EEO303 Digital Signal Processing

Bulletin Course Description

Covers the general area of discrete-time signals and the analysis and design of discrete time systems. Topics include time domain analysis, solutions of difference equations, Z-transform analysis, sampling of continuous-time signals, discrete Fourier transforms, Fast Fourier Transforms, and spectral analysis. Processing of discrete-time signals using the DFT and FFT. Design and implementation of discrete-time filters. Extensive use of software simulations in Matlab. Final Matlab-based project required.

Prerequisites: EEO 301. The course assumes a basic understanding of Signals & Systems.

Instructor and Office Hours

Instructor: Mark Fowler

Email: mfowler@binghamton.edu **(Don't use my Stony Brook email!!!)**

Office Location: N/A for online course

Office Phone: N/A

Office Hours: TBD…. Email me any questions or issuses

Location: N/A for online course

Time: TBD

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LEARNING OBJECTIVES

At the end of this course, students will:

1. Apply the z-transform to analyze linear, time-invariant discrete-time systems
2. Apply the discrete-time Fourier transform to analyze discrete-time signals
3. Apply the discrete-time Fourier transform to analyze linear, time-invariant discrete-time systems

4. Apply the theory of sampling to analyze schemes for sampling continuous-time signals
5. Apply the discrete Fourier transform (DFT) to numerically analyze discrete-time signals
6. Understand the operation of fast Fourier transform (FFT) algorithms
7. Apply FFT algorithms for efficient linear filtering implementation
8. Apply FFT algorithms for spectral analysis of discrete-time signals
9. Design discrete-time filters to meet specifications
10. Implement discrete-time filters using practical methods
11. Use MATLAB to simulate discrete-time signals, systems, and processing.

COURSE REQUIREMENTS

Proctor Policy

As this is an online course, all exams must be proctored by an acceptable proctor. A librarian, member of the HR/Training staff within your company, former professors, supervisor/manager, superior officers if you are in the military, member of the clergy, or a member of a learning or testing center could qualify to serve as your proctor. Public libraries will normally proctor examinations; however, there is sometimes a nominal charge for this service.

Textbook and Reading

John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 4th Edition. Prentice Hall. 2007.

Topics and semester schedule

Week	Topics
Week 1 Lecture 1	Review of Basic Signals & Systems
Week 1 Lecture 2	Review of Basic Signals & Systems
Week 2 Lecture 1	Definition and mathematical properties of Z Transform (ZT)
Week 2, Lec 2	Using ZT to analyze discrete-time systems
Week 3, lec 1	Mathematical properties of the DTFT
Week 3 Lecture 2	Using DTFT to analyze DT signals

Week 4 Lecture 1	Using the DTFT to analyze DT systems
Week 4, Lec 2	Using the DTFT to characterize DT filters
Week 5, Lec 1	Sampling Theory & Practical Sampling and Reconstruction
Week 5, Lec 2	Bandpass Signals
Week 6, Lec 1	Bandpass Sampling & Oversampling
Week 6, Lec 2	Midterm Exam #1
Week 7 Lecture 1	Introduction to Matlab for Signal Processing
Week 7, Lec 2	Mathematical Details of DFT
Week 8, Lec 1	Using DFT to Implement FIR Filters
Week 8, Lec 2	Using DFT for Spectral Analysis
Week 9 Lecture 1	1. DFT with windows 2. Spectral Analysis in presence of noise
Week 9 Lecture 2	FFT Algorithm – Radix 2 Decimate-in-Time
Week 10 Lecture 1	Alternative FFT Algorithms
Week 10 Lecture 2	Midterm Exam #2
Week 11 Lecture 1	Design of FIR Filters, Part I
Week 11 Lecture 2	Design of FIR Filters, Part II
Week 12 Lecture 1	Design of IIR Filters, Part I
Week 12 Lecture 2	Design of IIR Filters, Part II
Week 13 Lecture 1	Implementation Structures for FIR Filters

Week 13 Lecture 2	Implementation Structures for IIR Filters
Week 14 Lecture 1	Representation of Numbers
Week 14 Lecture 2	Quantization of Filter Coefficients
Week 15	Round-off Effects in Digital Filters

Grading

Your grade will be based on attendance, paper reviews (written and oral), programming assignments, a midterm exam, and the final project.

Homework	15%
Midterm Exam #1	25%
Midterm Exam #2	25%
Final Exam	35%

Honor Policy

- All exams, homework, and project assignments are subject to this Honor policy. This means that placing your name on an exam or an assignment implicitly pledges that you abided by the terms of this policy.
- The homework assignments, exams, and projects are to be done alone. Any malpractice (e.g., reporting fraudulent data, copying another student's solution, plagiarism) will be treated as an Honor Code violation.

Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/