ECE 346: Digital Signal Processing – Spring 2015

Lectures (All Sections) — MTh 8:40–10:00 AM, PH–115

Instructor

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Means of Communication

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Office Hours

Office Hours: M 10:15–11:00 AM
Additional Office Hours: By appointment

Teaching Assistants

Zahra Shakeri – `zahra.shakeri@rutgers.edu`
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TA-led Recitations *(starting Jan. 26)*

Section 1: W 10:20–11:40 AM, EN-B125
Section 2: M 03:20–04:40 PM, EN-D110
Section 3: T 03:20–04:40 PM, EN-D110

Required Text

Sanjit K. Mitra, *Digital Signal Processing: A Computer-Based Approach, 4/e*
McGraw-Hill (ISBN-13: 978-0077366766)

Caution: *Some homework/practice 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 Text (*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)**

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 are also expected to be comfortable with the use of MATLAB for assignments/projects.

Course Policies

The final course grade will be based upon:

1. Pre-requisite quiz (2%)
2. Random attendance (3%)
3. Quizzes (5%)
4. Homework (5%)
5. Term Project (7.5%)
6. Two in-class exams (40%)
7. Final exam (37.5%)

Random attendance policy: Because of its convoluted nature `:)`, it will be explained in the video introduction.

Late homework submission policy: Every student gets a grace period of up to 3 days for a maximum of two homeworks. 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.

Quiz makeup policy: As a general policy, no makeups will be permitted for the quizzes. However, rules are meant to be broken `:)`, so feel free to bring up any special circumstances to my knowledge and I will be happy to review the makeup requests on a case-by-case basis.

Exam policy: Exams will be closed book and closed notes. Students can bring in two, two-sided letter-sized pages for midterm exams and four, two-sided letter-sized pages for the final exam. 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 at and below class average will get C+ and lower, respectively. 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).

Academic misconduct and plagiarism warning

It is important that the students familiarize themselves with the Rutgers Academic Integrity Policy, available at `http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers`, and the definition of plagiarism (see, e.g., `http://www.plagiarism.org/plagiarism-101/what-is-plagiarism/`). All cases of academic misconduct, whether minor or major, will not only be reported to the School of Engineering, but will, in most cases, also result in loss of one or more grade points.

Some tips for making learning the class material easier

Let's admit it, digital signal processing is a hard class. But we can work together in a team to make it a fun and enjoyable class. I will work hard to achieve this goal, but all of you have to work equally hard to make this a reality. Here are some tips that I hope you will remember to ensure you have a good learning experience throughout the class.

- If you feel lost during the class, please reach out to the instructor and/or the TAs. You will be surprised to know that the instructor does not turn into a monster during office hours :).
- Because of the mathematically intensive nature of the course, one cannot learn it by forgetting about it till it is time for an exam. It is therefore important that you try to keep up with the class material on a regular basis.
- Class lectures are not enough to learn everything about the course. Reading material and sample problems (ungraded) will be assigned on a regular basis to help you learn all the important aspects of the course. Please make sure you keep up with these things, which will be communicated via email and via the course website.
- While the percentage of the grade assigned to quizzes and homeworks is small, these two categories are going to teach you the most and ensure that you do well on the exams. The purpose of keeping the percentage small is that you don't feel pressured to blindly cheat from other students. You are encouraged to discuss things with others, but you will be doing yourself a big favor by doing the homeworks and quizzes in the end by yourself.

Tentative Course Outline

- *Week 1*—Introduction to signal processing and review of key pre-requisite concepts
- *Weeks 2-6*—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 7-11*—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 12-14*— 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