ECE 521: Digital Signals and Filters – Fall 2013

MTh 3:20–4:40 PM, CoRE–538

Instructor

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Course Website: http://www.rci.rutgers.edu/~wub1/courses/ece521f13.html
Sakai: https://sakai.rutgers.edu/portal/site/4327793c-a312-4990-9e08-0a4051dbedd1

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 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 Texts (*not required*)

- Martin Vetterli, Jelena Kovacevic, and Vivek Goyal, *Foundations of Signal Processing*, Cambridge University Press (2013). ***Online:*** http://www.fourierandwavelets.org/FSP_b2.0_2013.pdf
- Jelena Kovacevic, Vivek Goyal, and Martin Vetterli, *Fourier and Wavelet Signal Processing*, Cambridge University Press (2014). ***Online:*** http://www.fourierandwavelets.org/FWSP_a3.2_2013.pdf
- Sanjit Mitra, *Digital Signal Processing*, McGraw-Hill (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. Individual Matlab assignments (15%)

2. Two in-class exams (55%)

3. Team term project (30%)

Typesetting policy: Being a graduate class, it is expected that students typeset, either in LaTeX or other software of choice, reports of their individual assignments and term projects. Failure to meet this expectation will result in automatic deduction of points.

Late assignment submission policy: No late submissions for the term project will be accepted. Every student gets a grace period of up to 3 days for one assignment during the semester. Utilization of this grace period comes with a 20% penalty. No late submissions will be accepted from a student who has utilized this grace period.

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[1]

- *Weeks 1-8—Sampling Theory:* Topics include sampling and reconstruction of bandlimited signals, multiband signals, multidimensional signals, as well as blind multiband signal sampling, sampling in shift-invariant subspaces, etc.
- *Weeks 9-12—Transform-Domain Signal Processing:* Topics include processing and analyses of signals using the discrete Fourier transform, short-time Fourier transform, and wavelet transforms
- *Weeks 13-14—Design of Digital Filters and Filter Banks:* Topics include design of finite impulse response filters using the window method and the ParksMcClellan algorithm, as well as fundamentals of the filter bank theory

[1] *Caveat emptor:* This outline is subject to change as the semester progresses. In particular, some topics listed in here might not be fully covered.