

# RUTGERS UNIVERSITY, DEPARTMENT OF ECE

## COURSE SYLLABUS: 14:332:226

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Probability theory studies random phenomena in a formal mathematical way. It is essential for all engineering and scientific disciplines dealing with models that depend on chance. Probability provides a well-defined way to quantify the uncertainty of a random event. With this framework, we can analyze the behavior of complex systems and **make informed decisions** (i.e., minimize the negative effect of bad behavior and maximize the positive effect of good behavior). With a long history development of probability theory, it plays a central role in e.g., telecommunications and finance systems. Telecommunications systems strive to provide reliable and secure transmission and storage of information under the uncertainties coming from various types of random noise and adversarial behavior. Finance systems strive to maximize profits in spite of the uncertainties coming from natural and man-made events. The students will learn the fundamentals of probability that are necessary for several ECE courses and related fields and help them prepare for the career in the industry and academia.

**Class Time and Place:** Monday~Thursday 10:30am~12:20pm, Busch SEC-203.

**Office Hour:** TBD.

**Contact:** kw414@scarletmail.rutgers.edu.

**Prerequisites:** Calculus.

**Grading:**

- Structure:
  - HW Presentation: 20 times×1 credit
  - Exam: 2 times×50 credits
  - Bonus Project: 1 times×20 credits
- Exam Formats:
  - In total 150 points in each exam. Each will convert to 50 credits in final grade.
  - 60 points easy questions from HW. No partial credit. Need a complete calculation process.
  - 40 points intermediate questions modified from HW. No partial credit. Fill the blank.
  - 50 points hard questions. Multiple-choice. Probability class deserves some randomness.

**Textbook and Materials:**

1. **(Best For Beginner and Engineer)** Roy D. Yates and David J. Goodman. *Probability and stochastic processes: A friendly introduction for electrical and computer engineers*. 3rd ed. Wiley, 2015

**Student Companion Site**

2. **(Beginner Alternative)** Sheldon M. Ross. *A First Course in Probability, Global Edition*. 10th ed. Pearson, 2020
3. **(Online Alternative)** Introduction to Probability, Statistics, and Random Processes by Pishro-Nik
4. **(Modern Alternative)** Introduction to Probability by Grinstead and Snell

**Topics Covered By Day:**

- Day 1** Course Introduction and Review of Calculus
- Day 2** Combinatorics Analysis, Counting Methods, Tree Diagrams
- Day 3** Examples and Exercises
- Day 4** Set Theory, Axioms of Probability, Conditional Probability, Independence, Venn Diagrams
- Day 5** Examples and Exercises
- Day 6** PMF, Discrete Random Variables, CDF, Derived Random Variable, Expectation
- Day 7** Examples and Exercises
- Day 8** CDF, Continuous Random Variables, PDF, Gaussian Random Variable, Delta Function
- Day 9** Examples and Exercises
- Day 10** Review
- Day 11** Exam 1
- Day 12** Joint CDF, Joint Random Variables, Joint PMF, Joint PDF, Marginal PMF, Marginal PDF, Joint Expectation, Covariance, Correlation, Linear Independence
- Day 13** Examples and Exercises
- Day 14** Derived Random Variables
- Day 15** Examples and Exercises
- Day 16** Conditional Random Variables
- Day 17** Examples and Exercises
- Day 18** Sum of Random Variables
- