ECE 521: Digital Signals and Filters – Fall 2012

MTh 3:20–4:40 PM, CoRE–538

Instructor

Waheed U. Bajwa
723 CoRE, Tel. 732-445-6400 x280
E-Mail: waheed.bajwa@rutgers.edu
Office Hours: MTh 4:45–5:45 PM
Course Website: http://www.rci.rutgers.edu/~wub1/courses/ece521f12.html
Sakai: https://sakai.rutgers.edu/portal/site/49bba31a-43d3-4c11-a55d-34b376239386

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*)

- John G. Proakis and Dimitris K. Manolakis, *Digital Signal Processing*, Prentice Hall (4th edition)
- Gilbert Strang and Truong Nguyen, *Wavelets and Filter Banks*, Wellesley College (2nd edition)
- Stephane Mallat, *A Wavelet Tour of Signal Processing: The Sparse Way*, Academic Press (3 edition)
- Jean-Luc Starck, Fionn Murtagh and Jalal M. Fadili, *Sparse Image and Signal Processing: Wavelets, Curvelets, Morphological Diversity*, Cambridge University Press (1st edition)

Prerequisites

Students must have taken ECE 345 (Linear Signals and Systems) and ECE 346 (Digital Signal Processing) or equivalent courses at other universities. In addition, it is expected that students are comfortable with the use of MATLAB.

Course Policies

The final course grade will be based upon:

1. Homework (10%)
2. Class participation (5%)
3. Two in-class exams (45%)
4. Two mid-term projects (25%)
5. Final project (15%)

Typesetting policy: Being a graduate class, it is expected (but not required) that students turn in their homeworks and projects using LaTeX. In order to incentivize this, every homework and project typeset in LaTeX after October 1 would get up to an extra 10% of the graded points.

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: The 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 B and lower. If the class performs really well, however, then the B+ can turn into an A. Similarly, if the class performs really bad then the B+ will turn into B (or even C+!).

Attendance policy: There will be insights, examples, and notes covered in class that cannot be easily gleaned from the required and reference 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.

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 1-8—Traditional Signal Processing:* Introduction, review of background material, Shannon–Nyquist sampling theorem, multirate signal processing, filter banks, discrete Fourier transform, structures for discrete-time systems, and design of FIR and IIR filters
- *Weeks 9-12—Transform Domain Analysis of Signals:* Discrete Fourier transform, time–frequency analysis, and discrete wavelet transforms
- *Weeks 13-14—Beyond Nyquist Sampling:* Introduction to the general sampling theory and compressive sampling of (discrete) signals