Department of Electrical and Computer Engineering
University of Massachusetts/Amherst

ECE 563: Introduction to Communications and Signal Processing
Fall 2014

Catalog Data: Continuous-time (CT) and discrete-time (DT) signals and systems. DT processing of CT signals. DT and CT random process and noise models. Analog communication systems and their performance in noise. Digital filter design methods. Prerequisites: ECE 313, 314.

Objectives: Students completing this course will know:

1. How to represent and analyze continuous-time and discrete-time signals and systems.
2. How to implement continuous-time processing using discrete-time systems.
3. How to design, implement and characterize analog communication systems (amplitude and frequency modulation).
4. Key properties of continuous-time and discrete-time random processes and noise.
5. How to use random process models to analyze the performance of analog communication systems in noise.

Prerequisites: ECE 313 (Signals and Systems), ECE 314 (Introduction to Probability and Random Processes) or equivalents

Instructor:
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Web Site: All course information (assignments, solutions, announcements, etc.) will be posted on Moodle: http://moodle.umass.edu
(You will need to be registered in the course to have access to Moodle.)

Lectures: M/W, 2:30 – 3:45 PM, ELAB 304

Office Hours: Monday, 4 – 5 PM; Thursday, 11 AM – noon

Textbook: None is required (all course material will be covered in lecture), but the following is recommended for purchase as a reference:
Hsu, *Analog and Digital Communications (Schaum's Outlines), 2nd ed.*, McGraw-Hill, 2002.

References: Proakis and Manolakis, *Digital Signal Processing, 4th ed.*, Prentice Hall, 2006.

Proakis and Salehi, *Communication Systems Engineering, 2nd ed.*, Prentice Hall, 2001.
Hayes, *Schaum's Outline of Digital Signal Processing, 2nd ed.*, McGraw-Hill, 2011.

Grading policy: Homework: 10%
Exam 1 (Thursday, Oct. 9, 7-9 PM)
Exam 2 (Thursday, Nov. 6, 7-9 PM)
Exam 3 (Monday, Dec. 8, 3:30-5:30 PM)
The lowest exam grade will count for 10% of the course grade; the two highest exam grades will count for 40% each of the course grade.

Course Grade Scale:

If your overall course grade is in the range:	You will receive a course letter grade of at least:
85-100	A
80-84	A-
75-79	B+
70-74	B
65-69	B-
60-64	C+
55-59	C
50-54	D (undergraduate)

Topics covered:

1. **Review of Continuous-Time (CT) Signals and Systems**: signal properties; linear time-invariant (LTI) systems; Fourier series; Fourier transforms.
2. **Discrete-Time (DT) Processing of CT Signals:** sampling; discrete-time implementations of continuous-time systems; D/A and A/D conversion; quantization errors.
3. **Introduction to DT Filter Design and Implementation:** FIR filter design; direct-form and DFT implementations.
4. **Amplitude Modulation (AM) Systems:** AM transmitters; time-domain and frequency-domain analysis; coherent and superheterodyne receivers; bandpass signal representations; equivalent baseband implementations of bandpass systems, with application to bandwidth-efficient versions of AM.
5. **Frequency Modulation (FM) systems:** FM transmitters; time-domain and frequency-domain analysis; discriminator and phase-locked loop receivers.
6. **CT Random Processes and Noise:** stationarity; autocorrelation function, power spectral density and wide-sense stationarity; LTI filtering of random processes; Gaussian random processes; white noise; narrowband noise.
7. **Performance Analysis of Analog Communication Systems in Noise:** signal-to-noise ratios; conventional AM; FM with a discriminator receiver.
8. **(Time permitting) DT Random Processes and Noise Filtering**.