University of California, Santa Barbara

Department of Electrical and Computer Engineering

Course Syllabus

ECE 139 *Probability and Statistics* 4 units
(Required)

Catalog Description:
Fundamentals of probability, random variables, functions of random variables, expectation and high order moments, characteristic functions, random sequences, laws of large numbers, hypothesis testing.

Prerequisites:
Must be an Electrical Engineering, Computer Engineering or Pre-Computer Engineering major.

Text, References, and Software:
Required: Roy D. Yates and David J. Goodman, "Probability and Stochastic Processes", Wiley 2005.
Optional: Sheldon Ross, "A First Course in Probability," Prentice–Hall; Peyton Z. Peebles, "Probability, Random Variables, and Random Signal Principles," McGraw-Hill.

Topics Covered and Course Goals:
1. Elementary Concepts in Probability
    1. Introduction to probability and counting
    2. Joint and conditional probability, Bayes theorem
    3. Statistical independence
    4. Bernoulli trials

    The goal is to introduce student to probability and statistics, to convey the crucial role they play in science and engineering with emphasis on applications, and to develop statistical thinking and basic problem solving skills

2. Discrete and continuous random variables
    1. Cumulative distribution, probability mass, and probability density functions
    2. Families of discrete and continuous random variables (Binomial, Pascal, Poisson, Gaussian, exponential, etc.)
    3. Expectation
    4. Moments
    5. Functions of a Random Variable

    The goal is to understand the power of statistical models as means to account for practical uncertainties in engineering problems, and to develop skills to accurately formulate diverse application problems in terms of random variables and their functions.

3. Random vectors, or multiple random variables
    1. Joint, marginal and conditional distributions and densities
    2. Correlation, covariance and higher moments
    3. Independent, uncorrelated and orthogonal random variables
    4. Sum of random variables (and other functions)
    5. Jointly Gaussian random variables
    6. Application to estimation (practical examples from various electrical and computer engineering fields)

    The goal is to achieve a quantitative understanding of statistical dependencies between random variables, and to develop the statistical tools to formulate and solve practical problems involving interaction between random components of a system.

4. Brief introduction to concepts of random processes

The goal is not mathematical rigor, but to provide "preview" into how the concepts and tools covered in the course can be extended and usefully employed to model the time evolution of random systems. Motivating examples are selected from communications and signal processing, applied physics, digital circuits and computer systems.

Class/Laboratory Hours:

Lecture, 3 hours; Discussion, 2 hours

Contribution to Criterion 5

Contributes to one year of mathematics and basic sciences appropriate to the discipline, with an application emphasis to bridge toward engineering practice.

Contribution to Program Outcomes:

Course Goals	P1	P2	P3	P4	P5	P6
1.1	X					
1.2	X					
1.3	X					
1.4	X					
2.1	X					
2.2	X					
2.3	X					
2.4	X					
2.5	X					
3.1	X					
3.2	X					
3.3	X					
3.4	X					
3.5	X					
3.6	X					

4	X					

Prepared by: Kenneth Rose **Date: March 11, 2008**