Department of Electrical and Computer Engineering

New Jersey Institute of Technology

ECE 673: Random Signal Analysis I

Class Time: Tuesday, 6:00 pm - 9:05 pm
Class Location: CULM LECT 2
Class Webpage: http://web.njit.edu/~abdi/ECE673/

Instructor: Ali Abdi, PhD

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Office: ECE Bldg., Room 303
Tentative Office Hours: Tuesday (5 - 6 pm), Wed. (5 - 6 pm), and by appointment

Course Description: This course provides an introduction to the fundamentals of random variables, random signals, and simulation of random phenomena. Topics include random variables and their key characteristics, sequences of random variables and central limit theorem, properties of random processes, correlation and spectral analysis, linear systems with random inputs, and prediction of random signals.

Course Learning Outcomes:

- Apply the fundamental concepts and methods of probability and random signals to develop an awareness of the key models and their interrelationships.
- Develop problem solving skills and understand how to make the transition from a real world problem to a random/probabilistic model.
- Design and analyze random discrete-time and continuous-time signals and systems.
- Perform frequency domain analysis on random signals and systems.
- Design linear filters operating on random signals.
- Use measurement data to formulate models for random signals and systems.
- Design a variety of computer-based components, programs and systems for applications including signal processing, communications, computer networks, and control systems.

Textbook S. M. Kay, *Intuitive Probability and Random Processes using Matlab*. New York: Springer, 2006.

Course Evaluation: Exams and Quizzes (70%), Homeworks and Projects (30%)

Homeworks and Projects: Each is due **at the beginning** of the class on the due date. Late submission is not acceptable. Please put a cover page on your submission, with your name on it. All the pages should be stapled. Please write legibly. For computer exercises, please provide a printout of your program and the outcome of the program.

Honor Code: NJIT Honor Code will be upheld, and any violation will be brought to the immediate attention of the Dean of Students.

Covered Materials on Random Variables (from Kay's book)

Topics	Page Numbers
(a) Basics of Monte Carlo computer simulation in Matlab (b) One discrete random variable	17-19, 21, 31-34, 111-113, 137, 139, 140-141, 143-149, 152-155.
(a) One continuous random variable (b) Mixed random variables	293-297, 303-306, 310, 313-315, 324-325, 345-346, 349-352, 354-357, 359-364.
Two jointly distributed continuous random variables	385-389, 391-392, 394, 396-397, 400-401, 403-408, 412, 414-415, 417-418, 438-439, 446-447.
N jointly distributed continuous random variables, Limit theorems	458-459, 461-462, 465-468, 470, 475-476, 491, 497, 499.
Hands-on experiments with Matlab (simulation and analysis of random variables)	---

Covered Materials on Random Signals (from Kay's book)

Topics	Page Numbers
Basic Random Processes (Chapter 16)	521, 523, 525-526, 528-531, 533-536.
Wide Sense Stationary Random Processes (Chapter 17)	549-557, 562-564, 566-569, 571-577, 579, 580-585.
Linear Systems and Wide Sense Stationary Random Processes (Chapter 18)	599-600, 602-606, 623-626.
Hands-on experiments with Matlab (simulation and analysis of random signals)	---
Multiple Wide Sense Stationary Random Processes (Chapter 19)	642-658, 661-662.
Gaussian Random Processes (Chapter 20)	676-678, 681-689.
Prediction of a Random Variable and Wiener Filtering	192-194, 412-413, 471-475, 609-617.