ELE 756 Random Processes (Spring 2003)

GENERAL INFORMATION
Class Eggers Hall 111, M & W 2:30-3:50
Instructor Biao Chen, Link Hall 381, 443-3332, bichen@ecs.syr.edu
TA Ying Lin, Link Hall 385, 443-2993, ylin20@ecs.syr.edu
Office Hours Monday 9-12 (Biao Chen) and Wednesday 10-12 (Ying Lin) or by appointment
Course URL http://www.cis.syr.edu/~bichen/ele756

TEXT

REFERENCES

HOMEWORKS (30 %)
Homeworks, along with solutions, will be posted on the website. Homeworks may include some computer assignments for which Matlab is strongly recommended.

QUIZZES (10 %)
Randomly given at the beginning of classes. A necessary condition to achieve good score on quizzes: To understand fully the materials taught in the previous class.

EXAMS (60 %)
Midterm (30 %). Tentatively March 5 from 2-4pm. Place TBD.
Final (30 %). Tentatively scheduled on May 1 from 2:45-4:45pm.
Both exams are open book, open notes — so bring your own library.

MISCELLANEOUS
• Late hand-in will only be graded under unusual circumstances (e.g., conference travel, sick). Advance notification required in such cases.
• Honor policy — While students are encouraged to discuss with each other after class regarding the course materials, each one is expected to do his/her assignment independently. Failure in abiding the honor policy may result in failing the course.
PREREQUISITES
A solid understanding on analysis/calculus is necessary. Other knowledge required include probability and some preliminary understanding in linear algebra.

COURSE OBJECTIVE
This is a non-measure theoretic introductory course on random processes. The primary goal of the course is to build basic working knowledge in random processes. Many application examples, including some inference problems, will be presented to reinforce the fundamental properties and concepts introduced in this class. Students who have successfully completed this course should feel comfortable toward further exposure to advanced topics related to random processes.

COURSE CONTENT

- Review on Probability and Random Variables
  - Basic axiom, sample space, $\sigma$-algebra, probability, and random variables.
  - Moments and moment generating functions.
  - Vector random variables and covariance matrix.
  - Multivariate Gaussian random variables and complex Gaussian random variables.

- Properties and concepts
  - Convergence of random sequences.
  - Large sample theorems (LLN and CLT).
  - Stationary and wide sense stationary random processes.
  - Power spectral density (PSD).
  - Sampling of bandlimited random processes.
  - Bandpass random processes and their representation.
  - Random processes passing through linear systems.
  - Estimation theory — ML estimate, MMSE estimate, Wiener filter.

- Spectral estimation
  - Ergodic random processes and nonparametric PSD estimation.
  - Parametric PSD estimation for harmonic models.
  - Subspace methods for PSD estimation.

- Random processes
  - Markov chain, Markov process, and their applications.
  - Independent increment and poisson processes, compound poisson (time permits).

- Other possible topics (time permits)
  - Cyclostationary processes.
  - Gaussian Markov processes.
  - Karhuhnen-Loeve expansion.