ECE 346: Digital Signal Processing – Spring 2013

MTh 8:40–10:00 AM, PH–115

Instructor

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Course Website: http://www.rci.rutgers.edu/~wub1/courses/ece346sp13.html
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Teaching Assistants

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Required Text

Alan V. Oppenheim and Ronald W. Schafer, *Discrete-Time Signal Processing*, Prentice Hall (3rd edition, ISBN-10: 0-13-198842-5)

Caution: *Some homework problems might be assigned from the text. Please match your book's ISBN with the ISBN listed above or consult with the library reserve to ensure you will be solving the right problem.*

Reference Texts (*not required*)

- James H. McClellan, Ronald W. Schafer, and Mark A. Yoder, *Signal Processing First*, Prentice Hall **(highly recommended for students with weak understanding of the prerequisites)**
- Sophocles J. Orfanidis, *Introduction to Signal Processing* (available freely online)
  URL: http://eceweb1.rutgers.edu/~orfanidi/intro2sp/

Prerequisites

The courses ECE 345 (and ECE 347) *Linear Systems and Signals* (and Lab). In particular, enrolled students should be comfortable with the concepts of complex numbers, Fourier, Laplace, and z transforms, continuous and discrete signals and systems, time-domain and frequency-domain relationships between the input and output of linear, time-invariant (LTI) systems, continuous and discrete convolutions, etc. The students will also be expected to turn in some assignments using MATLAB.

Course Policies

The final course grade will be based upon:

1. Pre-requisite quiz (2%)
2. Attendance quiz(zes) (5%)
3. Biweekly homework (5%)
4. Term report (10%)
5. Two in-class exams (44%)
6. Final exam (34%)

Attendance quiz(zes) policy: If the number of students present in the class drops below 2/3rd of the class size then the instructor can initiate an attendance quiz, with all those absent getting zeros and all those present getting full marks.

Late homework submission policy: Every student gets a grace period of up to 3 days for a maximum of two homeworks during the semester. Utilization of the first grace period is without any penalty. Utilization of the second grace period comes with a 30% penalty. No late submissions will be accepted from a student who has utilized both these grace periods.

Exam policy: Exams will typically be open required text and class notes *only*. As a general policy, there will be no makeup exams. I will allow exceptions for rare emergency situations, but this would require at least 7 days advance approval to skip an exam. Any one not appearing in an exam without such prior approval will automatically get a 0.

Grading policy: Grades will be assigned on a relative basis. The relative scale though will vary based upon the performance of the overall class. In an ideal setting, students above class average will get B and higher and students below class average will get C+ and lower. If the class performs really well, however, then the B will turn into B+ (or even A!). Similarly, if the class performs really bad then the B will turn into C+ (or even C).

Attendance policy: There will be insights, examples, and notes covered in class that cannot be easily gleaned from the required and recommended texts. It is therefore in the students' best interests that they regularly attend the class. However, there will be no formal roll call in the class other than the attendance quizzes.

Mobile and computing devices policy: Use of mobile and computing devices during the class is strictly forbidden. The only exception to this rule is when a student uses a computing device in order to take notes using a stylus.

Tentative Course Outline

- *Weeks 1-5—Introduction to Signal Processing and Sampling Theory:* Introduction, sampling of continuous-time (CT) signals, aliasing, sampling theorem, reconstruction & anti-aliasing filters, discrete-time Fourier transform (DTFT), properties of the DTFT, discrete-time (DT) processing of CT signals, finite impulse response (FIR) and infinite impulse response (IIR) DT, LTI systems, convolution in the matrix–vector form, tapped delay line model of FIR filters, digital processing of analog signals, A/D and D/A conversion, and quantization error
- *Weeks 5-7—First Midterm*
- *Weeks 6-10—Discrete and Fast Fourier Transforms:* Discrete Fourier transform (DFT), properties of the DFT, linear convolution using the DFT, fast Fourier transform (FFT, and spectral analysis of signals using the DFT
- *Weeks 9-11—Second Midterm*

- *Weeks 11-15—Design of IIR and FIR Filters:* Analysis of LTI systems using the z-transform and the pole–zero diagram, realizations of filters in direct form I and direct form II, realizations of filters in cascade and parallel form, design of digital filters and IIR filter design using impulse invariance, and FIR filter design using the windowing method
- *Week 15—Term Report Due*