EE 5581 - Information Theory and Coding
Fall 2005

Course Information

Instructor: Nihar Jindal, 6-119 EE/CS, nihar@umn.edu, 625-6306

Class Time and Location: Mon/Wed/Fri, 12:20 PM - 1:10 PM, MechE 102

Office Hours: Tu/Th, 10:30 AM - 12:00 PM

TA: Hakim Alhussien, 6-158 EE/CS, hakimh@umn.edu, 626-7178

TA Office Hours: Mon/Wed, 4:00 - 5:00 PM

Class Webpage: http://www.ece.umn.edu/class/ee5581/index.html

Required Textbook: *Elements of Information Theory*, T. Cover and J. Thomas, Wiley-Interscience, 1991.

Prerequisite: EE 5531, Probability and Stochastic Processes (or equivalent).

Homework: There will be weekly homework assignments.

Exams: There will be two midterm exams (tentatively scheduled for Oct. 14 and Nov. 18) and a final exam (Wed, Dec. 21, 4-6 PM).

Project: A research project is a required portion of this course. The project can either be a literature survey of a few information theory papers, or an original research idea. The project will be due towards the end of the semester.

Grading Policy: Final grade will be 15% project, 15% homework, 20% each midterm, and 30% final.

Tentative Course Outline

1. **Information Theory Basics** (3 weeks)
   Entropy, mutual information, chain rules, inequalities, asymptotic equipartition property (AEP), entropy of random processes.

2. **Source Coding** (3 weeks)
   Unique decodability, prefix-free codes, Kraft inequality, AEP-based compression, Huffman coding, arithmetic coding, universal coding.

3. **Channel Capacity** (3 weeks)
   Discrete memoryless channels, joint typicality, achievability & converse proofs of channel capacity theorem, feedback channels, source-channel separation, practical channel codes.

4. **Differential Entropy & Gaussian Channels** (2 weeks)
   Differential entropy, capacity of AWGN channels, band-limited channels, parallel & fading channels.

5. **Rate-Distortion (Lossy Source Coding)** (2 weeks)
   Quantization, proofs of achievability & converse of rate distortion function.