

Syllabus for ECE503
Digital Signal Processing
Spring 2012

Instructor: Prof. D. Richard Brown III

- Office: Atwater Kent 313
- Office hours: Wednesdays 1:30-3:00pm or email me for an appointment.
- email: drb@ece.wpi.edu

Class Meets:

Mondays 6:00–8:50pm AK233 except Jan. 16 (MLK), Mar. 5 (break), and Apr. 16 (Patriots' Day).

Examination Schedule:

- Midterm exam: Monday, February 27.
- Final exam: Monday, April 30.

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:

- *Digital Signal Processing: A Computer Based Approach*, fourth edition, Sanjit K. Mitra (McGraw-Hill).

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.
- *Discrete-Time Signal Processing*, third edition, A. Oppenheim and R. Shafer (Prentice Hall). Another popular graduate-level textbook, perhaps a bit more theoretical than Mitra or Proakis and Manolakis, on the subject of digital signal processing.
- *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:

Meeting	Date	Topics	Reading
1	01/12	Course introduction and review. Discrete-time signals in time and frequency domains. Bandpass sampling.	Chaps. 1-3
2	01/23	Review of discrete-time systems.	Chap. 4
3	01/30	Finite-length discrete transforms including the DFT and the short-time Fourier transform.	Chap. 5
4	02/06	The z -transform.	Chap. 6
5	02/13	LTI discrete-time systems in the transform domain.	Chap. 7
6	02/20	Digital filter structures.	Chap. 8
7	02/27	MIDTERM EXAM	
8	03/12	IIR digital filter design.	Chap. 9
9	03/19	FIR digital filter design.	Chap. 10
10	03/26	DSP algorithm implementation.	Chap. 11
11	04/02	Analysis of finite wordlength effects.	Chap. 12
12	04/09	Multirate digital signal processing.	Chap. 13
13	04/23	Multirate filter banks.	Chap. 14
14	04/30	FINAL EXAM	

In each meeting, I plan to nominally lecture for the first hour on material from the assigned reading that I feel is the most interesting, important, and/or difficult to understand. This lecture will *not* be a comprehensive coverage of the assigned reading since there is little value in having me just repeat basic material from the textbook that is already clearly explained. After a break, I will solve some example problems, using Matlab as appropriate to simulate or verify the solutions. The remaining time will then be spent on open discussion, including any questions you have from the assigned reading or homework problems.

For this to format to work, you will need to read the assigned materials in *advance* of each meeting and prepare a list of questions to ask in lecture. Reading the assigned materials after lecture will be much less effective.

Course Web Page and Announcements:

The official web page for this course is:

http://spinlab.wpi.edu/courses/ece503_2012/

All course materials including homework assignments, their solutions, any announcements, and useful links will be made available here.

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.

Grading, Exams, and Homework Policy

Grading for the course is on a 1000-point scale, with the points distributed as follows:

Homework assignments (10 worth 25 points each, drop two lowest)	200
Midterm Exam	300
Comprehensive Final Exam	500
Total	1000

To encourage an interactive classroom environment, I will apply up to a 5% bonus to your final grade for class participation.

Exams are closed-book and closed-notes. If you wish, you may bring one sheet of paper with notes (in your own handwriting — no photocopies or printouts) on one or both sides to the midterm examination. Two sheets of paper with notes may be brought to the final examination. Use of a calculator is permitted during examinations.

Homework assignments are due by the end of each lecture. A 20% late penalty will be deducted from a homework assignment turned in after class on the Monday it is due but before 5:00pm on the subsequent Tuesday. A 40% late penalty will be deducted from a homework assignment turned in after class on the Monday it is due but before noon on the subsequent Wednesday. Since homework solutions will be posted on Wednesday afternoons, no homework assignments will be accepted after noon on Wednesdays following the homework due date.