EEE 350 Random Signal Analysis (3) [F, S, SS]

Course (Catalog) Description:
Probabilistic and statistical analysis as applied to electrical signals and systems.
Lecture. Required course.

Pre or corequisite:
EEE 203

Textbook:
Yates and Goodman, *Probability and Stochastic Processes*, second edition, Wiley, 2005.

Supplemental Materials:
1. D. P. Bertsekas and J. N. Tsitsiklis, *Introduction to Probability,* Athena Scientific, 2002.
2. Henry Stark and John W. Woods, Probability and Random Processes with Applications to Signal Processing (2nd edition), Prentice Hall, 2002.
3. P Z Peebles, Probability, random variables, and random signal principles , McGraw-Hill, New York, 1993.
4. A. Papoulis and S. U. Pillai, *Probability, Random Variables, and Stochastic Processes*, Fourth Edition, McGraw-Hill, 2002.

Coordinators:
Junshan Zhang and Tolga Duman

Prerequisites by Topic:
1. Calculus
2. Linear Algebra

Course Objectives:
1. Students can perform statistical analysis
2. Students can extract math models from word problems and solve engineering problems that include probability, with awareness of the Monte Carlo method
3. Students are well prepared for senior level electives

Course Outcomes:
1. Students can perform rudimentary statistical analysis of univariate and bivariate data
2. Students can solve engineering problems using axiomatic probability theory, random variables, and random processes
3. Students are well prepared for senior-level electives that include EEE 350 as a prerequisite, with awareness of computer simulation tools (including the Monte Carlo method)

Course Topics:
1. Axiomatic probability
2. Random variables, distribution functions, and density functions
3. Special distributions: Gaussian, exponential, Poisson, Binomial, Geometric, etc.
4. Expectation and variance

5. Multiple random variables
6. Central limit theorem and law of large numbers
7. Maximum-likelihood estimation and confidence intervals
8. Random processes
9. Statistical analysis using sample statistics, histograms, and linear regression

Computer Usage:
Several computer projects are assigned during the semester. These projects introduce students to statistical data analysis, Monte Carlo simulation as a means of solving engineering problems, estimation and decision theory, and processing of signals. The projects involve students in open-ended design experiences in which final objectives are specified but design and implementation of the computer solution are left to the student.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:
This course teaches engineering science through the application of fundamental statistical principles to engineering problems. For example, students are exposed to the ideas of statistical signal processing with applications to image and speech signals, communication systems design issues. This course also provides students with opportunities to solve open-ended problems. For example, students use the statistics to perform semiconductor process control, yield management, and reliability analysis.

Course Relationship to Program Outcomes:
a: Understanding of random variables and their applications is central for the constituent industries. Students apply mathematics to understand and solve problems in this course.
k. Students utilize modern tools (software) to solve homework problems.
e. Students can perform and design engineering algorithms/procedures to analyze data, and solve engineering problems.

People preparing this description and date of preparation: Junshan Zhang, Tolga M. Duman and Douglas Cochran, Feb. 2015.