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. A key skill obtained is the ability to change rapidly between the continuous-time (analog hardware) and discrete-time (digital hardware or software) domains, and think about designs that include portions in each domain. This allows the course to serve as a nice capstone design course for the mathematical side of systems design. 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 (Time: 1:25-2:15pm, Place: Marston 132)

Instructor: Dennis Goeckel, 215L Marcus Hall, Phone: 545-3514, e-mail: goeckel@ecs.umass.edu
Office Hours: Monday, 2:30-3:30pm Wednesday, 12:15-1:15pm (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: (Not required, but a useful shelf reference. I would recommend waiting until I discuss this the first day of class before considering buying.): Fundamentals of Communication Systems, by J. Proakis and M. Salehi, 2005, Pearson Prentice-Hall.

Grading: Homework - 20 %
Midterm Exam 1 (Wednesday, October 12th, 7-9pm) - 25 %
Midterm Exam 2 (Wednesday, November 16th, 7-9pm) - 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.