UNIVERSITY OF ILLINOIS AT URBANA CHAMPAIGN
Department of Electrical and Computer Engineering

ECE420: Digital Signal Processing Laboratory
Fall 2009
Lecture: 241 Everitt Laboratory, *Lab:* 251 EL
Credit: 2 hours or 1/2 unit
http://courses.ece.uiuc.edu/ece420/

Course Syllabus

Instructor: Douglas Jones, dl-jones@illinois.edu, 113 Coordinated Science Lab

Teaching Assistants:
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Laboratory Hours: See the course website for current lab and office hours. During official lab meeting hours, students in that section get priority.

Text: Digital Signal Processing Laboratory (ECE 420) at
http://cnx.org/content/col10397/latest.

Description: The first seven weeks of the course will consist of a structured laboratory based on the text. The rest of the course will be the development, testing, and documenting of a DSP project of the student's choice (subject to instructor approval).

Course Goals: Students will learn to implement and analyze real-time digital signal processing (DSP) systems. Students will both broaden and deepen their understanding of basic digital signal processing theory and techniques and learn to relate this understanding to real-world observations and applications. They will learn industrially relevant skills such as assembly-language implementation of real-time DSP systems on a DSP microprocessor. Other significant educational experiences include open-ended design, oral and written communication, and team projects. A more complete summary of the Course Goals and Instructional Objectives is available at http://www.ece.uiuc.edu/abet/CourseGoals/420.pdf.

Grading: The structured laboratory segment will count for 50% of the total grade, based on completion of and oral examination over the weekly laboratory assignments. Oral examinations will include underlying theory, details of the implementation and code, and the observed behavior of the system. Each lab is worth 10 points, usually with 1 point for prelab completion, 4 points for working code, and the remaining 5 points for quiz performance. *We emphasize that your grade is based heavily on your understanding and demonstration of the course material, not just on submitting working code.*

The project will count for 45% of the total grade, with 20% of the total grade dependent on technical work and oral demonstration of the project, 10% of the grade depending on the completeness and quality of the project proposal and the design review, 10% on the final report, and 5% on the project lab(s). The final 5% of the total course grade comes from a written quiz over the lecture material.

It is expected that each student will attend and participate in scheduled class and laboratory meetings, or will make prior alternate arrangements with the instructor. The final grade may be penalized if this does not occur.

All assignments other than the lecture quiz, final report, and design and final reviews are due during the scheduled laboratory meeting. All programming assignments through the final laboratory assignment will be graded by oral examination. A late penalty of 50% will be assessed for assignments less than a week late; assignments more than a week late will receive no credit. However, all graded assignments must be submitted to receive a passing grade in the course.

Projects: The last half of the course will be devoted to team projects of the student's choice. The projects can be primarily software, primarily hardware, or a mixture, depending on the student's interests. A DSP platform other than the TMS320C5510 development system can be used (or may be required) as appropriate for the needs of the project. Real-time, audio-rate digital signal processing of significant complexity is feasible, as is a basic digital communication system or relatively simple video processing. The emphasis in grading will be on successful completion of the agreed-upon project. Project ideas from the students will be welcomed.

Project Proposal. The Project Proposal is a written document (typically 3-10 pages) listing the team members, overviewing the topic (for example, speech recognition) to be addressed by the project, with a literature or research review relevant to the proposed project, complete with citations and references in standard (e.g., IEEE journal) format, and a proposal as to the specific project and goals to be performed. That is, the Project Proposal should be a description of the intended final "product," (e.g., DSP-based program for recognition of the digits 0-9), and a description of the specific algorithms or approach that will be taken for the implementation, based on the results of the literature/background review. Typically, this would consist of a detailed block diagram of the proposed system along with which algorithm or method will be used to implement each block.

The Project Proposal can generally be expected to serve as a basis for the Introduction, Background Research, and parts of the system design portions of the Final Report, should the proposed approaches prove successful.

Design Review. The Design Review will consist of a prepared oral presentation with supporting visuals (e.g., PowerPoint), to an expert panel consisting of the ECE 420 teaching staff and possibly additional outside experts, describing in detail the project goals, the proposed project design, the background research findings or other arguments leading to the selection of this approach as the preferred solution, and a plan for completion including milestones, timetables, and individual responsibilities or work packages. A test and verification plan must also be included.

The Project Proposal and Design Review serve to summarize the background research and the preliminary decisions as to the exact scope of the project, the algorithms and approach to be used, and the expected final product; in the absence of unanticipated problems, the work following the design review should consist of implementation and testing of the proposed system. It also serves as a kind of "contract," specifying (to the mutual agreement of both the student and the teaching staff) the technical accomplishments required for full credit. Final evaluation of the project will be based on successful completion of the proposed work as agreed upon after the Design Review.

Final Project Demonstration. The final project demonstration will be a scheduled but relatively informal review by the ECE 420 teaching staff of the (hopefully) completed project in action.

The project team will demonstrate their system, or all working components if incomplete, perform verification experiments or show test results confirming to the satisfaction of the course staff that it works as designed, and answer any questions.

Final Report. Each project team will submit a final report. This written report should include at least an Introduction, a Literature or Research Review, a Technical Description of the project, a Results section including descriptions of the testing done on the project, Suggestions for Extensions and/or Modifications, and Software and Hardware Documentation including (commented) program (paper and electronic) listings, logic diagrams, etc., as applicable. In short, the documentation should be concise, but sufficient for another student to easily take up where the project left off or to use the results in a future project.

Schedule:

Week Beginning	*Laboratory*	*Assignment Due*
8/24	Lab 0: Lab Orientation	
8/31	Lab 1: FIR Filtering	Prelab 1
9/7	Lab 2: Multirate Filtering	Lab 1 quiz, Prelab 2
9/14	Lab 3: IIR Filtering	Lab 2 quiz, Prelab 3
9/21	Lab 4: Spectral Analysis	Lab 3 quiz, Prelab 4
9/28	Lab 5: Optimization Lab	Lab 4 quiz, Prelab 5
10/5	Assigned Project Lab	Lab 5 quiz, decide on project area
10/12	Background Research	Project Lab
10/19	Project Design	Project Proposal
10/26	Work on Projects	Design Review
11/2	Work on Projects	
11/9	Work on Projects	
11/16	Work on Projects	
11/23	Thanksgiving Break	
11/30	Work on Projects	
12/7	Final Project Demonstrations	Final reports due 5pm 12/13

Lab access and etiquette. Students are expected to be in the lab for their two-hour assigned lab period. In addition, students can access the lab at any time (subject to departmental rules for normal lab privileges) using their I-card. It is expected that students will require additional lab time to complete their assignments. ECE 420 students having difficulty with their I-card access should notify a teaching assistant.

Students have priority in the lab during their assigned lab period.

Basic rules of courtesy and professional behavior are expected in the lab. Please do not remove any lab equipment, books, or manuals from the lab at any time. If you would like to listen to music as you work, please use headphones. No drinks or food are allowed in the lab.