

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
Department of Electrical Engineering

COURSE SYLLABUS

Course Description

This is a core course on digital communications, presenting the basic principles of communication systems and the analysis of their performance. The following topics will be covered: Different types of baseband and passband modulation, signal and receiver design, noise and its effects, detection and probability of error calculations, source and channel coding, Shannon capacity, ISI and maximum likelihood sequence detection.

Course Requirements

The student is assumed to have a working knowledge of transforms (especially the Fourier transform), linear systems, probability and random processes (correlation, spectrum). This background material will be reviewed, but not taught.

Course Outline

The following is a preliminary course schedule.

- Week 1: Introduction, Fourier Transform, Signals and Systems, Spectrum, Sampling theorem
- Week 2: Hilbert transforms, complex envelopes and analytic signals, Passband PAM and baseband PAM
- Week 3: Nyquist pulses and eye diagrams, passband and baseband noise, random PAM
- Week 4: Alphabet design, PSK and differential coding, spectral efficiency, extensions of PAM: multipulse, OFDM
- Week 5: Decoding and error analysis, systematic analysis of digital modulation
- Week 6: Source and Channel coding
- Week 7: Shannon capacity
- Week 8: Vector representation of continuous time signals, Time-bandwidth product and the number of independent signals
- Week 9: Waveform communications, N-orthogonal signaling, etc.
- Week 10: ISI and ML sequence detection, the Viterbi algorithm

Calendar

- First class: January 8, 2008 (Tuesday)
- There will be an in-class midterm exam in week 5 or 6.
- Last class: March 13, 2008 (Thursday)
- Final project - see separate handout.
- Holidays: January 21 (Monday), February 18 (Monday)

Class Time and Location Lecture times: Tu Th 4:00-5:45pm, Thimann Lab 101. **Reference**

Books

- Digital Communication, third edition, by J. Barry, E. Lee, D. Messerschmitt, Kluwer Academic Publishers, 2004.
- Digital Communications, fifth edition, by J. Proakis and M. Salehi, McGraw Hill, 2008.
- Digital Modulation and Coding by S. G. Wilson, Prentice Hall 1996.
- Principles of Digital Transmission by S. Benedetto and E. Biglieri, Kluwer Academic, 1999.

Grading Policy

Course grade will be based on the homeworks (20%), the midterm exam (30%), and the final project (50%).

Academic Dishonesty

Any confirmed academic dishonesty including but not limited to copying homeworks or cheating on exams, will result in a no-pass or failing grade. You are encouraged to read the campus policies regarding academic integrity. Examples of cheating include (but are not limited to): Sharing results or other information during an examination. Working on an exam before or after the official time allowed. Submitting homework that is not your own work. Reading another student's homework solution before it is due. Allowing someone else to read your homework solution before the assignment is due.

For more details see the Official UCSC Guideline on Academic Integrity.