Polytechnic University of Puerto Rico
Department of Electrical Engineering
Master's Degree in Electrical Engineering

Course Syllabus

Course Title : Digital Communications

Course Code : EE 6760

Credits : Three (3) credits

Duration : One academic quarter.

Schedule : Forty-five credit hours per course.

Prerequisites : 5714 Digital Communication Systems

Course Description

A review of the behavior of digital communication systems in the presence of noise, optimal threshold detection and optimum receivers. Topics include optimum receivers for general M-ary signaling in the presence of AWGN, geometrical representation of signals, determination of an orthogonal basis set, MAP detectors, decision regions and error probability, equivalent signal sets, minimum energy signal set, colored channel noise, generalized Bayes Receiver, and Maximum Likelihood Receiver. Other topics are: Introduction to information theory, Huffman Code, Channel Capacity. Mutual Information, capacity of a band-limited AWGN channel, and Error Correcting Codes.

Justification

There is a need for a more generalized and comprehensive view of the digital communication systems in the presence of noise. Such concepts were introduced at the end of the prerequisite course. The present course provides detailed coverage of optimum receivers for general M-ary signaling in the presence of AWGN, as well as a solid introduction to Information Theory and Error Correcting Codes.

Objectives

To provide solid grounding in the area of optimal signal detection as well as an introduction to Information Theory and Error Correcting Codes.

Textbook:
Modern Digital and Analog Communication Systems (1998)
By B. P. Lathi
3rd Ed
Oxford University Press
New York, NY
ISBN 0-19-511009-9

Topics Covered: (Textbook Chapters: 13, 14, 15, 16)

1. Review of behavior of digital communication systems in the presence of noise, optimal threshold detection, optimum receivers. (Chapters: 13)

2. Optimum Signal Detection. Optimum receivers for general M-ary signaling in the presence of AWGN.

3. Geometrical representation of signals.

4. Determination of an orthogonal basis set.

5. Optimum receivers. Decision procedure. Decision regions and error probability.

6. Equivalent Signal Sets.

7. Colored Channel Noise

8. Generalized Bayes Receiver, Maximum Likelihood Receiver, Minimax Receiver.

9. Introduction to Information Theory. Huffman Code. Channel Capacity. Mutual Information. Capacity of a band-limited AWGN channel.

10. Introduction to Error Correcting Codes.

Evaluation Criteria

Final course grade will be determined, unless otherwise accorded in class, based on the following scale:

100-90	A
89-80	B
79-70	C
69-60	D
59- 0	F

Homework is suggested to be 0% to 10% of the final grade. Two exams (50%) and a final exam (25%) are suggested. A design project, research report or paper reviews (15%),

should be assigned to the students. Final percentages are to be determined by the instructor.

Course History

April, 2002; prepared by Marvi Teixeira, Ph.D., P.E.
June, 2002; revised by Carlos Ortiz, Ph. D.

Bibliography

Contemporary Communication Systems Using MATLAB®(2004)
John G. Proakis, Masoud Salehi, Gerhard Bauch
2nd Edition
McGraw-Hill
ISBN: 0534406173

Communication System Engineering. (2002)
by J. G. Proakis and M. Salehi.
2nd Edition
Prentice Hall
ISBN: 0-13-061793-8

Digital Communications (2000)
by J. G. Proakis
4th Edition
Prentice Hall
ISBN: 0072321113

Wireless Digital Communications (1995)
by Kamilo Feher
1st Edition
Prentice Hall
ISBN: 0-13-098617-8

Communication Systems (1994)
by Simon Haykin
3rd Edition
John Wiley
ISBN: 0-471-57176-8

Digital Signal Processing in Telecommunications (1993)
by Kishan Shenoi
1st Edition
Prentice Hall
ISBN: 013-096751-3