The Ohio State University
Department of Electrical and Computer Engineering

ECE 702 – Communication Systems

Spring 2008

Instructor: Dr. Phil Schniter, Associate Professor
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Web Page: `http://www.ece.osu.edu/~schniter/ee702/index.html`
Homework assignments, homework modifications, homework solutions, and relevant handouts will be posted on the web page.

Lectures: MWF 10:30am-11:18am, 120 Baker Systems Engineering

Office Hours: To be posted on course web page.

Objectives: To develop a basic understanding of digital communication systems through performance analysis of various communication schemes.

Text: Michael P. Fitz, *Fundamentals of Communications Systems*, McGraw Hill: New York, 2007.

Outline: *Introduction and review*: complex-baseband representations, statistical properties of noise, the digital communication problem. (3 lectures)
Optimal communication of a single bit: MAP and ML bit detection, matched filtering, waveform design, BFSK, BPSK, spectral efficiency. (5 lectures)
Optimal communication of multiple bits: MAP and ML word detection, union bound, pair-wise error probability, MFSK, MPSK. (6 lectures)
Modulation under complexity constraints: linear modulation (PAM, QAM), orthogonal modulation (OFDM, OCDM, stream modulation). (5 lectures)
Modulation under bandwidth constraints: Nyquist criterion, squared cosine pulses, spectral shaping for OFDM and stream modulation, scatter plots, eye diagram. (4 lectures)
Modulation with memory: Trellis diagram, ML word detection, spectral characteristics, convolutional codes, trellis codes. (6 lectures)

Prerequisites: Signals and systems (e.g., ECE 351-352).
Probability and random variables (e.g., Math 530 or Stats 472).
Analog communication in noise (e.g., ECE 501).

References:

1. J. G. Proakis and M. Salehi, *Fundamentals of Communication Systems*, Prentice Hall, 2005.
2. J. G. Proakis and M. Salehi, *Contemporary Communication Systems Using Matlab*, 2nd Ed., Thomson-Engineering, 2003.
3. S. Haykin, *Communication Systems*, 4th Ed., Wiley, 2000.
4. M. K. Simon, S. M. Hinedi, and W. C. Lindsey, *Digital Communication Techniques*, Prentice Hall, 1994.
5. J. D. Gibson, *Principles of Digital and Analog Communications*, 2nd Ed., MacMillan, 1989.

Grading: The course grade will be based on homework and projects ($\sim 30\%$), an in-class midterm ($\sim 30\%$), and a comprehensive final exam ($\sim 40\%$). Note: These weightings are approximate and may change. Some homework problems will require MATLAB computer programming and not necessarily all problems on each homework assignment will be graded.

Late Policy: No late material (projects, homework, etc.) will be accepted unless prior arrangements have been made. Arrangements need to be made at least 24 hours in advance. Any emergency situation will be handled on a case-by-case basis.

Attendance: The student is responsible for all assignments, changes to assignments, announcements, and subject material presented during the regularly scheduled classroom lecture. Copies of lecture notes will not made available. If you miss a lecture, please obtain notes from a classmate.

Honor System: All homework and examinations in this course will must be accomplished in accordance with the ECE Honor System. This means that *all submitted work must be your own.* While discussions among students relating to the homework are permitted (and often encouraged), a student's submitted assignment must reflect his/her *own* understanding of the material. Discussion of an exam is strictly prohibited until after the exam is submitted.