Syllabus for ECE503
Digital Signal Processing
Spring 2014

Instructor: Prof. D. Richard Brown III

- Office: AK313
- Office hours: Wednesdays 1:30-3:00pm or email me for an appointment.
- email: `drb@ece.wpi.edu`

Teaching Assistant: Radu David

- Help session hours: Mondays 1:00-3:00pm AK207.
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Class Meets:

Mondays 6:00–8:50pm AK219 except Jan. 20 (MLK), Mar. 10 (spring break), and Apr. 21 (Patriots' Day).

Examination Schedule:

- Comprehensive final exam: Monday, May 5.

Course Description (from the WPI Catalog):

Discrete-time signals and systems, frequency analysis, sampling of continuous time signals, the z-transform, implementation of discrete time systems, the discrete Fourier transform, fast Fourier transform algorithms, filter design techniques. (Prerequisites: Courses in complex variables, basic signals and systems).

Expected Background:

Students taking ECE503 should have a basic understanding of discrete time signals and systems (ECE2312 or equivalent) including a working knowledge of sampling theory, time-domain signal and system representation, z-transforms, and frequency domain analysis. Students in ECE503 are also expected to have some experience programming in Matlab and an understanding of basic matrix/vector operations in Matlab.

Required Textbooks:

- *Discrete-Time Signal Processing*, third edition, Alan V. Oppenheim, Ronald W. Shafer (Prentice Hall).

Other Potentially Useful Books:

Digital signal processing is a rich field with an abundance of high-quality textbooks. Here are some references that you might find useful for understanding some of the material covered in ECE503:

- *Digital Signal Processing*, fourth edition, J. Proakis and D. Manolakis (Prentice Hall). This book has been used for previous offerings of ECE503 and is another popular graduate-level textbook on the subject of digital signal processing.
- *Digital Signal Processing: A Computer Based Approach*, fourth edition, Sanjit K. Mitra (McGraw-Hill). This book has also been used for previous offerings of ECE503.
- *Understanding Digital Signal Processing*, third edition, R. Lyons (Prentice Hall). A textbook focused more on practical issues in digital signal processing, full of useful tips and tricks.
- Your ECE2312 (undergraduate discrete-time signals and systems) textbook.

Tentative Course Schedule:

Date	Quiz	Topic	Reading
Jan 16	none	Course introduction, notation, review of basic discrete-time signals and systems concepts.	2.0–2.11
Jan 27	1	The z-transform, part 1	3.0–3.3
Feb 03	2	The z-transform, part 2	3.4–3.7
Feb 10	3	Sampling of continuous-time signals, part 1	4.0–4.6
Feb 17	4	Sampling of continuous-time signals, part 2	4.7–4.10
Feb 24	5	Transform analysis of LTI systems, part 1	5.0–5.3
Mar 03	6	Transform analysis of LTI systems, part 2 [project 1 assigned]	5.4–5.8
Mar 10		Spring Break.	
Mar 17	7	Structures for discrete-time systems, part 1 [project 1 due by 6pm]	6.0–6.6
Mar 24	8	Structures for discrete-time systems, part 2	6.7–6.11
Mar 31	9	Filter design techniques	7.0–7.4
Apr 07	10	The discrete Fourier transform, part 1	8.0–8.6
Apr 14	11	The discrete Fourier transform, part 2 [project 2 assigned]	8.7, 10.0–10.4
Apr 21		Patriots Day (no class)	
Apr 28	12	No new material assigned [project 2 due by 6pm]	review
May 05	none	Comprehensive final examination	done!

Quizzes, Projects, and Grading

In meetings 2-13, a 60-minute quiz will be given in the second half of the meeting period. Quizzes are open-book and open-notes. Use of calculators is also permitted during quizzes. No laptop computers, phones, or tablets are permitted.

Here is how it works: At the end of meetings 1-12, students are responsible for watching the screencasts posted to the course website, reading the assigned chapters in the textbook, and working on the suggested problems to reinforce key concepts and test their understanding of the material. The screencasts are not intended to be comprehensive and can be watched before or after reading the assigned material in the textbook. Working on the suggested problems collaboratively is encouraged, although it is important that each student learns the material and is capable of taking the quiz without help from other students. Homework is not collected or graded in this course. Any discussion/questions should be posted to Piazza. Based on the Piazza discussion leading up to the next lecture (and any questions raised in office hours), the instructor will prepare lecture materials and examples for the first half of the class meeting period, prior to the quiz. The quiz will be focused primarily on the reading assignment for the prior week, but may rely on concepts developed in earlier weeks.

For example: At the end of the Jan 16 meeting, students should read Chapter 2 of the textbook, watch the screencasts, and work on the suggested practice problems. The first half of the Jan 27 meeting will be an open discussion on the key concepts and examples related to the reading assignment and the practice problems. The Jan 26 meeting will conclude with a 60-minute quiz on these topics.

Makeup policy: You must notify the instructor and schedule a makeup quiz **in advance** if you are unable to attend class. Failure to schedule a makeup quiz in advance will result in a grade of zero on that quiz.

Two projects will also be assigned: one to be completed over spring break and one to be completed in the April (Patriots day) break. Each project grade is weighted the same as one quiz. The comprehensive final examination scheduled for the final meeting is weighted equal to two quizzes.

Grading

There are a total of twelve quizzes, the lowest two of which may be dropped. Each project has the same weight as one quiz and the final exam has the weight of two quizzes. Adopting a quiz, project, and final exam grade scale of 0-100, the final average will be computed as

$$\text{final average} = \frac{(\text{total of best 10 quizzes}) + (\text{project 1}) + (\text{project 2}) + 2 \times (\text{final exam})}{14}$$

Class participation bonus: A multiplier of up to 1.05 will be applied to the final average for students that consistently participate in the class discussions (in the classroom and on Piazza) over the course of the semester. Students are encouraged to answer each other's questions on Piazza.

Course Web Page and Announcements:

The official web page for this course is:

`http://spinlab.wpi.edu/courses/ece503_2014/`

Most of the course materials will be available here. Announcements and Q&A will be posted on Piazza.

Important course announcements such as schedule changes will be sent via the course email distribution list:

`ece503@ece.wpi.edu`

A test email was sent prior to the first lecture. If you did not receive it, send an email to the Instructor and we will correct the problem.

End of Syllabus