ECE 5200: Introduction to Digital Signal Processing

Course Description

Sampling and reconstruction; discrete-time rate conversion; processing of discrete-time signals; design of discrete-time filters, selected topics in adaptive and/or multidimensional signal processing.

Prior Course Number: 600, 801.01
Transcript Abbreviation: Intro Dig Sig Proc
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 3050 (352), and Stat 3470 (427) or Math 530; or Grad standing.
Exclusions: Not open to students with credit for 600 or 801.01.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Learn filter design criteria based on magnitude response and phase response; FIR filter design methods like window-based, weighted least-squares, & equiripple designs; IIR filter design methods based on bilinear transform & least-squares
Learn the fundamentals of sampling and reconstruction, i.e., conversion between the continuous-time and discrete-time domains, as well as discrete-time rate conversion (e.g., upsampling, downsampling, interpolation, decimation)
Learn the fundamental concepts in the processing of finite-duration discrete-time signals, including windowing, DFT, circular convolution, spectral analysis, FFT, fast convolution, and overlap/save processing

Master undergrad-level signals & systems concepts (e.g., linearity, time-invariance, causality, stability, impulse response, convolution, Fourier series, CTFT, DTFT, Laplace transform, Z-transform), applying these concepts to new problems
Learn selected topics in multidimensional and/or adaptive signal processing
Learn to efficiently use Matlab for discrete-time signal processing and analysis

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Signals and systems review: system properties (e.g., linearity, time invariance, causality, stability), impulse response, convolution, Fourier series, CTFT, Laplace transform, DTFT, Z-transform	6.0							
Sampling and conversion: sampling, aliasing, Nyquist rate, sinc reconstruction, ZOH reconstruction, upsampling, downsampling, interpolation, decimation, rate conversion	6.0							
Processing of finite-length discrete-time signals: DFT, circular convolution, windowing, spectral analysis, matrix/vector formulations, FFT, fast convolution, overlap-save	6.0							
Design of discrete-time filters: ideal magnitude responses, group delay, linear phase, FIR designs (e.g., window-based, frequency-sampled, weighted least-squares, equiripple), IIR designs (e.g., bilinear transform, Prony's method, Shank's method).	8.0							
Selected topics in multidimensional and/or adaptive signal processing	12.0							

Representative Assignments

Weekly homework problems with both analytical and Matlab content will be assigned.

Grades

Aspect	Percent
Homework	25%
Two midterm exams	40%
Final exam	35%

Representative Textbooks and Other Course Materials

Title	Author
Discrete-Time Signal Processing (3rd Ed.), Prentice-Hall 2010	Oppenheim and Schafer

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.

Course Contribution		College Outcome
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Update prereq, exclusion, goals and topics to match university format.

DEleted text Digital Signal Processing (3rd Ed.), McGraw-Hill 2006 by Mitra.

Added MATH 530 to prereqs. Note that MAath 530 is acceptable but the semester version is NOT. 5/7/12

Added srping offering (to be offeredboth semesters now) March 15, 2013.

Changed AEBT-EAC criteion 3c from significant to substation contribution. April 29,. 2014 BLA

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