University of Massachusetts
Department of Electrical and Computer Engineering

ECE 563 - Introduction to Communications and Signal Processing
Fall, 2007

http://www-unix.ecs.umass.edu/∼goeckel/ece563.html

Objective: The purpose of this course is to study the theory and application of techniques for the analysis and processing of deterministic and random signals. In particular, at the completion of this course, students will:

1. Understand the theory of continuous-time and discrete-time signals and systems.
2. Be able to specify the processing of continuous-time signals using discrete-time processing.
3. Be able to apply knowledge of signals and systems to the analysis and design of analog communication systems.
4. Understand the theory of continuous-time and discrete-time random processes and noise.
5. Be able to apply knowledge of random processes and noise to the characterization of analog communication systems in noise.

Course Format: Three 50-minute lectures (MWF 1:25, ELAB 303)

Instructor: Dennis Goeckel, 215H Marcus Hall, Phone: 545-3514, e-mail: goeckel@ecs.umass.edu
Office Hours: Monday, 12:20-1:10 p.m.; Wednesday, 2:30-3:30 p.m.; or by e-mail appointment.

"Where Everybody Knows Your Name": Please come by my office hours during the first two weeks of the semester so that I can meet you.

Prerequisite: ECE 313, ECE 314 or equivalents.

Main Textbook: (Available at the Jeffrey Amherst College Book Store)
Fundamentals of Communication Systems, by J. Proakis and M. Salehi, 2005, Pearson Prentice-Hall.

Grading: Homework - 20 %
Midterm Exam 1 - 25 %
Midterm Exam 2 - 25 %
Final Exam - 30 %

All exams will be closed-book closed-notes; a single **hand-written** formula sheet will be allowed. The final exam will be cumulative. Homeworks will be collected at the beginning of the lecture on the date that they are due. Homeworks will not be accepted after their solutions are distributed.

Ground Rules: You are encouraged to work together on homeworks; however, each student must submit his own solutions. Also recall that homeworks are really only preparation for the exams, so do not rely too heavily on other students for help. **Academic dishonesty** (either taking or giving answers, use of extra crib sheets, etc.) on an exam will be dealt with harshly; you will receive an "F" for the course, and there may be further disciplinary action.

Course Outline (Subject to Modification)

I. Motivation and Overview

II. Deterministic, Continuous-Time Signals and Systems
Signal properties and examples in continuous time.
LTI systems, Fourier series and Fourier transform, applications to simple AM radio systems. Complex baseband representation, application to bandwidth-efficient AM. A non-linear application: FM/PM.

III. Deterministic, Discrete-Time Signals and Systems
LTI systems and difference equations. Fourier transform (DTFT) and its sampled version (DFT). Discrete-time processing of continuous-time signals, sample rate modification, applications to digital transmitter/receiver implementation.

IV. Random Continuous-Time Signals and Systems
A single random variable and two random variables (review).
Random processes, stationarity, power spectral density.
Filtering of random processes. Applications to communication system analysis/design in a noisy environment.

V. Random Discrete-Time Signals and Systems
Filtering of discrete-time random processes. Design and analysis of digital processing systems for random signals.

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Detailed Course Objectives

At the completion of this course, students will:

1. Understand the theory of continuous-time and discrete-time signals and systems.
2. Be able to specify the processing of continuous-time signals using discrete-time processing.
3. Be able to apply knowledge of signals and systems to the analysis and design of: (1) analog communication systems, and (2) digital filters.
4. Understand the theory of continuous-time and discrete-time random processes and noise.
5. Be able to apply knowledge of random processes and noise to the characterization of analog communication systems in noise.

ABET Outcomes	1	2	3	4	5
1. Apply knowledge of math and physical sciences	Y	Y	Y	Y	Y
2. Conduct experiments and analyze data	N	N	N	N	N
3. Design electrical systems components to specifications	N	Y	Y	N	Y
4. Function in multidisciplinary teams	N	N	N	N	N
5. Identify, formulate, solve engineering problems	Y	Y	Y	Y	Y
6. Understand professional, ethical responsibility	N	N	N	N	N
7. Communicate effectively	N	N	N	N	N
8. Understand impact in a societal context	N	N	N	N	N
9. Understand need to continue in life-long learning	N	N	N	N	N
10. Use modern engineering tools/techniques	Y	Y	Y	Y	Y