ECE 5654 - Digital Communications - Spring 2005
CRN 11753 (T,Th 2-3:15pm, Durham 261)

Instructor: Dr. R. Michael Buehrer Durham Hall 433 (540) 231-1898
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Office Hours: Tuesday/Thursday 9:30am-12pm (or by appointment)

Text: John G. Proakis, Digital Communications, 4th. edition, McGraw-Hill, 2000.
Supplementary material may be made available throughout the semester.

Software: The student edition of Matlab for Windows.

Prerequisites: EE 4634 - Digital and Analog Communications (or equivalent background)
EE 5605 - Stochastic Processes I (or equivalent background)

Web Page: http://www.mprg.org/people/buehrer/5654/ecpe_5654.htm

Grading:

Homework	10%
Midterm Exam	30%
Final Exam	30%
Project	30%

Scores will be normalized to assure proper weighting

Course Description: An introductory graduate course in digital communications. Major topics will include: modulation theory (Maximum A Posteriori decision theory, optimum receivers, vector-space representation of signals, probability of error analysis, energy and bandwidth efficiency), basic simulation principles, signal processing (block codes, convolutional codes, equalization), and spread spectrum communications (direct-sequence, frequency-hopped). Examples will be taken from radio and satellite communications systems.

Homework: There will be approximately five to ten homework assignments, approximately one per week except when another major assignment is (project or mid-term) due. Homeworks are due by the end of class on the date assigned. *Late homeworks will not be accepted*. Homework problems will be graded on the basis of 0,1 or 2 points per part of a problem.

Exams: There will be one in-class mid-term exam and one in-class final exam. Make up exams will be given *only in the case of a true emergency.*

Project: The course will include a group project. Groups of 1-4 students will undertake a research project focusing in detail on a relevant topic, algorithm or technique in the field of digital communications. A project proposal will be required early in the semester. An oral presentation and written report will be required later in the semester. Additional information on the projects will be made available as the semester progresses.

Honor Code: You may confer with your colleagues on interpretation and approach to homework problems, but the solutions should then be your own. All work submitted for examinations should be your own unaided work. You should write and sign the honor pledge on your exam: "I have neither given nor received unauthorized assistance on this assigment." Research projects should conform to accepted academic standards, and all outside sources of information should be clearly referenced.

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Preliminary Syllabus*

Date	No.	Topic	Text
1/18	1	Introduction and Course Overview	Chptr. 1
1/20	2	Review of Probability and Random Processes	Chptr. 2
1/25	3	Signal Space Representation of Digital Signals	4.1, 4.2
1/27	4	Vector spaces; Gramm-Schmidt procedure	4.3
2/1	5	Pulse Shaping, Spectral Characteristics	4.4
2/3	6	Optimum Receivers Structures - Matched Filters	5.1
2/8	7	Optimum Receivers Structures - ML and MAP	5.1, 5.2
2/10	8	Performance of Binary and M-ary Digital Modulation in AWGN	5.2
2/15	9	Union Bound - Performance of M-ary Modulation	5.2
2/17	10	Performance of Noncoherent Receivers	5.2, 5.4
2/22	11	CPM, MSK, GMSK / Performance measures for modulation	5.3
2/24	12	Fading Channels and Diversity	14.1-14.4
3/1	13	Diversity mechanisms	14.1-14.4
3/3		**IN CLASS MID-TERM EXAM**	
3/15	14	Multipath channels and equalization	11.1,11.2
3/17	15	Adaptive Equalization	11.1,11.2,11.4
3/22	16	Performance of Equalization	11.1,11.2,11.4
3/24	17	OFDM	12.2
3/29	18	Channel Capacity and Coding	Chptr. 7
3/31	19	Block Codes – Terminology and Structure	8.1
4/5	20	Block Codes – Decoding and Performance	8.2
4/7	21	Convolutional Codes - Encoding	8.2
4/12	22	Convolutional Codes - The Viterbi Algorithm	8.2
4/14	23	Convolutional Codes – Performance, Chernoff Bound	8.2
		ORAL PROJECT PRESENTATIONS 4/16	
4/19	24	Convolutional Codes – Soft Decision Decoding	8.2
4/21	25	Advanced Coding Techniques: Turbo Codes	handouts
4/26	26	Performance of Turbo Codes	handouts
4/28	27	Tellis Coded Modulation	8.3
		WRITTEN PROJECTS DUE: 5 pm	
5/3	28	Synchronization	handouts
		FINAL EXAM:	
		May 6, 10:05am-12:05pm	

*****Note: Please review this schedule immediately. If you have conflicts due to religious observances or other immovable, important events, please see me before the end of the second week of class. After that time, I will not consider making special arrangements except in the case of an emergency.

Version 1 (1-01-04)