Syllabus

ECE 528: Introduction to Random Processes in ECE

Course Number: ECE 528
Prerequisites: ECE 220 and STAT 346 (all with grade of C or better), or permission of instructor.

Instructor: Bijan Jabbari, Professor
Semester: Fall 2020
Lecture Time: Wednesday 7:20-10:00 pm Online Remote using Zoom Cloud

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Office hours: By appointment

Teaching Assistant: Haotian Zhai (email: hzhai@gmu.edu)
Recitation Time: Monday 4:30-5:45 pm
Office hours: Mondays and Wednesdays 9:30-10:30 am
Administrative Assistant: N/A

Course Description
Probability and random processes are fundamental to communications, control, signal processing, and computer networks. Provides basic theory and important applications. Topics include probability concepts and axioms; stationarity and ergodicity; random variables and their functions; vectors; expectation and variance; conditional expectation; moment-generating and characteristic functions; random processes such as white noise and Gaussian; autocorrelation and power spectral density; linear filtering of random processes, and basic ideas of estimation and detection.

Course Outline
- Probability Models in ECE
- Review of probability: set theory, basic concepts, probability spaces, conditional probability, Bayes' Rule, independence, Borel Fields, Generation of random numbers
- Discrete Random Variables: Notion of Random Variables, Probability Mass Functions (PMF), Expected Value and Moments, Important Discrete Random Variables, Generation of Discrete Random Variables
- General Random Variables (Single Variable): Cumulative Distribution Functions (CDF), Probability Density Functions (PDF), functions of random variables, expectations and characteristic function, Markov and Chebyshev inequalities
- Pairs of Random Variables: joint and marginal distributions, conditional distributions and independence, functions of two random variables, Expectations and correlations, pairs

of jointly Gaussian Random Variables, generating jointly Gaussian Random Variables

- Random vectors: Functions of several random variables expected value of vector random variables, jointly Gaussian Random vectors, convergence of random sequences
- Sums of random variables and long-term averages: the sample mean and the Laws of Large Numbers, the Central Limit Theorem
- Stochastic Processes: Basic concepts, Covariance, correlation, and stationarity, Gaussian processes and Brownian motion, Poisson and related processes, Power spectral density, Stochastic processes and linear systems
- Markov Processes and Markov Chains

Textbook and References:

- **Required Textbook:** Probability, Statistics, and Random Processes for Electrical Engineering , 3rd Edition, by Alberto Leon-Garcia, Pearson Prentice Hall, 2008.

- D. P. Bertsekas and J. N. Tsitsiklis, Introduction to Probability. Athena Scientific, Belmont, MA, 2nd Edition, 2008. See http://www.athenasc.com/probbook.html

Grading:

There will be weekly assignments, one Mid-term exam, and a Final exam. They will count towards the grade as follows:

- Homework and MATLAB Projects 20%
- Mid-term 35% (mid October)
- Final Exam 45% (up to 2 hours and 30 minutes) – see the schedule of Final Exams