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

Course Syllabus

Course Title : Digital Communication Systems

Course Code : EE 5714

Credits : Three (3) credits

Duration : One academic quarter.

Schedule : Forty-five credit hours per course.

Prerequisites : EE 4702 Analog Communication Systems
EE 4710 Random Processes

Course Description

This course provides a review of Random Processes. Topics include the sampling theorem, pulse modulation including PAM, PPM, PWM and PCM; Baseband and passband transmission of digital signals including FSK, PSK, and QAM; M-ary modulation techniques; Introduction to spread spectrum systems; Behavior of digital communication systems in the presence of noise; Optimal threshold detection; Optimum Receivers.

Justification

Required course for the communication engineer. It provides the foundations to tackle complex topics in the advanced digital communication course. Digital communication has become the system of choice in the information age and is the leading technology in the communication industry.

Objectives

To provide adequate foundations in the area of Digital Communication. Some of the specific objectives of this course are:

1. Describe the process of sampling a signal and the consequences of aliasing.

3. Describe the Time Bandwidth product and its implications.

4. Describe the different digital modulation / demodulation techniques.

5. Describe how noise affects the different digital communication systems.
6. Perform BER calculations for digital communication systems.

7. Analyze a given digital communication system.

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

Software

MATLAB and VisSim Communication Toolbox or Simulink Communication Blockset are used to help in the process of illustrating the different modulation techniques.

Topics Covered: (Textbook Chapters: 6, 7, 8, 9,13)

1. Review of Random Processes (Chapters: 10, 11)
2. The Sampling Theorem.
3. Pulse Modulation (PAM, PPM, PWM, PCM, DPCM, Delta Modulation)
4. Baseband Transmission.
5. Passband Transmission (FSK, PSK, QAM)
6. M-ary Modulation Techniques.
7. Line Coding, ISI, Pulse Shaping, Scrambling, Regenerative Repeaters, Equalizers, Detection Error Probability, Digital Multiplexing.
8. Introduction to Spread Spectrum Systems.
9. Behavior of Digital Communication Systems in the Presence of Noise.
   Optimum Threshold Detection, Optimum Binary Receivers,
   Carrier Systems (ASK, FSK, PSK, DPSK)
   Performance of Spread Spectrum Systems,
   M-ary Communication, Synchronization

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

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
McGraw-Hill
ISBN: 0072321113

Communication Systems (2000)
by Simon Haykin
4th Edition
John Wiley
ISBN: 0-471-17869-1

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

Digital Signal Processing in Telecommunications (1995)
by Kishan Shenoi
1st Edition
Prentice Hall
ISBN: - 0-13-096751-3