MAE 143 A: Signals and Systems. Spring 09.

Instructor: Sonia Martínez, EBU-I 1205, 858-822-4243, soniamd@ucsd.edu

Teaching Assistant:

Robert Krohn (rhkrohn@ucsd.edu)

Lecture Time and Place: Tuesday-Thursday, 12:30 pm - 1:50 pm, place Centr 105

Discussion Sections:

- Robert Krohn: Fridays, 11:00 am - 11:50 am, place TBA

Office Hours:

Instructor: Thursdays, 2:30 pm - 3:30 pm, place EBU-II, 305

If you have any questions about the course, you can send me an email. I will try to respond the questions, if not by email, in class. If the questions you have are very involved, it is better that you ask them to me personally. I will share questions (and their answers) that are particularly good with the rest of the class.

Teaching Assistant's office hours:

Robert on Mondays, 2:30 pm - 3:30 pm, place EBU-II 305

Texts: The following will be the main text the course will be based on:

M.J. Roberts. *Fundamentals of Signals and Systems*. McGraw Hill, 2008

The following two texts are additional, complementary references on Signals and Systems that you may also consult:

E.W. Kamen and B.S. Heck. *Fundamentals of Signals and Systems*. Prentice Hall, 07

G.F. Franklin, J.D. Powell, and A. Emami-Naeini. *Feedback control of dynamic systems*. Prentice Hall, 2006

Course Objectives: The course material will mainly focus on tools for the analysis of signals processed by systems. This is a first step to understand how signals carry information and how systems process this information, which will be useful for their posterior *design* and *control*. In this way, you can consider this as an applied mathematics course more than a course that covers the building of devices. However, the understanding of the material is very important for the successful design of devices. The subject of control will be expanded in MAE 143B and MAE 143C. A course that is quite related to this one is MAE 140 (Linear Circuits).

By the end of the course, you should be able to:

1. Know what different types of signals there are. Understand how to represent signals in different ways, and know main properties of signals useful to simplify their analysis. In particular we will cover:
   - Special continuous-time (analog) signals and their properties.
   - Continuous Time Fourier Series Expansion of periodic signals.

- Laplace and Fourier transforms of general (aperiodic) signals.
- Classification of signals according to their frequency spectrum. Energy and average power of a signal.
- Discrete time signals and sampling of analog signals (time permitting)
- Z transform of a signal (time permitting)

2. Know how to represent systems in the Time Domain and the Frequency Domain and know how to pass from one representation to another. Know how to classify systems according to their properties. We will cover:
   - Differential equations (ODEs) and state-space representation of continuous-time systems.
   - Impulse response of an LTI system
   - System responses through the convolution integral.
   - Transfer function and frequency response.
   - Classification of a system according to its filtering properties.
   - Difference equations for discrete-time systems (time permitting)
   - Difference equations
   - Impulse response and convolution sum
   - Z-transfer function
3. Determine system properties: homogeneity, additivity, linearity, time-invariance, stability, causality, invertibility.
4. Know how to obtain a system response to standard signals (impulse response, step response) and then the system response to any signal in terms of those.
5. Understand basic principles of radio/communication systems.

Homework:

There will be a set of homework due every week. Due dates are listed in the calendar of the website. The homework will be collected and returned in class. The TA is your contact in turning in and getting back homework. No late homework will be accepted, and there will be no make-up quizzes or exams except for justified reasons.

Homework must be stapled and must be written legibly and in logical order. You must include your name, your ID #, and the assigment on the first page of your homework. Readers will be instructed to reject homework that does not meet the above criteria.

You are encouraged to ask questions about the homework problems in the discussion sections. You can work in groups on homework problems but each student must turn in homework separately.

As in any math-like course, a lot of work is required to master the material. Spending at least one hour revising the class notes after the class is strongly advised to succeed in the course.

Discussion Sections:

Attending the discussion sections is very important to pass this course and obtain a satisfactory result. Although we will solve problems in class that are similar to those in the homework and exams, the discussion sections will be entirely devoted to this task. Attending the discussion sections is not mandatory, but very much encouraged.

Grading Policy: Your grade will be the maximum of the following two options.

Option 1:	Homework: 25%	Midterm: 30%	Final: 45%
Option 2:	Final 100%		

That is, your Final Grade (FG) will be: FG = max(Option 1, Option 2)
Note: Even though you think that you won't pass the course with Option 1, it is very much recommended that you keep turning in all the homeworks.

WebCT:

Your grades will be available to you via WebCT. Check out `http://webct.ucsd.edu` for instructions on how to register and log in.

Academic Honesty:

No form of academic dishonesty will be tolerated. For the definition of academic dishonesty and its consequences refer to the Student Conduct Code available at the website `http://ugr8.ucsd.edu/judicial/JudicialAffairs.htm`.

Course website:

`http://faemino.ucsd.edu/soniamartinez/teaching/`143a_`SignalsSystems/index.html`

The website contains this syllabus and the list of homework due. The website can also be accessed through the list of courses in the MAE website. Please check it periodically for updates and other important announcements related to the course.

The material that you have learned in Math 20E, Math 20F and Math 20D will be frequently used in this class, and it is of course assumed you have mastered it. In particular, we will make use of basic algebraic operations, limits, continuity, derivatives, how to solve basic ODEs and Laplace transforms throughout the course. MAE 105 is a prerequisite for the class this year, so some knowledge on Fourier transform is also assumed.

Important Dates:

The following is a calendar with the dates when homeworks will be issued, due and dates for quizzes and final exam.

	Issued	Due	Date
Homework 1	Mar 31	Apr 7	
Homework 2	Apr 7	Apr 14	
Homework 3	Apr 14	Apr 21	
Homework 4	Apr 21	Apr 28	
Homework 5	May 5	May 12	
Homework 6	May 12	May 19	
Homework 7	May 19	May 26	
Homework 8	May 26	Jun 2	
Midterm			Thurs Mar 7 (in class)
Final			Monday Jun 8, 11:30 am to 2:30 pm

A final word of advise: Use of the resources you are given to learn and understand the material of the course! Read the notes before attending the lectures, do the homework, ask questions in class or in the office hours, email me or the TAs with questions, consult other books, ask other students, use the university resources. After each class, make sure that you have understood the concepts taught. If you have questions, don't be shy and ask! Everything is on your side to help you master this signals and systems course.