EE442/EE592 Real-Time Digital Signal Processing (3 credits)
Spring 2011
Klipsch School of Electrical and Computer Engineering
College of Engineering
New Mexico State University

Instructor and Class Information

Instructor:	Prof. Phillip De Leon
	Goddard Annex 160G; (575) 646-DSP1 (3771); pdeleon @ nmsu . edu
Teaching Assistants:	Mr. Markus Safar (marcussafar@gmail.com)
Date and Time:	Lecture: M, W, F 1:30 – 2:20pm, T&B303
Office Hours:	T 1:30 – 2:30pm, F 3:00 – 5:00pm, and by *prior* appointment (De Leon)
	F 2:00 – 5:00pm (Teaching Assistant)

Course Description from the Graduate Course Catalog
Projects-oriented course covering the fundamentals of real-time digital signal processing (DSP) by programming a state-of-the-art digital processor to solve a variety of problems in digital audio and communications engineering.

Prerequisite
A grade of C or better in EE395 Introduction to Digital Signal Processing or EE545 Digital Signal Processing or equivalent. *Students will be automatically dropped without this prerequisite.*

Textbook and Other Required Materials
Real-Time Digital Signal Processing using the Motorola DSP5630xEVM by Phillip De Leon (available at FedEx Kinko's Copies, University Ave.)
DSP56300 Assembler Reference Manual (available as a free download)
DSP56300 Family Manual (available as a free download)
DSP56302 User's Manual (available as a free download)
DSP56302EVM User's Guide (available as a free download)
Domain Technologies Debug-56K User's Guide (available as a free download)

Hardware
Personal Computer (PC) with Windows XP (available in T&B 206)
Motorola DSP56302EVM, Texas Instruments TMS320C6416DSK

Software
Freescale DSP56300 Macro Assembler (available in T&B 206)
Domain Technologies Debug-EVM (available in T&B 206)
Code Composer Studio (CCS) (available in T&B 206)
MATLAB and Signal Processing Toolbox (available in T&B 206)

Online Resources
EE442/EE592 Web Page
`http://www.ece.nmsu.edu/~pdeleon/EE592`

Course announcements will be emailed via Blackboard. Student grades will be posted on Blackboard. For more information see
`http://learn.nmsu.edu`

Note: Please do not email Prof. De Leon through Blackboard Learning System--use the email address listed above.

Course Objectives
The objective of this course is to gain an understanding of real-time DSP through:
- Software design for real-time applications
- Understanding of digital signal processor architecture and programming model

- Understanding of processor addressing modes, instruction set, and parallel operations
- Algorithm and code development
- Debugging and code verification techniques

Contribution of EE442/EE592 to Meeting the Professional Component
Real-Time Digital Signal Processing is the depth course in DSP within the Electrical Engineering curriculum and is considered an engineering topics course in the Professional Component. Students in EE442/EE592 will apply techniques learned in class through software development and in-class discussions. Techniques learned in this class will provide students with a deepening of their knowledge base to see applications of mathematics, computer science, and electrical engineering techniques to the real-time processing of signals in the digital domain, provide preparation for capstone design project, and provide a basis for career employment or graduate school. Discussion of design issues relate the class theory to practical societal issues. Class provides 3 credits of engineering science credit.

Relationship of the Course to Program Objectives

Real-Time Digital Signal Processing builds upon mathematics and engineering techniques learned in previous courses to provide an electrical engineering depth elective to give students

- an understanding of actual products (DSP-based electronics)
- a basis for capstone design classes
- a preparation for career employment or graduate school
- an opportunity to use computers in engineering problem solving

This will allow students to further explore their major specialty as well as seeing applications of basic techniques learned from calculus, linear algebra, linear systems theory, and other engineering classes.

Equal Employment Opportunity / Americans with Disabilities Act (EEO/ADA)
Feel free to call Jerry Nevarez, Director of Institutional Equity, at 575-646-3635 with any questions you may have about NMSU's Non-Discrimination Policy and complaints of discrimination, including sexual harassment.

Feel free to call Diana Quintana, Director of University Disability Services/Student Accessibility Services, at 575-646-6840 with any questions you may have on student issues related to the Americans with Disabilities Act (ADA) and/or Section 504 of the Rehabilitation Act of 1973. All medical information will be treated confidentially.

Prepared
Phillip De Leon, 13 January 2011.

Grading

Projects – There will be four projects designed to test each student's individual ability to program the Motorola DSP56302 and Texas Instruments TMS320C6416 to solve digital audio and digital communications problems. Projects for EE592 will be significantly more difficult and involved than those for EE442. Each project is worth 15% of the final grade. Late projects are not accepted except in the case of an absence due to a medical or other *very serious* reason.

