ENG EC505 Stochastic Processes

2008-2009 Catalog Data:
Prereq: ENG EC 401, CAS MA 142 or equivalent and either ENG EC 381 or ENG EK 500. Introduction to discrete and continuous-time random processes. Correlation and power spectral density functions; linear systems driven by random processes. Optimum detection and estimation. Bayesian, Weiner, and Kalman filtering. Applications of Poisson and other processes. 4 cr.

Status in the Curriculum: Elective

Class/Lab Schedule:
LEC: 4hrs/wk (MW12-2)

Textbooks and other required materials:
"Course Notes on Stochastic Processes"
by D. A. Castanon & W. C. Karl available from the class web site.

Reference:
H. Stark and J. W. Woods, *Probability Random Processes and Estimation Theory for Engineer*s,
Prentice-Hall, 1986.

K. Sam Shanmugan, *Random Signals: Detection, Estimation, and Data Analysi*s, Wiley, 1988.

A. Papoulis, *Probability, Random Variables, and Stochastic Processe*s, 3rd ed., McGraw-Hill, 1991.

Coordinator:
W. C. Karl, Professor, ECE Department, BME Department

Prerequisites by topic:
EC381 or EK500, Introduction to Probability
EC401, Signals and Systems
MA142, Linear Algebra

Goals:
To provide students with:
Thorough understanding of the theoretical underpinnings of stochastic processes, detection, and estimation

Course Outcomes:
As an outcome of completing this course, students should be able to:

1. Understand stochastic process definitions and characterization
2. Understand and characterize the interaction of stochastic processes and linear systems
3. Understand stochastic signal representation, including Karhunen-Loeve expansions
4. Understand stochastic signal detection, including LRTs, ROC analysis, binary and M-ary detection
5. Understand stochastic signal estimation, including LLSE and ML estimation, Wiener and Kalman filtering
6. Design optimal Bayesian detection rules for stochastic signals
7. Design optimal Bayesian estimators for stochastic vectors and signals.
8. Implement and test optimal decision rules
9. Implement and test optimal signal estimators
10. Assess the impact of stochastic process theory on societal issues

Course Outcomes mapped to Program Outcomes:

Program Outcomes	A	B	C	D	E	F	G	H	I	J	K
Course Outcomes	1-9	8-9	6-7		1-9			10			
Emphasis (1-5)	5	3	3		5			1			

1=not at all; 5=a great deal;

Contribution of Course to Meeting the Professional Component:
Engineering topics: 100%

Prepared by: W. C. Karl, Prof. **Date:** 5/14/09