ECE U468 Noise and Stochastic Processes, Spring 2005
School of Electrical and Computer Engineering
Northeastern University

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Class Hours and Location:
9:15-10:20am MWTh, 108-G West Village

Course Description:
Discusses the physical origins of noise and models for its analysis in electronic devices, analog and digital systems, and communications. The basic theory of discrete and continuous probability, correlation, covariance, and power density spectra is developed and used to discuss random variables and stochastic processes, with application to the analysis of signals in the presence of noise in analog and digital systems.

Prerequisites:
Courses: ECE U464.
Topical: Linear systems. Transform techniques (Fourier, Laplace, and Z-transforms). Convolution integral. Properties of LTI systems. Linear algebra. An introductory probability course is extremely helpful, though not required.

Textbooks:

Reference Books (on reserve at Snell Library):
Grading Policy:
Homework: 10%, due at the beginning of class on due date.
Exams: 55%, see schedule below.
Final Exam: 35%, comprehensive.

- No late homeworks will be accepted after solutions have been handed out and/or posted on the class website.
- No make-up examinations will be given.

Examination dates:
Exam #1: February 24, 2005, 2:50pm-4:30pm, 108-G West Village
Exam #2: March 24, 2005, 2:50pm-4:30pm, 108-G West Village
Final Exam: April 20, 2005, 1:00 pm, room: TBD

Email and Course Web Page:
- You are required to send me an email with your legal name (and preferred name, if applicable), email address, and course title (ECE U468) no later than 01/07/2005 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. If special testing arrangements are required, you must bring your DRC letter to me immediately so that examination rooms can be reserved on your behalf.
Topical Outline:

Basic Concepts of Probability Theory
  Chapter 2
  Sample space, events, set operations
  Axioms of probability
  Counting methods
  Conditional probability
  Independent events
  Sequential experiments

Random Variables
  Chapter 3
  Cumulative distribution function (CDF)
  Probability distribution function (PDF)
  Important random variables (discrete & continuous)
  Functions of a random variable
  Expected value of a random variable
  Markov and Chebyshev inequalities
  Goodness-of-fit
  Transform methods

Multiple Random Variables
  Chapter 4
  Vector random variables
  Pairs of random variables
  Independence of two random variables
  Conditional probability and conditional expectation
  Functions of multiple random variables
  Expected value of functions of random variables
  Jointly Gaussian random variables

Sums of Random Variables and Long-Term Averages
  Chapter 5
  Sums of random variables
  Sample mean and the laws of large numbers
  Central limit theorem

Random Processes
  Chapter 6
  Discrete-time random processes
  Continuous-time random processes
  Stationary random processes (RP)
  Wide-sense stationary (WSS) RP
  Cyclostationary RP
  Continuity, derivatives, and integrals of RP
  Time averages and ergodic theorems

Analysis and Processing of Random Signals
  Chapter 7*
  Power spectral density
  Response of linear systems to random signals

* time permitting