ESC 704 – Stochastic Processes (3 credits)

Prerequisite: ESC 512 or equivalent
This course introduces students to stochastic processes, spectral representation and estimation, mean square estimation, entropy as a measure of uncertainty, Markov chains, and queueing theory. This course includes fundamental material for industrial engineering, communication theory, network theory, control theory, and signal processing.

ESC 704 Syllabus

COORDINATOR: Dan Simon

PREREQUISITE: EEC 512 or ESC 512 (Probability and Stochastic Processes)

TEXTBOOK: Probability, Random Variables and Stochastic Processes, by A. Papoulis and S. Pillai, Fourth Edition, McGraw Hill, 2002.

REFERENCES: An Introduction to Probability and Stochastic Processes, by J. Melsa and A. 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 A. Leon-Garcia, Addison-Wesley, 1989.
Introduction to Random Processes in Engineering, by A. Balakrishnan, Wiley, 1995.
Introduction to Stochastic Processes, by E. Cinlar, Dover, 2013.
Introduction to the Theory of Random Processes, by N. Krylov, American Mathematical Society, 2002.
Introduction to the Theory of Random Processes, by I. Gikhman and A. Skorokhod, Dover, 1996.
Random Signals and Systems, by B. Picinbono, Prentice-Hall, 1993.
Intuitive Probability and Random Processes using MATLAB®, by S. Kay, Springer, 2006.

COURSE OBJECTIVES:

This course introduces students to stochastic processes, spectral representation and estimation, mean square estimation, entropy as a measure of uncertainty, Markov chains, and queueing theory. This course provides fundamental background for communication theory, network theory, control theory, and signal processing.

October 21, 2013

COURSE OUTLINE:

Class Period 1: Review of Probability Theory
Class Period 2: Review of Probability Theory
Class Period 3: Review of Continuous-Time Stochastic Processes
Class Period 4: Review of Discrete-Time Stochastic Processes
Class Period 5: Stationarity
Class Period 6: Gaussian Processes
Class Period 7: Poisson Processes
Class Period 8: Shot Noise
Class Period 9: Review of Power Spectra
Class Period 10: Random Walks
Class Period 11: Sampling Theory
Class Period 12: System Identification
Class Period 13: Spectral Factorization
Class Period 14: Spectral Representation of Random Processes
Class Period 15: Spectral Estimation
Class Period 16: Spectral Estimation
Class Period 17: Midterm Exam
Class Period 18: Mean Square Estimation
Class Period 19: Constrained Estimation
Class Period 20: Kalman Filters
Class Period 21: Wiener Filters
Class Period 22: Entropy
Class Period 23: Coding and Channel Capacity
Class Period 24: Markov Chains
Class Period 25: Absorption Probabilities
Class Period 26: Markov Processes
Class Period 27: Queueing Theory
Class Period 28: Queueing Networks
Class Period 29: Final Exam

GRADING:

Homework 30%
Midterm Exam.....30%
Final Exam.....40%