The University of Texas at Tyler
Department of Electrical Engineering

EENG 5308.031

Digital Signal Processing

Syllabus

Catalog Description:

Introduction to modern digital processing. Basic building blocks, the basic math (Z-Transforms, Fourier Transforms, Fast Fourier Transforms), deterministic processing, FIR and IIR filters, polyphase filtering, introduction to statistical filtering, basic power spectral density.

Prerequisites: Introduction to Random Processes (EENG 5307)

Credits: (3 hours lecture, 0 hours laboratory per week)

Text(s): Oppenheim, Schafer. Discrete-Time Signal Processing, 2e. Prentice Hall, 1999.
McClellan, Schafer, Yoder. DSP First, 2ed, Pearson, 2016.
Mitra. Digital Signal Processing: A Computer-Based Approach, 4ed, McGraw-Hill, 2010.

Additional Material: MATLAB, Class Notes

Course Coordinator: Seyed Ghorshi, PhD

Topics Covered: (paragraph of topics separated by semicolons)

Discrete-Time signals and systems; Z transform; Sampling of Continuous time systems; Transform analysis of linear time-invariant systems; Filter design techniques; the DFT and FFT algorithms; Fourier analysis of signals using the DFT; DSP applications.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives[1]: By the end of this course students will be able to:

1. Discus and describe DSP fundamentals: sampling, frequency analysis and filtering [1,2]
2. Simulate and Apply digital signal processing concepts to provide solutions to engineering problems [3,5]
3. Evaluate the performance of DSP implementations [3,5].

[1] *Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Outcomes [2]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. Graduates of the program will possess a breadth and depth of knowledge in electrical and computer engineering. [1,2,3]
2. Graduates of the program will possess and demonstrate oral and written communication skills. [1,2,3]
3. Graduates of the program will demonstrate the capability to perform independent learning and investigation. [2,3]

[2]Numbers in brackets refer to course objective(s) that address the Program Outcome.

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:		hours
Engineering Sciences and Design:	3	hours
General Education Component:		hours

Prepared By:	Mark Humphries, Adjunct Professor	Date:	13 January 2008
Modified By:	Hector A. Ochoa, Assistant Professor		3 June 2009
	Seyed Ghorshi, PhD		13 January 2019

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EENG 5308.031: Digital Signal Processing

Outline

Course Description

The signal for processing is mathematically modeled as a function or a sequence of numbers that represent the state or behavior of a physical system. The examples of the signals range from speech, audio, image and video in multimedia systems, electrocardiograms in medical systems (ECG/EKG), to electronic radar waveforms in military. Signal processing is concerned with the representation, transformation, and manipulation of signals and the information they contain. For example, we may wish to remove the noise in speech to make it clear, or to enhance an image to make it more natural. Signal processing is one of the fundamental theories and techniques to construct modern information systems. During the last half century, lots of theories and methods have been proposed and widely studied in digital signal processing. In this semester, we only study the fundamentals of discrete-time signals and systems. The course content includes the concept and the classification of discrete-time signal, representations of signals in time, frequency, z- and discrete frequency domains, representations and analyses of systems, and filter designs.

The course is a prerequisite course for other multimedia related courses, such as speech processing, image processing, audio and video data compressing, pattern recognition, communication systems, etc.

Course Objectives

In this course, we will mainly study the following topics: signal representation in time domain, Fourier transform, sampling theorem, linear time-invariant system, discrete convolution, z-transform, discrete Fourier transform, and discrete filter design.

After this lecture, the students should be able to understand how to analyze a given signal or system using tools such as Fourier transform and z-transform; what kind of characteristics should we analyze to know the property of a signal or system; how to process signals to make them more useful; and how to design a signal processor (digital filter) for a given problem.

Course Content

Introduction
Discrete-time signals and systems
FIR filters
IIR filters
Filter design
The z-transform
Z-domain analysis of LTI systems
Discrete-time Fourier transform (DTFT)
The discrete Fourier Transform (DFT)

Structures for the realization of DT systems
Fast Fourier transform (FFT)

Text Books

Oppenheim, Schafer. Discrete-Time Signal Processing, 2e. Prentice Hall, 1999.
McClellan, Schafer, Yoder. DSP First, 2ed, Pearson, 2016.
Mitra. Digital Signal Processing: A Computer-Based Approach, 4ed, McGraw-Hill, 2010.

Assessment

Homework: 10%
Project: 20%
Midterm: 30%
Final Exam: 40%