EEE 261 INFORMATION THEORY, CODING, AND DETECTION

Elective Course **Date:** May 25, 2007

Course Area: Communications

Course Coordinator: Warren D. Smith, EEE.

Catalog Description: EEE 261. Information Theory, Coding and Detection. Signal space concepts, optimum M-ary communication systems, MAP estimation of continuous waveform parameters, information theory, coding. Prerequisite: EEE 185. 3 units.

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Text: Lathi, B. P., Modern Digital and Analog Communication Systems, 3rd Ed., Oxford University Press, 1998.

Additional Resources:

Course Objectives: After a brief review of probability theory and random processes, students will use mathematical representations of signals and noise to develop optimum receivers. Students then will learn how to measure information and how to determine the capacity of a channel for communicating information. Then, students will learn methods of coding to control communication errors

Prerequisites by Topic:

1. Measures of signal strength and correlation
2. Signal spectra by Fourier series and Fourier transform analysis
3. Time and transform domain methods of system analysis, including transfer functions
4. Introductory probability and statistics
5. Analog and digital communication systems
6. Methods of modulation and demodulation in communication systems

Topics Covered:

1. Review of probability and statistics and random processes
2. Geometrical representation of signals
3. Optimum receiver
4. Measure of information
5. Channel capacity
6. Error-control coding

Evaluation: Student performance in this course will be evaluated on the basis of three exams (75%), a project (15%), and homework (10%). Typical projects include identifying a research paper in the literature on information theory, coding, or detection and making an oral presentation of the paper to the class.

Course Outline/Schedule

Week	*Topic*	*Text Reference*
1	BACKGROUND. Review of probability, random variables Review of probability density functions/cumulative distribution functions	434-463
2	Review of expected values, central limit theorem Review of correlation, least mean square estimation	463-486
3	Review of random processes, stationarity, ergodicity Autocorrelation. Power spectral density	463-509
4	Multiple random variables. Transmission through linear systems Exam #1 (50 points)	509-521
5	OPTIMUM SIGNAL DETECTION Geometrical representation of signals. Gaussian random noise	626-637
6	Optimum receiver Equivalent signal sets	637-661
7	Non-white channel noise Other useful performance criteria	662-678
8	Review Exam #2 (50 points)	
9	INFORMATION THEORY Measure of information. Source encoding	679-690
10	Error-free communication over a noisy channel Channel capacity of a discrete memoriless system	690-700
11	Channel capacity of a continuous channel Practical communication systems in light of Shannon's equation	701-727
12	Review Exam #3 (50 points)	
13	ERROR-CONTROL CODING Linear block codes. Cyclic codes	728-745
14	Burst-error detecting and correcting codes Convolutional codes	745-755
15	Comparison of coded and uncoded systems Review	755-763
	Oral paper presentations (25 points) Exam #4 (50 points)	