EECS 152A DIGITAL SIGNAL PROCESSING
(Elective for CpE and EE)

Catalog Data: **EECS 152A Digital Signal Processing (Credit Units: 3)** Nature of sampled data, sampling theorem, difference equations, data holds, z-transform, w-transform, digital filters, Butterworth and Chebychev filters, quantization effects. Prerequisite: EECS150B/CSE120A. Same as CSE135A. Formerly ECE135A. (Design units: 2)

Textbook: Proakis and Manolakis, *Digital Signal Processing,* 3rd edition, Prentice-Hall, 1996.
Stearns and David, *Signal Processing Algorithms in MATLAB,* Prentice-Hall, 1998.

References: Oppenheim, Schafer, and Buck, *Discrete Time Signal Processing,* 1998.

Coordinator: Jeorg Meyer

Course Objectives: To understand concept of sampling theory in time and frequency domain.
To analyze and understand frequency responses of discrete systems using z-transform, Discrete-Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), and Discrete Wavelet Transform.
To understand concept of linear phase and window techniques for FIR filter design.
To review design techniques of analog filters (e.g. Butterworth, Chebyshev, and Elliptic) and apply them to design digital filters.
To introduce different, digital filter structures (e.g. Direct Form I & II, Cascade, Parallel, Transposed Forms, and Wrap-around Implementation).

Course Outcomes: Students will:
Characterize sampled systems in time and frequency domain.
Apply z-transform, DTFT, DFT and DWT to analyze and design DSP systems.
Design basic FIR digital filters.
Design basic IIR digital filters (using the bilinear transformation).
Use DSP tools such as MATLAB to analyze discrete systems and design digital filters.

Prerequisites By Topic: It is presumed that the students understand Fourier transforms and linear system theory.

Lecture Topics: The course is 3 credits and covers the aforementioned topics in a ten-week term.

Class Schedule: Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.

Computer Usage: Students are expected to have sufficient computing to aid with the exercises, although no specific requirements are imposed. MATLAB is strongly encouraged, although people might use C/C++ or Java if they cannot get access to MATLAB.

Laboratory Projects:

Professional Component: Contributes toward the Computer Engineering Topics Courses and Electrical Engineering Topics Courses and Major Design experience.

Relationship to Program Outcomes: This course relates to Program Outcomes for electrical a, b, e, and k as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/electrical/mission
Program Outcomes for CpE a, g, e, and m as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/computer/mission

Design Content Description

Approach: This course is devoted to the application of digital analysis techniques to the design of digital processors. In particular, design of basic samples, IIR digital filters and FIR digital filters, including Butterworth and Chebychev filters and sampling filters. Design for quantization effects is also included. The homework problems emphasize the applications of these techniques to design.
Lectures: 0%
Laboratory Portion: 100% as homework

Grading Criteria:

Midterm exam :	50%
Final exam:	50%
	100%

Homework is assigned, solutions are given, but not graded.

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 1 credit units or 33%
Engineering Design: 2 credit units or 67%

Prepared by: Joerg Meyer **Date:** July 2007

CEP Approved: Fall 2005