EECS141B COMMUNICATION SYSTEMS II

Catalog Data: **EECS141B Communication Systems II (Credit Units: 3)**
Signal space analysis. Optimum receivers for digital communication. Maximum a posteriori and maximum likelihood detection. Matched filter and correlation receiver. PAM, QAM, PSK, FSK, and MSK and their performance. Introduction to equalization, synchronization, information theory, and error control codes. Prerequisite: EECS141A. (Design units: 1)

Textbook: *Communication Systems*, Simon Haykin, Wiley, 2001.

Coordinator: Ender Ayanoglu

Course Objectives: For students to be able to understand, analyze, and design fundamental digital communication systems.

Course Outcomes:

1. Students are able to analyze digital communication signals as vectors.
2. Students understand the principles of maximum a posteriori and maximum likelihood detection.
3. Students understand the basics of PAM, QAM, PSK, FSK, and MSK. They can analyze probability of error performance of such systems and are able to design digital communication systems based on these modulation techniques as block diagrams.
4. Students understand and are able to analyze equalizers.
5. Students understand and are able to analyze synchronization systems.
6. Students understand the basics of information theory and error correcting codes.

Prerequisites By Topic: The students are expected to have a background that includes probability theory, analog and digital signal processing, Fourier transform theory, random processes, and analog communication systems.

Lecture Topics:

1. Geometric representation of signals
2. Conversion of continuous AWGN channel into a vector channel
3. Optimum receivers, maximum a posteriori detection
4. Maximum likelihood detection, likelihood functions
5. Matched filter and correlation receiver
6. Probability of error
7. Pulse and quadrature amplitude modulation
8. Phase shift keying
9. Frequency shift keying
10. Minimum shift keying
11. Digital signaling through bandlimited channels: Nyquist criterion
12. Principles of equalization
13. Adaptive equalization
14. Carrier recovery
15. Timing recovery
16. Introduction to information theory
17. Error correction
18. Linear block codes

19. Convolutional codes and the Viterbi algorithm

Class Schedule: Each class meets 3 hours per week.

Computer Usage: Computer use is not required but can be helpful in solving problem sets.

Laboratory Projects: Not applicable.

Professional Component: Contributes towards the Electrical and Computer Engineering major requirements for Engineering Topics courses.

Relationship to Program Outcomes:

This course relates to Program Outcomes 1, 3, and 5 as stated at: http://www.eng.uci.edu/dept/objective_electrical.

Design Content Description:

1. The course focuses on developing a thorough understanding of digital communication systems by using a series of specific examples and problems. These illustrate and require the student to understand analysis and design of modern digital communication systems.
2. The course focuses on design of basic digital communication systems in building blocks. Specific examples include digital modulators, receivers, optimum detectors, phase locked loops, synchronization systems, and error correcting codes. These and other design examples make up 50% of the lecture time and 50% of the homework problems.

Approach:
Lectures: 100%
Laboratory Portion:

Grading Criteria: The grade in this course is based on homework, a midterm examination and a final examination which are weighted as (10% Homework + 40% Midterm + 50% Final). The homework is assigned weekly. Letter grades are based on a curve about the median score, which is a B- grade.

Estimated ABET Category Content:

Engineering Science: 2 credit units or 67%
Engineering Design: 1 credit units or 33%

Prepared by: Ender Ayanoglu **Date Prepared:** October 2005

Date Last Modified: October 2005