ECE 519 - Fall 2007.
Coding for Reliable Communications

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Text: Error Control Coding, by Shu Lin and Daniel J. Costello, Jr., Prentice Hall, Second Edition, 2004.

References: Theory and Practice of Error Control Codes, by Richard E. Blahut, Addison Wesley Publishing Company, 1983.
The Theory of Error-Correcting Codes, by F. J. MacWilliams and N. J. A. Sloane. New York: North-Holland, 1977.
Error-Correction Coding for Digital Communications by G. C. Clark, Jr. and J. B. Cain. Plenum Press, New York, 1981.
Digital Communications, by John G. Proakis, McGraw-Hill Book Company, 2001.

Course Outline:

Coding for Reliable Digital Transmission and Storage
- Introduction. Types of Codes
- Modulation and Demodulation. Maximum Likelihood Decoding
- Types of Errors and Error Control Strategies

Introduction to Algebra
- Definitions. Groups. Fields
- Galois Field GF(2^m). Construction and Properties
- Vector Spaces. Matrices

Linear Block Codes
- Introduction
- Syndrome and Error Detection
- Minimum Distance. Error Correction Capability
- Standard Array and Syndrome Decoding
- Error Probability over BSC
- Hamming Codes

Cyclic Codes
- Description. Generator and Parity-Check Matrices.
- Encoding. Syndrome and Error Detection. Decoding
- Cyclic Hamming Codes

BCH Codes
- Description. Encoding/Decoding
- Nonbinary BCH Codes and Reed Solomon Codes
- Weight Distribution and Error Detection Capability

Convolutional Codes
- Encoding
- Structural Properties Of Convolutional Codes
- Distance Properties of Convolutional Codes

Maximum Likelihood Decoding of Convolutional codes
- The Viterbi Algorithm
- Performance Bounds for Convolutional Codes
- Construction. Implementation of Viterbi Algorithm
- Sequential Decoding of Convolutional Codes

Introduction to Trellis Coded Modulation and Turbo Codes