EE 436/636–4.0
Digital Signal Processing
Theory, Application, and Implementation
Fall 2007

Instructor: Dr. Kefu Xue, 425 Russ Center, Phone 775-5063

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Class meets on: MWF.: 12:15 pm to 1:05 pm plus a 2–hour laboratory section each week (starting from the second week) in the DSP lab. at 420 RC (time to be determined).

Office hours: Office hours have been set in the following table and students are encouraged to make use of those to have their academic difficulties resolved. *If you can not come during the office hours, please email me to setup an appointment.*

Monday	1:30 pm - 3:00 pm
Wednesday	1:30 pm - 3:00 pm

Prerequisite: EE322 (Topics: DFT, Sampling theory, Z-transform, Difference equation, Frequency response, LTI system, Linear and Circular convolutions) and CEG220 (C programming language, memory allocation and pointers)

Text books: "Real–time Digital Signal Processing, Implementations, Applications and Experiments with the TMS320C55x" by Sen M. Kuo and Bob H. Lee, John Wiley & Son, the Second Edition: ISBN 0-470-01495-4.

Description of the Course: Cellular telephone, wireless network, high definition TV, speech synthesis and coding, image processing and compression, multimedia computing , advanced medical imaging and testing equipment, house hold appliances, digital instrumentation, intelligent sensors that are a few examples indicate that digital signal processing (DSP) has established itself as the essential technology in today's industries. This course will focus on the DSP applications, algorithms and implementation. The learning objective of this course: students will understand the theorem of DSP filtering applications and can realize the applications in a DSP hardware system. There was an old Chinese saying "You heard it, you forgot; You saw it, you remembered; You did it, you understood." The course will be centered around solving problems and working out computer assignments which are considered the most effective ways to learn DSP subjects.

Topics and Schedule

1st Week – 3rd Week Introduction to digital signal processing systems and their software and hardware development environment

1. Introduction to real-time DSP systems
2. TMS320C55x Digital Signal Processor architecture
3. Peripherals: McBSP, DMA, EMIF, GPIO, USB, I^2C, etc.
4. ADC and DAC

5. Memory systems
6. JTAG and XDS510 emulation device
7. Software development environment and CCS
8. The DSP system in the DSP lab. (420 RC)
9. Signal acquisition and synthesis
10. Reading assignments: Chapter 1, 2, and 3 (complete before 1st class of 2nd week)
11. Suggested problems, Chapter 1: 1.1, 1.2, 1.3, and 1.4; Chapter 3: 3.1, 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9, 3.11

4th Week – 5th Week: FIR filter design methods and its implementation

1. Frequency response review and filter specifications
2. FIR filter design: Window, frequency sampling and Parks–McClellan methods
3. FIR filter implementation and quantization errors
4. Reading assignments: Chapter 4 (complete before 1st class of 4th week)
5. Suggested problems, Chapter 4: 4.1, 4.2, 4.3, 4.5, 4.6, 4.7, 4.9, 4.10, 4.14.
6. DSP Assignment II

6th Week – 8th Week: IIR filter design methods and its implementation

1. IIR filter design using frequency transform method: Butterworth and Chebyshev filters
2. Quantization errors and Cascade implementation
3. Reading assignments: Chapter 5 (complete before 1st class of 6th week)
4. Suggested problems: Chapter 5: 5.3, 5.4, 5.7, 5.8, 5.9 (a) (b).
5. DSP assignment III

9th Week – 10th Week: FFT and DSP applications

1. Explain Fast Fourier Transform algorithm and its implementation
2. Reading assignments: Chapter 6 (complete before 1st class of 9th week)
3. Suggested problems: Chapter 6: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.9, 6.10, 6.11, and 6.13.
4. Extra Assignment IV (for EE636 students only)

The computer projects are assigned to groups of students. The purpose of working in groups is twofold. First, you will be able to learn from each other and from yourself too by discussing and explaining the ideas that you get out of lecture, reading, and problem solving . If you can't explain it, then you, most likely, don't understand it. Second is to get you accustomed to working with other people, a likely situation in your future jobs. For this purpose, every member of a group should work out and understand the entire computer assignment. The teaching assistant of the DSP laboratory will test each student for the competence in DSP programming and experiments. Therefore you should not divide the assignment among your group members, but have each person work on every component of the assignment and discuss what you come up with. The computer assignments will be in MATLAB for software simulation and in C and Assembly languages for real–time hardware implementation.

Grading policy: There will be several unannounced quizzes about the reading assignments and suggested problems. There are three DSP assignments. Each group (EE636) will also propose a topic for their final project and present their project to the class in the final exam week. They will count toward the final grade as follows.

Class	EE436	EE636
Home work (suggested problems)	5%	5%
DSP Assignments: I, II, III	65%	55%
Quizzes	30%	25%
Extra Assignment	N/A	15%

If the total score is less than 50%, the final grade will be "F". No make-up quiz will be given unless the student has received permission from the instructor prior to the quiz or experienced some emergency beyond his/her control!! The instructor is responsible to provide the first and second quiz score and the first computer assignment score as the feedback before the fifth week drop date.

cls/wk	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1st (Wed.)	9/5	9/12	9/19	9/26	10/3	10/10	10/17	10/24	10/31	11/7
3rd (Mon.)	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29	11/5	11/9