EEO 306: Random Signals and Systems

Spring 2017

2016-2017 Catalog Description:

Random experiments and events; random variables, probability distribution and density functions, continuous and discrete random processes; Binomial, Bernoulli, Poisson, and Gaussian processes; system reliability; Markov chains; elements of queuing theory; detection of signals in noise; estimation of signal parameters; properties and application of auto-correlation and cross-correlation functions; power spectral density; response of linear systems to random inputs. (3 credits)

Course Designation: Required

Text Book: R. D. Yates and D. J. Goodman, "Probability and Stochastic Processes," John Wiley and Sons, Inc, 2005.

Prerequisites: EEO 301 (Signals and Systems)

Instructor: Petar M. Djurić

Goals: The goals of the course are to teach students the basics of probability theory. They include concepts of random experiments, probability spaces, random variables, random vectors, random processes, and the application of these concepts to problems in electrical and computer engineering.

Objectives: Upon the completion of this course, students will be able to solve problems that involve random events, random variables and random processes. The students will also be able to solve problems with practical context and related to the fields of electrical and computer engineering.

Topics Covered:

Week 1.	Sets, basic operations with sets, applying set theory to probability; random experiments; probability spaces
Week 2.	Conditional probabilities; law of total probability; independence; sequential experiments; Bayes' theorem; combinatorics
Week 3.	Random variables; characterization of random variables; properties of CDFs, PMFs, and PDFs; Test 1/5
Week 4.	Specific random variables, random vectors; CDFs, PMFs, PDFs of random vectors; marginal distributions, independence of random variables

Week 5.	Random processes, types of random processes
Week 6.	Mean and variance of random variables; mean and covariance of random vectors; Test 2/5
Week 7.	Mean of random processes, autocorrelation of random processes; stationary processes, crosscorrelation
Week 8.	Functions of random variables, expectations of derived random variables
Week 9.	Functions of random vectors, Test 3/5
Week 10.	Systems with random inputs, power spectral density
Week 11.	Conditional distributions; conditional expectations
Week 12.	Basics of statistics; sample mean; Test 4/5
Week 13.	Basics of estimation theory
Week 14	Hypothesis testing; Neyman Pearson theorem; Bayesian testing, Test 5/5

Class/laboratory Schedule: 3 lecture hours per week.

Program Outcomes and Assessment	**% contribution**
✓ (a) an ability to apply knowledge of mathematics, science and engineering	60
❑ (b1) an ability to design and conduct experiments	
❑ (b2) an ability to analyze and interpret data	20
❑ (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
❑ (d) an ability to function on multi-disciplinary teams	
✓ (e) an ability to identify, formulate, and solve engineering problems	20
❑ (f) an understanding of professional and ethical responsibility	
❑ (g) an ability to communicate effectively	
❑ (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
❑ (i) a recognition of the need for, and an ability to engage in life-long learning	
❑ (j) a knowledge of contemporary issues	
❑ (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	
❑ Any other outcomes and assessments?	
❑ (l) an ability to communicate and/or collaborate effectively online	

Document Prepared by: Petar M. Djurić, 5/26/17