ECE G332 Error Correcting Codes, Fall 2003
School of Electrical and Computer Engineering
Northeastern University

Instructor:
Dr. Suparna Datta
Tel: 617-373-4663
Email: suparna@ece.neu.edu
Fax: 413-280-9575
Office: 322 Dana Research Center
Office Hours: 8-9am MTh, 12-1pm Th, and by appointment
Web Page: www.ece.neu.edu/faculty/suparna/courses/eceg332

Class Hours and Location:
11:40am-1:20pm MW, 145 Ryder

Course Description:
Introduction to traditional error control coding. Topics include detailed coverage of algebraic structures, groups, rings, ideals and vector spaces over finite fields, Galois fields, linear block codes, Hamming codes, cyclic codes, BCH and Reed-Solomon codes, convolutional codes, and the Viterbi decoding algorithm. Brief overview of iterative decoding including turbo codes and low density parity check (LDPC) codes (time permitting).

Prerequisites:
Familiarity with abstract algebra, linear algebra, probability, and digital communications is useful.

Required Textbook:

Reference Books (on reserve at Snell Library):

Grading Policy:
Homework: 20%
Exams (2): 40%, in-class.
Project: 10%
Final Exam: 30%

• Project will be a computer implementation of a coding system. Details will be announced later.

Examination dates:
Exam #1: October 29, 2003, in class
Exam #2: December 3, 2003, in class
Final Exam: TBD

Email and Course Web Page:
• You are required to send me an email with your legal name (and preferred name, if applicable), and email address no later than 9/12/2003 so that I can construct an email list for this class.
• All students are required to check their email everyday for any class updates or notices.
• Any changes or updates to the class syllabus or schedule will also be posted on the class website. Copies of homeworks, exams, and solutions will be posted there as well.

Special Needs:
Any student requiring any special accommodations because of a disability, please see me during office hours or send me an email immediately so that appropriate arrangements can be made.
Topical Outline:

Galois fields
   Groups, fields, vector spaces

Chapter 2

Finite Field Theory
   Euclidean Domains and Euclid's Algorithm
   Constructing Fields from Euclidean Domains
   Properties of Finite Fields
   Factoring Polynomials over Finite Fields

Chapter 3

Linear Block Codes
   Parity check and generator matrices, syndrome decoding
   Hamming Codes

Chapter 4

Cyclic Codes
   Generator polynomials
   Encoding Cyclic Codes
   Decoding Cyclic Codes

Chapter 5

BCH and Reed-Solomon Codes
   BCH bound
   Design of BCH and Reed-Solomon Codes
   Fourier Transform approach to BCH and Reed-Solomon Codes

Chapter 8

Decoding BCH and Reed-Solomon Codes

Chapter 9

Convolutional Codes

Chapter 11

Viterbi Decoding Algorithm

Chapter 12

Introduction to Iterative Decoding Methods
   Turbo Codes
   Low-density parity-check (LDPC) codes

Notes

** time permitting