EE 229B ERROR CONTROL CODING **Spring 2005**

First class meeting : Tuesday 1/18. 3.30 p.m. - 5 p.m., 299 Cory.

Regular class meetings : Mondays 12.00 p.m. - 2.00 p.m. and Tuesdays 4.00 p.m. - 5.00 p.m., 299 Cory.

Makeup lectures (as needed) : Thursdays 3.30 p.m. - 5.00 p.m. 299 Cory.

Instructor : Venkat Anantharam, 271 Cory, 643-8435; ananth@eecs.berkeley.edu

Web page : http://www.eecs.berkeley.edu/~ananth

Office Hours : Mondays 3.00 p.m. - 4.00 p.m. in 271 Cory until further notice.

Text : "Error Control Coding", Second Edition, by Shu Lin and Daniel J. Costello Jr., Prentice Hall, ISBN 0-13-042672-5.

Required Work :

Four homework problem sets. This counts for 25 % of the grade.

Take home final. This counts for 25% of the grade.

Written individual project, on a topic of your choosing, subject to approval of the instructor. This counts for 50 % of the grade.

A report on this project is due by 5 p.m. Friday May 13. This written report should NOT exceed 15 pages, excluding references. It should be submitted as a pdf file. It will be placed online so that everybody in the course can benefit from reading your project report.

Please define your project by Friday March 18 (before the beginning of Spring Break). Please start this process early enough so we can agree on your project definition by this time.

There is considerable flexibility in defininining your project. The only constraint is that it should involve error control coding in a significant way.

Books on reserve in the Engineering library :

Stephen B. Wicker "Error Control Systems for Digital Communication and Storage', Prentice Hall, 1995.

Shu Lin and Daniel J. Costello Jr. "Error Control Coding : Fundamentals and Applications", Prentice Hall, 1983.

Shu Lin and Daniel J. Costello Jr., "Error Control Coding", Second Edition, Prentice Hall, 2004 (if available).

Robert J. McEliece "The theory of information and coding : a mathematical framework for communication", 1984.

Richard E. Blahut "Algebraic codes for Data Transmission", Cambridge University Press, 2003.

F. J. MacWilliams and N. J. A. Sloane "The theory of error correcting codes", North Holland, 1977.

Shu Lin, Tadao Kasami, Toru Fujiwara, and Marc Fossorier "Trellises and Trellis-Based Decoding Algorithms for Linear Block Codes", Kluwer, 1998.

Stephen B. Wicker and Vijay K. Bhargava "Reed Solomon Codes and their Applications", IEEE Press, 1994.

Course outline :

Error control codes are an integral part of most communication and recording systems where they are primarily used to provide resiliency to noise.

In this course we will cover the basics of error control coding for reliable digital transmission and storage. We will discuss the major classes of codes that are important in practice, including Reed Muller codes, cyclic codes, Reed-Solomon codes, convolutional codes, concatenated codes, turbo codes, and low density parity check codes. The relevant background material from finite field and polynomial algebra will be developed as part of the course.

The prerequisites are some familiarity with linear algebra and some familiarity with basic probability (EE 126 or equivalent should be more than enough). In particular, it is not necessary to have had prior exposure to information theory in order to take this course.

Overview of topics :

Binary linear block codes
Reed Muller codes
Galois fields
Linear block codes over a finite field
Cyclic codes
BCH and Reed Solomon codes
Convolutional codes and trellis based decoding
Message passing decoding algorithms
Trellis based soft decision decoding of block codes
Turbo codes
Low density parity check codes