Quizzes – There will be four quizzes during the semester to test each student's overall knowledge regarding material covered in class and during the course of coding the projects. The quizzes are worth 13% of the final grade. There are no makeup quizzes except in the case of an absence due to a medical or other *very serious* reason.

Final Proposal – There will be a final project proposal in which the student will examine the signal processing problem to be solved, algorithm, and estimation of computational and memory requirements. Worth 2% of the final grade.

Final Project – The final project is to be chosen by the student and is a great opportunity to exhibit creative use of a DSP. Grade will be based on complexity or novelty of project and implementation success. Worth 20% of the final grade.

Final Presentation – There will be a final project presentation/demonstration lasting 15 minutes. The presentation schedules are listed in the Course Schedule (next page). Students must be present for at least two of the sessions. Worth 5% of the final grade.

Bonus – For each typographic error or omission in the text that is first brought to the instructor's attention, an additional 1% will be awarded up to a maximum of 3% of the final grade. Additional comments or suggestions regarding material in the text which lead to a revision are also eligible for this bonus.

Appropriate partial credit will be awarded in all of the above items.

Final Grades – Final grades will be assigned as follows (we reserve the right to lower the grade ranges for particular letter grades but will never raise the grade ranges).

A+		C+	79 – 76
A	100 – 95	C	75 – 73
A–	94 – 90	C–	72 – 70
B+	89 – 86	D+	69 – 66
B	85 – 83	D	65 – 63
B–	82 – 80	D–	62 – 60

Policies

All codes must developed and debugged on an individual basis with assistance from the instructor and teaching assistants. While we encourage discussion of lectures, algorithms, and DSP operation, there is to be no joint work on a code or sharing of any portions of a code. We will thoroughly examine and test everyone's code–any plagiarism of project codes will result in an automatic **F** in the course.

Disputes regarding project or quiz grades must be submitted in writing to Prof. De Leon for review within 7 days after graded work has been returned or posted.

Topics Covered / Class Schedule

The topics covered and class schedule are described in the Course Outline section of this syllabus.

EE442/EE592 Spring 2011 Course Schedule

Week 1 January 9, 2011

Introduction to real-time DSP, Introduction to the Freescale DSP56300 family

Week 2 January 16, 2011

Architecture Introduction, Addressing Modes, Parallel Moves, Instruction Set
January 17 MLK Holiday!

Week 3 January 23, 2011

Architecture and Programming Model, Freescale DSP56302EVM, Simple Programs
January 28, Quiz 1

Week 4 January 30, 2011

Project 1 Sound Field Simulator
February 3 (1:10pm), 4 (2:30pm) Lab 1

Week 5 February 6, 2011

Project 1 Sound Field Simulator
February 10 (1:10pm), 11 (2:30pm) Lab 2
February 11, Quiz 2

Week 6 February 13, 2011

Project 2 Adaptive Noise Canceler
Project 1 development
February 17 (1:10pm), 18 (2:30pm) Lab 3

Week 7 February 20, 2011

Project 2 Adaptive Noise Canceler
Project 1 development
February 25, Project 1 due

Week 8 February 27, 2011

Texas Instruments TMS320C6416
Project 2 development
March 3 (1:10pm), 4 (2:30pm) Lab 4
March 4, Quiz 3

Week 9 March 6, 2011

Project 3 Sound Field Simulator (TI TMS320C6416)
Project 2 development
March 11, Project 2 due

Week 10 March 13, 2011

Project 4 BPSK Modem lectures
Project 3 development
March 17 (1:10pm), 18 (2:30pm) Lab 5

Week 11 March 20, 2011

Spring Break!

Week 12 March 27, 2011

Project 4 BPSK Modem lectures
Project 3 development
April 1 Project 3 due

Week 13 April 3, 2011

TI TMS320C64x DSPLib
Project 4 development
April 8, Final project proposals due

Week 14 April 10, 2011

TI TMS320C6416 FFT
Project 4 development
April 15, Project 4 due

Week 15 April 17, 2011

Real-Time DSP using PortAudio
Final project development
April 20 (2:30pm), 21 (1:10pm) Lab 6
April 20, Quiz 4
April 22 Spring Holiday!

Week 16 April 24, 2011

Revision Control
Final project development
April 29, Final project due

Week 17 May 1, 2011

May 3, 3:30-5:30pm, Presentations
May 4, 3:30-5:30pm, Presentations
May 5, 1:00-3:00pm, Presentations
May 6, 10:30am-12:30pm, Presentations