

ECE 528 – Introduction to Random Processes in ECE

Lecture 0: Administrative Matters

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Outline

- Course Structure and Prerequisites
- Textbooks
- Grading
- Homework
- Projects
- Exams

Course Structure

ECE 528: Random Processes in ECE

- Fall 2020 – August 26 - December 2
- Day and Class Room Location
- Class Participation and Reading
 - Both class participation and doing the readings are important
- Class notes will be posted on the web

Course Web pages

cnl.gmu.edu






Communication and Networking Laboratory George Mason University

Founding Director: Dr. B. Ramjee

- Home
- Faculty & Students
- Research
- Teaching
- Publications
- Resources
- Seminars

The Communications and Networking Laboratory in the Department of Electrical Engineering (School of Engineering) is involved in research, education and scholarly activities in the broad area of communication networks and systems, with emphasis on theory, architecture, modeling, performance analysis, multi-access, mobility, routing and switching, teletraffic and protocols. The current areas of research focus include routing and path computation in optical networks, optimal resource allocation in wireless networks, and high performance computer networks and applications.

The primary objective of this laboratory is to foster cooperative research programs with academia and research agencies at the national and international level. The goal is to achieve aggregate results and contributions to the field through these interactions which will have significantly more impact than individual efforts.

-  [ECE 462: Data and Computer Communications](#)
-  [ECE 528: Introduction to Random Processes in ECE](#)
-  [ECE 542: Computer Network Architectures and Protocols](#)
-  [ECE 642: Design and Analysis of Computer Communication Networks](#)
-  [ECE 741: Wireless Networks](#)

Admin Matters

- Bijan Jabbari, Professor ECE, GMU, Fairfax, VA
 - Office: Eng. Bldg Rm 3232
 - Phone: 703-993-1618 (please use email this semester)
 - Email: bjabbari@gmu.edu
 - Web: <http://cnl.gmu.edu/bjabbari>
 - Office hours: by Appointment
- Teaching Assistant/Grader: Haotian Zhai (email: hzhai@gmu.edu)
 - Recitations: Mondays: 4:30-5:45 pm
 - Office hours: Mondays & Wednesdays 9:30-10:30 am
- Administrative Assistant: N/A

Course Description

- This course provides basic theory and important applications of Random Processes. 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. In a nutshell, this course will give you the basis for understanding the radio and infrastructure aspect of the wireless networks and Internet
- ECE 220 and STAT 346, or permission of instructor.

Textbooks

Required Textbook

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

Recommended Book (Introductory)

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

Exams and Grading

- Homework assignments (some homework assignments possibly require a model development on a computer)
- Mid-term and Final exams
 - **The mid-term Exam will be on Wednesday October 21**
 - **The Final Exam is scheduled according to the university schedule (closed book, closed notes)**
- Grading:
 - Homework 20%
 - Mid term Examination 35%
 - Final Examination 45%

Tentative Course Outline

- Introduction to random processes and 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 Chebychev 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

Tentative Schedule

Lecture 1

- Introduction and course overview
- Review of probability: set theory
- Required Reading Chapter 1

Lecture 2

- Introduction to random processes and probability models in ECE
- Basic concepts, probability spaces,
- Required Reading: Chapter 2

Lecture 3

- Conditional probability, Bayes' Rule, independence, Borel Fields, Generation of random numbers
- Required Reading Chapter 2

Lecture 4

- Discrete Random Variables: Notion of a Random Variable, Probability Mass Functions (PMF), Expected Value, Moments, Important Discrete Random Variables, Generation of Discrete Random Variables
- Required Reading Chapter 3

Lecture 5/6

- General Random Variables (Single Variable): Cumulative Distribution Functions (CDF), Probability Density Functions (PDF), functions of random variables, expectations and characteristic function, Markov and Chebychev inequalities
- Required Reading Chapter 4

Tentative Schedule (cont'd)

Lecture 7/8

- 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
- Required Reading Chapter

Lecture 9/10

- Random vectors: Functions of several random variables expected value of vector random variables, jointly Gaussian Random vectors, convergence of random sequences
- Required Reading Chapter

Lecture 11/12

- Sums of random variables and long-term averages: the sample mean and the Laws of Large Numbers, the Central Limit Theorem
- Required Reading Chapter

Lecture 13/14

- Stochastic Processes: Basic concepts, Covariance, correlation, and stationarity, Gaussian processes and Brownian motion, Poisson and related processes, Power spectral density,

Lecture 15

- Stochastic processes and linear systems
- Required Reading Chapter