EE445S Real-Time Digital Signal Processing Lab (Spring 2014)

Lecture:	MWF 11:00am–12:00pm in ETC 5.148
Instructor:	Prof. Brian L. Evans, ENS 433B, 512-232-1457, bevans@ece.utexas.edu
Office Hours:	MW 12:00–12:30pm and TH 12:30–2:30pm
Lab Sections:	M 6:30–9:30pm (Sinno), T 6:30–9:30pm (Sinno),
(ENS 252B)	W 6:30–9:30pm (Jia), F 1:00–4:00pm (Jia)
TA Office Hours:	Ms. Zeina Sinno, W 3:00–4:30pm and TH 5:30–7:00pm, zeina@utexas.edu
(ENS 137)	Mr. Chao Jia, TH 3:30–5:30pm and F 9:30–10:30am, kurtjc@gmail.com
Course Web Page:	http://users.ece.utexas.edu/~bevans/courses/rtdsp

This course covers basic discrete-time signal processing concepts and gives hands-on experience in translating these concepts into real-time digital communications software. The goal is to understand design tradeoffs in signal quality vs. implementation complexity.

Prerequisites

EE 312 and 319K with a grade of at least C- in each; BME 343 or EE 313 with a grade of at least C-; credit with a grade of at least C- or registration for BME 333T or EE 333T; and credit with a grade of at least C- or registration for BME 335 or EE 351K.

Topical Outline

System-level design tradeoffs in signal quality vs. implementation complexity; prototyping of baseband transceivers in real-time embedded software; addressing nodes, parallel instructions, pipelining, and interfacing in digital signal processors; sampling, filtering, quantization, and data conversion; modulation, pulse shaping, pseudo-noise sequences, carrier recovery, and equalization; and desktop simulation of digital communication systems.

Required Texts

1. C. R. Johnson Jr., W. A. Sethares and A. G. Klein, *Software Receiver Design*, Cambridge University Press, Oct. 2011, ISBN 978-0521189446. Paperback. Matlab code.
2. T. B. Welch, C. H. G. Wright and M. G. Morrow, *Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs*, CRC Press, 2nd ed., Dec. 2011, ISBN 978-1439883037.
3. B. L. Evans, *EE 445S Real-Time DSP Lab Course Reader*. Available on course Web page and on-demand from the HKN Office (ENS 129).

Supplemental Texts

4. B. P. Lathi, *Linear Systems and Signals*, 2nd ed., Oxford, ISBN 0-19-515833-4, 2005.
5. M. J. Roberts, *Signals and Systems*, McGraw-Hill, ISBN 978-0072930443, June 2003.
6. A. O. Oppenhiem and R. W. Schafer, *Signals and Systems*, 2nd ed., Prentice Hall, 1999.
7. J. H. McClellan, R. W. Schafer, and M. A. Yoder, *DSP First: A Multimedia Approach*, Prentice-Hall, ISBN 0-13-243171-8, 1998. On-line Multimedia CD ROM.

Grading

14% Homework, 21% Midterm #1, 21% Midterm #2, 5% Pre-lab quizzes, 39% Laboratory. Midterms will be held during lecture, with midterm #1 on Friday, Mar. 7th, and midterm #2

on Friday, May 2nd. Attendance/participation in laboratory is mandatory and graded. Lecture helps connect together all of the pieces of the class— laboratory, reading, and homework assignments. Lecture attendance is helpful in landing internships and permanent positions, and allows you to get the most for your tuition dollar. Plus and minus grades will be assigned for the final letter grades. There is no final exam. Request for regrading an assignment must be made in writing within one (1) week of the graded assignment being made available to students in the class. *Discussion of homework questions is encouraged. Please submit your own independent homework solutions. Late assignments will not be accepted.*

University Honor Code

"The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, fairness, and respect toward peers and community." http://www.utexas.edu/about-ut/mission-core-purpose-honor-code

Religious Holidays

By UT Austin policy, you must notify the instructor of any pending absence at least fourteen (14) days prior to the date of observance of a religious holy day, or on the first class day if the observance takes place during the first fourteen days of the semester. If you must miss class, lab section, exam, or assignment to observe a religious holiday, you will have an opportunity to complete the missed work within a reasonable amount of time after the absence.

College of Engineering Drop/Add Policy

The Dean must approve adding or dropping courses after the fourth class day of the semester.

Students with Disabilities

UT provides upon request appropriate academic accommodations for qualified students with disabilities. Please contact Office of Dean of Students at 512-471-6259 or ssd@uts.cc.utexas.edu.

Lecture Topics

Introduction
Sinusoidal Generation
Introduction to Digital Signal Processors
Signals and Systems
Sampling and Aliasing
Finite Impulse Response Filters
Infinite Impulse Response Filters
Interpolation and Pulse Shaping
Quantization
Data Conversion
Channel Impairments
Digital PAM
Matched Filtering
Quadrature Amplitude Modulation (QAM) Transmitter
QAM Receiver