The Ohio State University
Department of Electrical Engineering

EE 804 – RANDOM VARIABLES AND PROBABILITY THEORY

Autumn 2000

Instructor: Dr. Phil Schniter, Assistant Professor
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Course Web Page: `http://eewww.eng.ohio-state.edu/~schniter/ee804`

Will contain homework, solutions, and relevant handouts. Course announcements, homework hints and modifications will be posted on this page.

Lectures: MWF 12:30pm-1:18pm, 31 Hitchcock

Objectives: To provide a fundamental understanding of concepts and techniques of random variables. The emphasis will be on developing the analysis and design tools needed to apply probability and random variables in graduate electrical engineering research. This course is the first in a three-course sequence on random signals and systems.

Prerequisites: A basic understanding of continuous time and discrete time signals and systems in the time and frequency domains (EE352 or equivalent). A basic understanding of elementary probability concepts (Stat 427 or Math 530 or equivalent.)

Text: H. Stark and J. Woods, *Probability, Random Processes, and Estimation Theory for Engineers,* 2nd edition, Prentice-Hall, 1994.

References:

1. *Probability, Random Variables, and Stochastic Processes* by A. Papoulis, McGraw–Hill, 1991.
2. *Probability and Random Processes* by W. B. Davenport, McGraw–Hill, 1970.
3. *An Introduction to the Theory of Random Signals and Noise* by W. B. Davenport and W. L. Root, McGraw–Hill, 1958.
4. *Probability* by Breiman, Addison-Wesley, 1968.
5. *An Introduction to Probability Theory and Its Applications* 2nd ed. by W. Feller, Wiley, 1957.
6. *Introductory Probability and Statistical Applications* by P. L. Meyer, 1966.

7. *A First Course in Probability*, by S. M. Ross, Macmillan, 1988.
8. *Introduction to Probability* by J. B. Thomas, Springer-Verlag, 1986.

Grading: The course grade will be based on homework, projects, an in-class midterm and an in-class final exam. The final exam will be comprehensive.

Office Hours: See course web page.

Late Policy: No late material (projects, homework, etc.) will be accepted unless prior arrangements have been made. Arrangements need to be made at least 24 hours in advance. Any emergency situation will be handled on a case by case basis.

Attendance: The student is responsible for all assignments, changes of assignments, announcements, lecture notes, etc.. Lecture notes will not be given out. If you have missed a lecture, please get notes form a classmate.

Other: All examinations in this course will be administered in accordance with the EE Honor System. Homework problems will be assigned and collected on a regular basis; but only certain of these problems will be graded. The student is responsible for all assignments, changes of assignments, and announcements given in class.

Outline:

1. **Introduction** (1 lecture, Ch 1)
2. **Probability Basics** (3 lectures, Ch 1)
   set theory, probability spaces, partitions, conditional probability, Bayes' Rule, independence, Bernoulli trials.
3. **Random Variables** (5 lectures, Ch 2)
   definition, distribution and density functions, joint and conditional density, some common random variables.
4. **Functions of Random Variables** (5 lectures, Ch 3) definition, distribution and density scalar functions of one and two random variables, multivariate functions of multiple random variables, applications.
5. **Expected Values** (6 lectures, Ch 4)
   expected value, conditional expectation, moments, moment generating functions, characteristic functions, related bounds and inequalities.
6. **Vector Random Variables** (4 lectures, Ch 5)
   joint distributions and densities, covariance matrices and properties, multidimensional Gaussian, characteristic functions.
7. **Random Sequences** (5 lectures, Ch 7)
   definitions, types of convergence and their relationships, law of large numbers.

Chapter numbers refer to Stark & Woods textbook.