CALIFORNIA POLYTECHNIC STATE UNIVERSITY
San Luis Obispo, California

STAT 350 – Probability and Random Processes for Engineers **Winter 2007**

1. Catalog Description

STAT 350 Probability and Random Processes for Engineers (4) GE B6
Random events, random variables, and random processes, with emphasis on probabilistic treatment of signals and noise. Specific topics include: sample spaces, probability, distributions, independence, moments, covariance, time/ensemble averages, stationarity, common processes, correlation and spectral functions, physical noise sources. 4 lectures.

2. Required Background and/or Experience

MATH 241, EE 228 or equivalent

3. Expected Outcomes

The student should be able to:

a. demonstrate an understanding, both conceptually (i.e., the idea of "likelihood") and mathematically (i.e., precise definitions), of probability, random events, random variables, and random processes;
b. calculate probabilities, conditional probabilities, expected values, etc., for random events, random variables, and random processes by utilizing a variety of mathematical tools and methods; and
c. define and use various kinds of random variables and processes, as well as various physical noise sources, commonly encountered in electrical engineering.

4. Text and References

Text: Yates, R., Goodman, D., *Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers*, 2^{nd} ed., Wiley, 2005.

5. Minimum Student Materials

Calculator for student use in preparing assignments and taking exams.

6. Minimum University Facilities

Chalkboard for instructional use, overhead projector.

7. Expanded Description of Content and Method

Content:	*Number of Lectures*
1) Random events	8

a) Set theory (review), combinations and permutations (review)
b) Sample space, random events, probability
c) Joint and conditional probabilities, Bayes' rule
d) Statistically independent events, including pairwise and conditional independence

Content:		*Number of Lectures*
2)	**Random variables**	14

a) Real and complex random variables, discrete versus absolutely continuous
b) Probability density function (one or more dimensions), including conditional density
c) Cumulative distribution function (one or more dimensions)
d) Probability functions for a mixture of discrete and continuous random variables
e) Expectation, including conditional expectation
f) Moments, including mean, variance, standard deviation
g) Characteristic function (one or more dimensions)
h) Mixture of random variables and events
i) Jointly distributed random variables; random vector
j) Independent random variables, including pairwise and conditional independence
k) Uncorrelated and orthogonal random variables
l) Functions of several random variables
m) Common distributions, including uniform, binomial, Poisson, (jointly) Gaussian distributions
n) Law of large numbers
o) Central limit theorem

3) Random processes 14

a) Discrete- and continuous-time random processes
b) Time versus ensemble averages
c) Statistically independent random processes, including pairwise and conditional independence
d) Stationarity, ergodicity
e) Second-order random process, wide-sense stationarity
f) Uncorrelated and orthogonal random processes
g) Autocorrelation, power spectral density
h) Cross-correlation, cross-power spectral density
i) Common processes, including Poisson process, Gaussian process
j) Linear filtering of a real or complex random process
k) White noise

Total 36

8. <u>Method of Evaluating Outcome</u>

Daily problem assignments, scheduled tests, and a final examination.