ECE 528 – Introduction to Random Processes in ECE

Lecture 0: Administrative Matters

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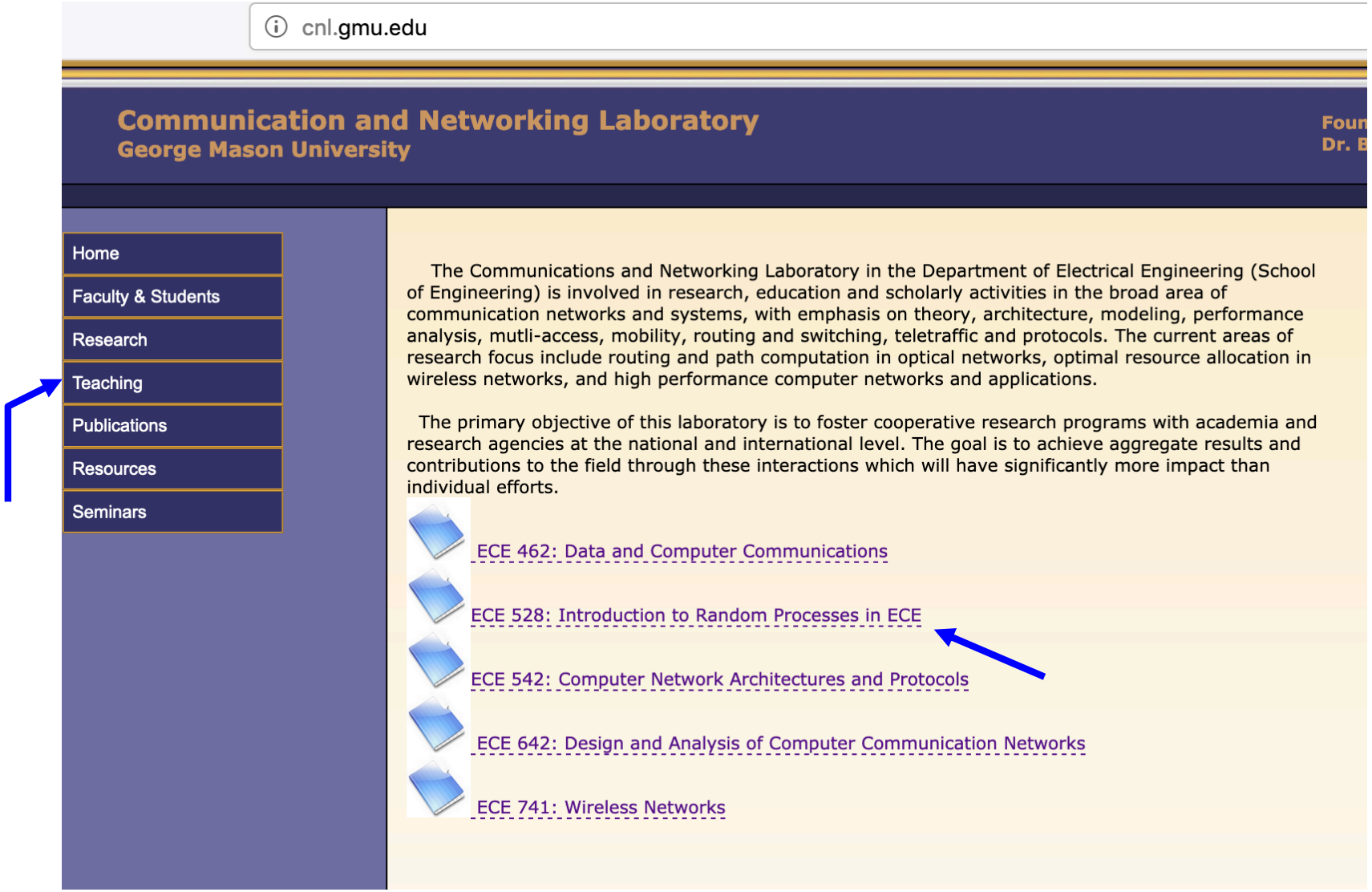
Outline

- 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



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