ARIZONA STATE UNIVERSITY
Department of Electrical Engineering

EEE 404/591
Real-Time Digital Signal Processing
Spring 2009

Course Information

Online using Blackboard under myasu.asu.edu

http://www.fulton.asu.edu/~karam/realdsp/

Class Hours: MW 2:00 p.m. – 3:15 p.m. **Location:** PSA 103

Lab Sections: On-Campus Lab Location: GWC 231 (RESP Laboratory)
Note: All on-campus students are required to register and attend one of the following lab sessions: Tuesdays 1:30 p.m. to 4:20 p.m., Tuesdays 6:00 p.m. to 8:50 p.m., Thursdays 1:30 p.m. to 4:20 p.m., or Thursdays 6:00 p.m. to 8:50 p.m.

On-line students can access the lab equipment, boards, and software remotely in real-time, and can develop and run on the lab equipment and boards real-time applications from their remote location.
Note: On-line students need to contact Prof. Karam by e-mail at karam@asu.edu with their preferred 3-hour to 4-hour time slots during which they can conduct the labs.

Instructor:

Prof. Lina Karam
Office: GWC 430
Email: karam@asu.edu
Phone: (480) 965-3694
Fax: (480) 965-8325

Office Hours: Mondays 3:30 p.m. to 4:25 p.m.; Wednesdays 1:00 p.m. to 1:50 p.m.

Teaching Assistants/Lab Instructors: Mr. Srenivas Varadarajan (Srenivas.Varadarajan@asu.edu) and Mr. Adithya Murthy (Adithya.Murthy@asu.edu)

TA Open Lab Hours: To be announced later in class.

Textbook:
S.M. Kuo and W.-S. Gan, *Digital Signal Processors: Architectures, Implementations, and Applications*, Pearson Prentice Hall, 2005.

Course Prerequisite: Signals and Systems, or equivalent.

Course Description and Objectives:

With the widespread usage of DSPs as part of real-time embedded systems, the breadth of applications in which DSPs can be used is large. These applications include, but are not limited to, modems, faxes, data transmission, data encryption, speech and image processing and compression, vehicle navigation, automotive control, seismic and spectral analysis, radar and sonar, ECG monitoring, digital audio and music, hearing aids, digital cellular phones, and video telephones.

The objectives of the proposed course is to provide the students with knowledge and hands-on experience in translating DSP and communications concepts into real-time software for embedded systems using DSP boards. The proposed course emphasizes designing and implementing real-time software for embedded systems through the programming of a special type of micro-processor, the

DSP, or Digital Signal Processor. Laboratory exercises will be based on writing C and assembly language software for selected DSP boards that are used in current consumer products, and interfacing the DSPs to external devices for test and measurement. The focus of the course is on Real-Time DSP programming. It provides an overview but does not provide in-depth coverage of signals/systems theory, nor does it teach computer programming, since it assumes some knowledge of both.

The main objectives of the proposed course are:

- to explore signal processing and communications concepts by implementing them on actual hardware in real-time;
- to gain experience using equipment commonly used in industry such as digital signal processors, Analog-to-Digital and Digital-to-Analog converters, and signal acquisition and analysis devices;
- to learn about DSPs.

Lab Projects:

Lab projects are a main component of this course. Ten to eleven projects will be assigned and will count for 40% of the course grade. The lowest lab project grade will be dropped. The projects provide hands-on experience in translating DSP and communication concepts into real-time software for embedded systems through the programming of fixed-point Freescale and TI DSPs. In addition, the projects provide hands-on experience in acquiring, analyzing, and processing real-time I/O.

The lab projects consists of the development of various real-time applications in which students will address implementation of real-time DSP systems from DSP algorithms to real-time I/O. Students will complete projects requiring specification, design, implementation, and testing. Projects for this course are based upon concepts that are introduced in the class lectures, in addition to prior coursework in signals and systems, microprocessor programming, and C or C++ programming.

