University of Texas at Dallas
Erik Jonsson School of Electrical Engineering and Computer Science
EE 4360 Digital Communications (3 sem. hrs)
Fall 2003

Instructor: Dr. Andrea Fumagalli
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Textbook:
Proakis and Salehi, "Communication Systems Engineering", 2nd ed., Prentice-Hall.
Other suggested book:
Sklar, "Digital Communications", 2nd ed., Prentice-Hall.

Course objective:
In the last few decades, digital communication has drastically improved our quality of life. Amenities such as fax machines, pagers, cell phones, and internet, are now considered indispensable. None of them are possible without digital communication.

This course explores elements of the theory and practice of digital communications. The course will 1) model and study the effects of channel impairments such as noise and distortion, on the performance of communication systems; 2) introduce signal processing, modulation, and coding techniques that are used in digital communication systems.

Concepts/tools to be acquired in this course:

- Overview
  - Classification of signals and systems
  - Orthogonal functions, Fourier series, Fourier transform
  - Spectra and filtering
  - Sampling theory, Nyquist theorem
  - Random processes, autocorrelation, power spectrum
  - Systems with random input/output
- Quantization, Compression, and PCM
  - Elements of compression, Huffman coding
  - Elements of quantization theory
  - Pulse code Modulation (PCM) and variations
  - Rate/bandwidth calculations in communication systems
- Communication over AWGN Channels

  - Signals and noise, Eb/N_0
  - Receiver structure, demodulation and detection
  - Correlation receiver and matched filter
  - Detection of binary signals in AWGN
  - Optimal detection for general modulations
  - Bandpass PAM, coherent and noncoherent detection
  - MPSK and MFSK, coherent and noncoherent detection
  - QAM modulations
  - Calculation of error probability
  - Effects of carrier phase error

- Communication over Bandlimited AWGN Channel
  - ISI in bandlimited channels
  - Zero-ISI condition: the Nyquist criterion
  - Raised cosine filters
  - Partial response signals
  - Equalization using zero-forcing criterion

- Elements of Coding
  - Types of error control
  - Block codes
  - Error detection and correction
  - Convolutional codes
  - The Viterbi algorithm

Pre-requisites:
EE 3350 (Communication systems). Thorough knowledge of signals and systems, linear algebra, and probability theory is essential.

Homework/Exams:

- Homework: weekly assignment
- I Midterm Exam
- II Midterm Exam
- Final Exam: 2:00 pm, Thursday, December 4, 2003

Homework will be given to test student's knowledge and understanding of the covered topics prior to each written exam. Homework and written exams must be individually done by each student without collaboration with others. No late homework will be allowed.

Grading policy:
Final grade will be determined using 10% of the homework grade and 45% of the best two among I midterm, II midterm, and final exam.