SAN JOSE STATE UNIVERSITY
Electrical Engineering Department
EE 160 Analog and Digital Communications - SPRING 2008

Course Description:

This course is an introduction to the basic principles and applications of communication systems with an emphasis on digital communications. The course is composed of three parts. The topics covered in the first part include Fourier techniques and their use in communication system analysis, energy and power spectral density, a brief review of probability theory, a brief discussion of analog communication, bandpass signals and their lowpass equivalent. The second part of the class focuses on digital modulation and demodulation techniques. Geometric representation of signals is introduced and error-rate performance is evaluated for various modulation schemes. The last part of the class covers an overview of modern techniques for wireless communication systems, including multicarrier (OFDM) and spread-spectrum modulation techniques, and an introduction to basic concepts of information theory.

Course Information:

- **Instructor:** Birsen Sirkeci, Room: ENG 359, Phone: 4-3913, Email: bsirkeci@email.sjsu.edu
- **Time and Location:** TTh 13:30 - 14:45, ENGR 401
- **Homepage:** http://www.sjsu.edu/faculty/birsen.sirkeci/EE160Spring2008.htm
- **Prerequisites:**
  EE112 (Linear Systems), EE102 (Probability and Statistical Analysis)
- **Office hours:** Wed 13:30-18:30
- **Reading Material:**
  - **Required Text:**
    Fundamentals of Communication Systems by J. G. Proakis and M. Salehi, Prentice-Hall, 2004.
  - **Supplemental Texts:**
    * *Communication Systems Engineering* by J. G. Proakis and M. Salehi, Prentice-Hall, 2002.
    * *Communication Systems* by S. Haykin, Wiley, 4th Ed, 2000.
    * *Modern digital and analog communication systems* by B.P. Lathi, Oxford Uni. Press, 1998.
    * *Digital communications: Fundamentals and Applications* by B. Sklar, Prentice-Hall, 2001
    * *Contemporary Communication Systems using MATLAB* by J. G. Proakis, M. Salehi, and G. Bauch, Bookware Companion Series, 2004.
  - **Other Reading Material:** Handouts posted on the webpage.

- **Grading Policy:**
  Homework sets will be assigned on **Thursdays** and they will be due in a week. Part of the homework problems will require **MATLAB**. Solutions will be provided after the due date. **Late homework will not be accepted.**

  There will be two midterm exams and a final exam. The exams are Open Books and Notes.

Homework	Assigned on Thursdays and due in a week.	25 %
Midterm 1	**February 21, Thursday, 13:30 - 14:45**	25 %
Midterm 2	**April 3, Thursday, 13:30 - 14:45**	25 %
Final	**May 15, Thursday, 12:15-14:30**	25 %
Total		**100 %**

Tentative Schedule:

- Introduction and communication systems today (1 Lecture)
- Basic communication system and its elements (1 Lecture)
- Fourier analysis of signals and systems (review) (2 Lectures)
- Power and energy (1 Lecture)
- Sampling of bandlimited signals (1 Lecture)
- Bandpass signals and their low pass equivalents (2 Lectures)

  MIDTERM 1
- Geometric representation of signal waveforms (1-2 Lectures)
- Pulse Amplitude Modulation (PAM) (1-2 Lectures)
- Pulse Position Modulation (PPM) (1 Lecture)
- Optimum receiver for AWGN channels (3-4 Lectures)
- Probability of error for signal detection in AWGN channels (2-3 Lectures)

  MIDTERM 2
- M-ary modulation: M-PAM, M-PPM, general M-ary modulation (2-3 Lectures)
- Digital transmission over bandlimited channels (1 Lecture)
- Signal design for bandlimited channels (1-2 Lectures)
- Probability of error in detection for transmission through bandlimited channels (1-2 Lectures)
- Digitally modulated signals with memory (if time permits)
- Topics in wireless communication: multipath fading, OFDM, spread spectrum (3 Lectures)
- Channel capacity (1 Lecture)

Learning Objectives:

- Understanding basic communication system and its elements
- Understanding basic communication terms such as bandwidth, power, energy, bandpass, lowpass, carrier, modulation, demodulation, matched filter, ISI, BER, SNR, AWGN etc.
- Ability to perform signal analysis in the frequency domain
- Understanding the performance degradation due to additive white Gaussian noise (AWGN) in digital communication systems
- Ability to derive the vector representation of waveforms
- Ability to find the optimal receiver in AWGN channels for a given modulation technique
- Ability to find the error performance for AWGN channels for a given modulation technique
- Ability to analyze the performance in bandlimited AWGN channels
- Understanding the trade-offs between SNR, BER and achievable data rate for digital communication systems.
- Learning limitations of wireless channels and techniques for combating these limitations

Notes:

- You are responsible for understanding the policies and procedures about add/drops, academic renewal, withdrawal, etc.
- You are responsible for reading and understanding the university/college/department policies.
- Attendance to all of the lectures are critical for learning the material.
- Classroom behavior: Come to the class on time and leave at the end of the lecture. Turn off your cell phone during the lectures. Do not eat and drink in the classroom.
- Additional office hours are possible by appointments only.

UNIVERSITY/COLLEGE/DEPARTMENT POLICY INFORMATION:

A. **Academic Integrity Statement:** "Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Integrity Policy, require you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Judicial Affairs. The policy on academic integrity can be found at: http://sa.sjsu.edu/judicial_affairs/index.html

B. **Campus policy in compliance with the Americans with Disabilities Act:** "If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities register with the DRC to establish a record of their disability."

C. **EE Honor Code:** The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students. "I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor."

Measures Dealing with Occurrences of Cheating:

- Department policy mandates that the student or students involved in cheating will receive an "F" on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
- A student's second offense in any course will result in a Department recommendation of suspension from the University.