ESC 512 PROBABILITY AND STOCHASTIC PROCESSES
4 Credits
Fall 2020

Lecture on-line: Tuesday 4:00p to 5:50p and Thursday 4:00p to 5:50p

Instructor:
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Catalog Description: Prerequisite: Graduate standing.

General concepts of probability and random variables, including random experiments, inequalities, joint distributions, functions of random variables, expectations, and the law of large numbers. Basic concepts of random processes and their properties are introduced. Markov processes, linear systems with stochastic inputs, and power spectra are presented.

TEXTBOOK: Probability, Random Variables, and Stochastic Processes, by Athanasios Papoulis, Third Edition, McGraw Hill, 1991 or Fourth Edition 2004.

REFERENCES: An Introduction to Probability and Stochastic Processes, by James L. Melsa and Andrew P. Sage, Prentice Hall, 1973.
Introduction to Random Processes, by William A. Gardner, Second Edition, McGraw Hill, 1990.
 Probability and Random Processes for Electrical Engineering, by Alberto Leon-Garcia, Addison-Wesley, 1989.
Digital Modulation Techniques, by Fuqin Xiong, Artech House, 2000

GRADING POLICY:
Midterm Test I: 30%
Midterm Test II: 30%
 Final Exam: 30%
Homework 10%

COURSE OUTLINE:

Class Period	Topics	Reading (sections)	Assignments
1	The meaning of Probability, Set Theory, Probability Space, probability Axioms	1-1 to 1-3, 2-1, 2-2	
2	Conditional probability, Bayes' Theorem, Independence	2-3	Individual Assignments in Blackboard
3	Bernoulli trials, binomial distribution, DeMoivre-Laplace Theorem	3-1 to 3-3	
4	The law of large numbers, Poisson theorem and random points	3-3, 3-4	Individual Assignments in Blackboard
5	Random variables, distribution and density functions	4-1, 4-2	
6	Important densities, conditional distributions	4-3,4-4	Individual Assignments in Blackboard
7	Review		
8	Midterm Test I	Chapters 1-4	
9	Function of one random variable, fundamental theorem, examples	5-1, 5-2	
10	Mean and variance, moments, characteristic function	5-3 to 5-5	Individual Assignments in Blackboard
11	Two random variables, joint distribution and density, probability mass	6-1	
12	One function of two random variables	6-2	Individual Assignments in Blackboard

13	Two functions of two random variables, applications	6-3	Individual Assignments in Blackboard
14	Continuing discussion of functions of two random variables: joint moments, correlation, independence, joint characteristic function	7-1,7-2	Individual Assignments in Blackboard
15	Conditional distributions, Bayes' theorem, conditional expected values	7-3, 7-4	Individual Assignments in Blackboard
16	Review		
17	Midterm Test II	Chapters 5 to 7	
18	Sequences of random variables, independence, correlation matrix, conditional densities	8-1, 8-2	Individual Assignments in Blackboard
19	Stochastic convergence and limit theorems	8-4, 8-5	
20	Stochastic processes and their statistics	10-1	Individual Assignments in Blackboard
21	Correlation functions, stationary processes	10-1	
22	Systems with stochastic inputs, ergodicity	10-2	Individual Assignments in Blackboard
23	Spectra of stochastic processes, Output of a linear system	10-3	
24	Discrete-time processes	10-4	Individual Assignments in Blackboard
25	PSD of bandpass signals	Appendix A (F. Xiong)	
26	PSD of baseband digital signals	Appendix A (F. Xiong)	Individual Assignments in Blackboard

27	PSD of digitally modulated carrier signals	Appendix A (F. Xiong)	
28	Review		
29	Final Exam		