On-campus students should attend their assigned lab sessions to get credit for the conducted projects. Missing a lab session will result in a zero grade on the project or part of the project that is performed during that session. On-line students can access the lab equipment and software remotely.

Pre-lab Quizzes:

Students will have to take a web-based pre-lab quiz before 1:00 p.m. on Tuesdays before each lab (except Lab 1). The pre-lab quizzes will count for 10% of the course grade. Each pre-lab quiz consists of a set of questions from the reading for the lab assignment. Once a student initiates a quiz, the student gets one hour to complete it. Each student is required to take the quiz by himself/herself and should not receive any help from anyone else.

Homework:

Homework will be assigned every other week and will count for 10% of the course grade. The completed homework will be due in two weeks. Working homework problems is an important component of the course. Any graded material including homeworks, is to evaluate each student's own understanding and performance skills. So, students are not allowed to refer to past homework solutions and/or solution manuals when solving the assigned homework problems. Students are encouraged to seek the help of the instructor when they encounter difficulties in solving assigned homework problems.

Exams:

Two exams will be given and will count for 30% (15% each) of the course grade. All exams are

to be taken on the dates and at the times specified by the instructor. Exams that are not taken on the specified date and during the allowed time period will not be accepted and will be awarded a zero grade. Online students should arrange with the ASU GOEE (previously called CPD) office to designate an approved proctor at their site and should take the exams at the specified dates. Exam dates and times are listed below in this handout, but these can change if circumstances warrant it. No make up exams will be given. Missing an exam will result in a zero grade for that exam unless due to a proven medical emergency. Cheating on an exam will not be tolerated; students caught cheating will receive a zero grade for the exam or a failing grade (E) for the course. Also, students need to abide by the exam rules as discussed in class and lab, and as written on the front page of the exam.

Final Demo

A final demo will be performed by the students at the end of the semester in place of the Final exam. This demo will count for 10% of the course grade. On-line students will be sent questions about a selected project out of the perfomed lab projects, and they need to turn in answers to these questions.

Academic Integrity:

Students should abide by the Student Academic Integrity Policy and ASU's Student Code of Conduct which can be found at *http://www.asu.edu/studentlife/judicial/integrity.html* and *http://www.asu.edu/aad/manuals/sta/sta104-01.html*.

The highest standards of academic integrity are expected of all students. The failure of any student to meet these standards may result in suspension or expulsion from the university and other sanctions as specified in the academic integrity policies of the individual colleges. Violations of academic integrity include, but are no limited to, cheating, fabrication, tampering, plagiarism, or facilitating such activities.

Under no circumstances will violations of academic integrity be tolerated. Penalties include reduced or no credit for submitted work, a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion and revocation of already awarded degrees.

If you are not sure if something is allowed or not allowed, you should ask the course instructor. The university requires that, should the instructor implements any penalty for violation of the academic integrity policy, the instructor reports the matter to the Dean's office.

Acknowledgment: This section on Academic Integrity has been adopted from Prof. Rida Bazzi, Computer Science & Engineering, ASU.

Attendance

You are responsible for everything covered, announced, or distributed in class and/or lab and/or on course web sites.

Grading Formula:

Projects	40%
Exam 1	15%
Exam 2	15%
Pre-lab quizzes	10%
Homework	10%
Final Demo	10%

Important Dates:

Exam 1	Wednesday 18 March, during class time
Exam 2	Wednesday 29 April, during class time
Projects	Due date as specified on each assigned project.
Final Demo	During Final Exam week as assigned by University Scheduling

Subject to Change Notice:

All effort will be made to follow the syllabus, but the syllabus can be modified by the instructor if circumstances warrant it.

Acknowledgements:

Prof. Karam would like to thank CEINT, Motorola/Freescale, Texas Instruments, and Tektronix for generously contributing to the development of this course and the operation of the Real-time Embedded Signal Processing (RESP) Laboratory.