Digital Signal Processing

ECE 8440  SPRING 2017
http://cs.clemson.edu/~ekp/courses/ece8440

COURSE DESCRIPTION
Digital filter design; discrete Hilbert transforms; discrete random signals; effects of finite register length in digital signal processing; homomorphic signal processing; power spectrum estimation; speech processing, radar, and other applications. Prerequisite: Students are expected to have completed a course comparable to ECE 4670 before enrolling in this course.

CONTACT
Eric Patterson, Ph.D.
ekp@clemson.edu
Office: 307 McAdams Hall
14:00 - 15:00 M W
11:00 - 12:00 T Th
Or by appointment.
Class: 15:35-16:50 M W
Vickery Hall 100

TEXTS

GRADING SCALE
A: 86-100
B: 71-85
C: 56-70
F: 0-55

Final exam is scheduled for 19:00-21:30 on Tuesday, May 2, 2017.

LEARNING OUTCOMES
COURSE TOPICS

Chapter 2 - Discrete-Time Signals and Systems (Read entire chapter for review.)
Example 2.18 - Square-Summability of Ideal Low-pass Filter (Unit 1)
Example 2.20 - Fourier Transform of Complex Exponential Sequences (Unit 1)
Section 2.10 - Discrete-Time Random Signals (to be covered between sections 4.8 and 4.9) (Unit 5)

Chapter 4 - Sampling of Continuous-Time Signals
Example 4.4 - Discrete-Time Implementation of an Ideal Continuous-Time Band-limited Differentiator (Unit 1)
Section 4.5 - Continuous-Time Processing of Discrete-Time Signals (Unit 1)
Section 4.6 - Changing the Sampling Rate Using Discrete-Time Processing (Unit 2)
Section 4.7 - Multi-rate Signal Processing (Unit 3)
Section 4.8 - Digital Processing of Analog Signals (Unit 4)
Section 4.9 - Oversampling and Noise Shaping in A/D and D/A Conversion (Units 6, 7, and part of Unit 8)
Section 4.10 - Chapter Summary (read)

Chapter 5 - Transform Analysis of Linear Time-Invariant Systems
Sections 5.1 - 5.3 - Review of Selected Topics (Unit 8)
Section 5.4 - Relationship Between Magnitude and Phase (Units 8 and 9)
Section 5.5 - All-Pass Systems (Unit 9)
Section 5.6 - Minimum Phase Systems (Unit 9)
Section 5.7 - Linear Systems with Generalized Linear Phase (Unit 10)
Section 5.8 - Chapter Summary (read)

Chapter 6 - Structures for Discrete-Time Systems
Sections 6.1 - 6.2 - Review of Selected Topics (Unit 11)
Example 6.3 - Determination of the System Function from a Flow Graph (Unit 11)
Section 6.4 - Transposed Forms (Unit 11)
Section 6.5 - Basic Network Structures for FIR Systems (Unit 11)
Section 6.6 - Lattice Filters (if time permits) (Unit 12)
Section 6.7 - Overview of Finite-Precision Numerical Effects (Unit 12)
Section 6.8 - Effects of Coefficient Quantization (Unit 12)
Section 6.9 - Effects of Round-Off Noise in Digital Filters (Units 13, 14, and 15)
Section 6.10 - Zero-Input Limit Cycles in Fixed-Point Realizations of IIR Digital Filters (Unit 15)
Section 6.11 - Chapter Summary (read)

Chapter 7 - Filter Design Techniques
Sections 7.1 - 7.6 - Review of Digital Filter Design Techniques (Unit 16)
Section 7.7 - Optimum Approximations of FIR Filters (Units 16 and 17)
Section 7.8 - Examples of FIR Equiripple Approximation (Unit 17)
Section 7.9 - 7.10 - Chapter Summary (read)

Chapter 8 - The Discrete Fourier Transform
Sections 8.1 - 8.6 - Review of Selected DFT Topics (Unit 18 and 19)
Section 8.7 - Computing Linear Convolution Using the DFT (Unit 19)
Section 8.8 - The Discrete Cosine Transform (Unit 20)
Section 8.9 - Chapter Summary (read)

Chapter 13 - Cepstral Analysis and Homomorphic Deconvolution (Unit 21-24)

Selected topics, time permitting:
Chapter 10 - Fourier Analysis of Signals Using the DFT
Chapter 12 - Discrete Hilbert Transforms
Tentative Schedule

JANUARY

Unit 1

Unit 2

Unit 3, 4

FEBRUARY

Unit 5, 6

Unit 7, 8

Unit 9, 10

Unit 11

MARCH

Unit 12, 13

Unit 14, 15

Unit 16, 17

SPRING BREAK

27

29  Test 2

Unit 18, 19

APRIL

Unit 19, 20

Unit 21, 22

Unit 23, 24

Selected topics, time permitting.

MAY

02  Final Exam 19-21:30
CLASS POLICIES

Unless special circumstances are involved, more than three absences may result in class failure. Students are individually responsible for keeping current with course material and assignments.

Class announcements supersede posted material.
Academic honesty in all your work is required for a passing grade.
This syllabus and course materials may be subject to change with reasonable notice.

BOILERPLATE

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It is university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students requesting accommodations should make an appointment with Disability Services (656-6848) to discuss specific needs within the first month of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

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