Title	**EEL 5701: Foundations of Digital Signal Processing**
Section	Fall 2005 (section 1560)
Instructor	Dr. Jianbo Gao Email: gao@ece.ufl.edu Office Hours: MWF 9:30 am-10:20 am Location: NEB 427 Phone: 392-0918 (email preferred)
Teaching Assistant	Pravin: pravin@ufl.edu Office hour: TBA
Class Schedule	*Classroom:* • LAR 310 *Class Times:* • MWF, Period 2 (8:30-9:20 am)
Class web site	http://www.gao.ece.ufl.edu/EEL5701 **It is the responsibility of each student to check the web site and their email account regularly for announcements.**
Course Description	Signals and systems; Fourier transform; z-transform; sampling; analysis and design of digital filters for discrete signal processing; spectral analysis
Prerequisites	• Solid understanding of systems theory, including convolution, Fourier transforms, and impulse functions. • **Computer requirement:** Some homework problems will require numerical computation. MATLAB is well suited to these exercises, but the student is free to use other software. Computer accounts can be setup for registered students in the computer lab in NEB 288. Alternatively, students may wish to purchase the student version of MATLAB to ensure access to the software as needed. **Note:** *Not being able to access a public computer will not be a valid excuse for late or missing homework assignments.*

Required Textbook	• Oppenheim, Schafer, and Buck , *Discrete-Time Signal Processing*, 2nd ed., Prentice-Hall, 2nd ed., 1999 (ISBN 0-13-754920-2)
Reference Textbooks	• Proakis and Manolakis, *Digital Signal Processing: Principles, Algorithms and Applications* • Mitra, *Digital Signal Processing, 3rd edition*
Topics (as time permits)	**Historical perspective** **Introduction** - Analog versus digital processing. **Basic Discrete**-Time Concepts - Discrete linear systems, impulse response, convolution, stability, frequency response, difference equations. **Z-Transform** - One-sided Z-transform, definition and properties, two-sided Z-transform, convergence, inversion, stability and causality. **Discrete-Time Fourier Transform** (DTFT) - Frequency response, Fourier transform of sequences (DTFT), sinusoidal response, properties of Fourier transform, Examples. **Review of Continuous Signals and Systems** - Fourier integral and properties, Gibb's phenomena, uncertainty principle. **Generalized Functions and Fourier Series** - Impulse function, generalized functions and their transforms, generalized limits, Fourier series and Poisson formula, continuous linear filters. **Digital Processing of Analog Signals** - Analog-digital conversion, sampling theorem revisited, digital-analog conversion. **Digital Filter Design I** - FIR filter design, windowing, frequency sampling, CAD: Parks-McClellan algorithm. **Digital Filter Design II** - IIR filter design, analog prototypes, impulse invariance, bilinear transformation, lowpass-to-otherpass transformations. **Discrete Fourier Transform (DFT)** - Inversion and properties, cyclic convolution, uniqueness of DFT for

convolution, linear convolution via DFT, sectioned convolutions.

Fast Fourier Transform (FFT) Algorithms - Complexity of DFT, decimation-in-time FFT, decimation-in-frequency FFT, mixed-radix FFT algorithms, prime factor FFT, Winograd fast convolution algorithm.

Discrete-Time Random Processes - Distribution and density, autocorrelation and power spectrum, linear filtering of random processes, optimal MMSE filtering.

Multi-Rate Processing and Subband Filter Banks - Decimation and interpolation, sampling rate conversion, narrowband Fourier transform, short-time Fourier transform and spectrogram, subband decompositions, analysis/synthesis filter banks, wavelets.

Nonlinear Digital Filters - Noise smoothing, median filter, order statistic filters.

Spectral analysis

Course Policies

- **Attendance:**
  - Perfect class attendance is not required, but regular attendance is expected, and a class participation grade will be assigned.
  - It is the student's responsibility to independently obtain any missed material (including handouts) from lecture. ***Lecture notes will not be provided.***
  - There will be ***no make-up exams.***
- **Late Assignments:**
  - Most ECE courses have too many students to expect the instructor or the TA to keep track of late assignments. They may be misplaced or may result in delayed or missing grades. Therefore, the following late policy will be applied with no exceptions.
  - First late assignment = ***grade reduction of 25%*** , if it is received ***before*** the solutions are posted. (Otherwise, the grade will be zero.)
  - All other late assignments = ***grade of zero*** .
- **Collaboration:** Discussion of homework questions is encouraged. Please be absolutely sure to submit your own independent homework solutions though.

- **Announcements:**
  - All students are responsible for announcements made in lecture, on the student access website, or via the class email list.
  - It is expected that you will **check your gatorlink email and the student access website several times per week** (preferably the night before each lecture) for possible course announcements.
- **Students with disabilities:**
  - For information on classroom accommodation and requirements for instructor notification, please see (http://www.dso.ufl.edu/drp/faqs.htm).

Academic Honesty

- *All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action.*

  This statement is a reminder to uphold your obligation as a student at the University of Florida, and to be honest in all work submitted and exams taken in this class and all others.

  For more information, please see the academic honor code.

Grading

Grades	*%*	*Dates*
HOMEWORK	30%	About every two weeks
MIDTERM EXAM	30%	TBA
FINAL EXAM (cumulative)	40%	TBA
Bonus grade (up to 20%)		Awarded to exceptional computer-based homeworks.