ECE 4634 – Digital Communications
Fall 2007

Course:	CRN 91876	MWF 10:10-11:00	RAND 331
Instructor:	Dr. R. Michael Buehrer	433 Durham Hall	231-1898
Office Hours:	MW 11:15-12:15, R 9:30-11	**Grader:** Jesse Reed	jesser@vt.edu

Textbook: Haykin and Moher, Introduction to Analog and Digital Communications, 2nd Ed., Wiley & Sons, 2007. *Matlab* will also be required and is available at the bookstore or www.computing.vt.edu.

Prerequisites: ECE 3614, STAT 4714 (co-requisite)

Website: http://www.mprg.org/people/buehrer/4634/ecpe_4634.htm

Grading:

Homework	10%	Quizes	10%
Mid-term I	20%	Midterm II	20%
Projects	20%	Final	20%

Course Objectives: To develop a fundamental understanding of digital communication systems. Signal modulation techniques will be emphasized. Digital modulation techniques will be examined only. Modulation techniques will be analyzed both in terms of spectral efficiency and power efficiency. Examples of practical communication systems will be presented.

Homework: Homework assignments will be given regularly with each assignment consisting of 2-5 problems. The object of these assignments will be to help the student verify that he/she understands the basic concepts presented in class and *to provide the student the opportunity to obtain a deeper understanding of the material*. The grading will be as follows: 2/2 for a correct part to a problem, 1/2 for an incorrect answer but valid attempt, and 0/2 for no meaningful attempt. The lowest HW grade (based on # of points) will be dropped.

Projects: Three short design projects will be assigned during the term. They will be *Matlab*-based and are meant to provide students with a deeper understanding of the design trade-off in communications systems. Each project report will be due two weeks after being assigned.

Exams: There will be three exams, two midterms and a final. All will be in-class exams. The exam dates are already scheduled. It is your responsibility to be available for those dates. If you will be out of town, it is your responsibility to make arrangements to take the exam *before* the exam date.

Quizzes: Nearly every week there will be a short quiz during Friday's class. The quizzes will be simple (1 question) and will test basic understanding. Each quiz will be worth 10 points. Your lowest quiz grade will be dropped.

Honor Code: All work submitted for tests and exams must be your own work. You should sign the honor pledge on the exam: "I have neither given nor received unauthorized assistance on this assignment." You may confer with your colleagues on interpretation and approach to homework and project problems, but the solution should then be your own. All external research of the design projects should be documented through citation of references in a manner consistent with academic standards.

Accommodations: Any student who feels that he or she may need an accommodation because of a disability (learning disability, attention deficit disorder, psychological, physical, etc.) should see me during office hours. Specific accommodation requests are handled by the Dean's Office and must be approved by that office.

Late Assignments: All assignments are due by the end of class on the due date. If you will be out of town, you must make arrangements to get me the assignment before the due date. Any assignment turned in within 24 hours of the end of class on the date due, will be accepted with a ½ credit penalty. *After 24 hours homework will NOT be accepted.* Also, I will drop your lowest (in terms of # of points) homework grade.

Missed Exams : If you miss an exam, you must have an excuse sent to me from the Schiffert Health Center or the Dean of Students via the College of Engineering Academic Affairs Office in order to take a make-up exam.

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Syllabus

Week	Date	Lecture Topics	Reading
1	8/20	Introduction, Course Overview	1.1-1.3
		Signals, Fourier Transforms,	2.1-2.3
		Singularity Functions, Linear Systems	2.4-2.6
2	8/27	Intro to Digital Communications	Skim Ch. 5-6
		The Sampling Theorem	5.1
		Analog Pulse Modulation	5.2-5.3
3	9/3	Digital Pulse Modulation	
		Pulse Code Modulation, Quantization	5.4-5.6
		Delta Modulation, DPCM	5.7-5.8
		Line Codes	5.9
4	9/10	Intersymbol Interference	6.1-6.2
		Pulse shaping	6.3-6.5
		Eye diagrams, equalization	6.6-6.8
		Design Project I Assigned	
5	9/17	Introduction to Digital Bandpass Modulation	7.1
		Bandpass Representations	
		Midterm Exam (9/21)	
6	9/24	BASK	7.2
		BPSK	7.3
		BFSK	7.4-7.5
7	10/1	Non-coherent modulation	7.6
		M-ary Modulation	7.7
8	10/8	**No Class on Monday – Columbus Day**	
		Signal Space representation	7.8 – 7.9
		Random Variables	8.1-8.5
		Design Project 2 Assigned	
9	10/15	Random Processes	8.6-8.9
		AWGN	8.10-8.11
		Noise in Digital Communication	10.1-10.2
10	10/22	Bandpass receivers	10.2-10.4
		Optimum detection	
		Error Probability for Binary Signaling with Matched Filters	
11	10/29	Error Probability for Coherent BPSK, BASK	10.5-10.6
		Error Probability for *M*-ary signaling	
		Midterm Exam (11/2)	
12	11/5	Performance of Non-coherent modulation	10.7-10.8
		Comparison of Digital Modulation Techniques	
		Error Correction Coding	
		Channel models	
		Design Project 3 Assigned	
13	11/12	Rayleigh fading	
		Link Budgets	11.1-11.5
		Multiple Access: TDMA, FDMA, CDMA	
14	11/26	System design – Satellite communications	11.6
		System design – Fixed wireless communications	
		System design – mobile communications	
15	12/3	System design – cellular communications	11.6
		Final Topics, Review for Final Exam	
	12/11	**Final Exam (3:25-5:25pm)**	