

ECE 346: Digital Signal Processing – Spring 2016

Lectures (All Sections) — MTh 8:40–10:00 AM, SEC–118

Instructor

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Modes of Communication

Piazza: <http://piazza.com/rutgers/spring2016/ece346/home> (preferred mode)
E-Mail: waheed.bajwa@rutgers.edu
Twitter: @SigProcessing (#RUECE346)
YouTube Channel: <http://youtube.com/c/SigProcessing>

Office Hours

Mondays 10–11 am, but only after an appointment has been made by the prior Sunday 1 pm at the latest.

Teaching Assistants

Ahmed Al-Abdel Abass (aa998@scarletmail.rutgers.edu)
Bo Li (b1352@scarletmail.rutgers.edu)

TA-led Recitations (starting Jan. 21)

Section 1: Wednesdays, 6:40–8 PM in EN-B125
Section 2: Mondays, 3:20–4:40 PM in EN-D110
Section 3: Tuesdays, 3:20–4:40 PM in EN-D110
(*you can subscribe to the calendar on Sakai*)

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 various exercises and the term project.

Course Policies

Division of Grades. The final course grade of 100% will be divided into the following categories:

1. Pre-requisite quiz: 1%
2. In-class activities: 15%
3. Recitation activities: 7%
4. Home activities: 7%
5. Two midterm exams: 35%
6. Term project: 7.5%
7. Final exam: 27.5%

Given that this is going to be a “flipped class,” you might not be familiar with the meanings of in-class, recitation, and home activities. In each class, we will carry out a number of activities using polling, solution sheets, and Matlab. These won’t be quizzes; rather, I and the peer leaders will be there to help you. Plus, you will be allowed to work in groups. These in-class activities will carry 15% of the total course grade. There will be some activities in recitations also (though on a smaller scale); hence, the name of recitation activities. Finally, the activities that you carry out outside class or recitations are termed home activities.

Will Attendance be Taken? There won’t be any attendance taken in class. Before you jump with joy on reading this, however, keep this in mind. There won’t be any make up for in-class or recitation activities. Further, 20% to 50% of each activity’s grade will be given for just submitting the activity (e.g., taking a poll might give you 50% of the grade of the question, even if you got the answer wrong). So, if you skip a class or recitation, you essentially lose out on valuable activity points. Can you afford to do that? Only you can answer that question.

The Implicit Attendance Policy Sounds so Cruel ... X-(How can I expect any one to attend every single class and recitation, especially when the class starts at 8:40am? Well, the simple answer is I don’t! And that is why I have another policy to accommodate missed classes and recitations due to genuine emergencies. Each student will get automatic bonus points in the three categories of the activities according to the following formula:

- In-class activities: 15% extra points (effectively, 3% of the course grade)
- Recitation activities: 20% extra points
- Home activities: 10% extra points

Here are a couple of scenarios to convince you that these extra points are effectively allowing you to either miss some classes, recitations, or home activities due to genuine emergencies or underperform in those activities.

- Say a student misses 3 classes, resulting in missing approximately 12% of the in-class activities. However, since that student will get 15% extra points automatically, this still gives him/her the opportunity to score 100% on the in-class activities. (Note that the total of in-class activities will be capped at 100%.)

- Say a student has not missed any class, but has been underperforming on some of the activities (remember that just taking part in the activities gets you some points). In that case, the extra 15% points for in-class activities allows such a student to make up for that bad patch.

In short, the bonus points are your buffer for either a bad patch or a few missed classes (similarly, recitations and in-home activities). I strongly encourage you to use this buffer wisely and try not to miss classes and recitations. As I wrote earlier, *there would not be any make-up of activities under any circumstances.*

Relative or Absolute Grading? 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). In short, I have no hesitation giving the entire class A's, if the class deserves them (or vice versa for F's).

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.

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. ***In particular, in order to facilitate learning, this year's offering of ECE 346 will be a "flipped class."*** I will be assisted in this offering through not only two TAs but also a number of "peer leaders." These PLs are ECE seniors who took my class last year and are interested in helping you out this year. As you will realize during the course of the semester, a flipped classroom means a lot of work for the instructor and his/her helpers. At the same time, it will also be a lot of work for you, ranging from coming to the class prepared (see below) to actively engaging during class and recitation times with the instructor/PLs and the TAs (no more snoozing, unfortunately). But I am confident that we can work together as a team during this semester and successfully achieve our learning goals.

Here are in particular some tips that I hope you will remember to ensure you have a good learning experience throughout the semester.

- You must keep up with the assigned videos and reading assignments to benefit from the flipped structure of the class (more on that later).
- If you feel lost at any time during the semester, please do not hesitate in reaching out to the instructor team (myself, TAs, and/or PLs).
- Pay attention to the flow of information via email and Piazza. Stay engaged, both within and outside the class. Make good use of Piazza for clarifying any doubts and also helping your fellow students.
- 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, especially if you either late to the class/recitation and/or end up missing a class or recitation.

- While the idea of a flipped classroom is that most of the learning takes place during the class time, this alone would not be enough for you to retain all the information. You have to ensure that you revisit the exercises done during class and recitation times for fully retention.

That's all from my side on this topic folks. Happy learning!

Tentative Course Outline

- Introduction to signal processing and review of key pre-requisite concepts (4 classes)
 - This year, the students have been introduced to discrete-time Fourier transform. This means both CTFT and DTFT will be part of the pre-requisite concepts.
- Basic components of a DSP system that involves continuous-time signals (8 classes)
 - This will involve sampling theory, types of discrete-time filters, discrete-time processing of continuous-time signals, practical issues associated with A/D and D/A conversion, etc.
- Finite-length transforms of discrete-time signals (8 classes)
 - This will involve DFT at the very least, but could also include STFT, DCT, Haar, etc.
- Analysis and design of LTI systems (6 classes)
 - This will involve z-transform based analysis of LTI systems as well as design of IIR and FIR filters.

The remaining two classes will be used for midterm exams. Please note that this is a “tentative” course outline and we will go faster or slower depending upon how the semester unfolds.