. Design of FIR Filters by the McClellan-Parks Remez Algorithm (7.7–8)

VII. Effects of Quantization and Finite Word Length Arithmetic in Digital Filters

   A. A/D Quantization Noise (4.8.2–3)
   B. Arithmetic Round-Off Noise (6.9)
   C. Quantization of Filter Coefficients (6.8)
   D. The Deadband Effect and Limit Cycles (6.10)

VIII. The Discrete Fourier Transform (Chapter 8)

   A. Definition of the DFT and the IDFT (8.1)
   B. Useful Transform Relationships (8.2)
   C. Cyclic Convolution and Correlation (8.2.5)
   D. The Fast Fourier Transform (FFT) (Chapter 9)
   E. Filtering Long Sequences Using the DFT (8.7)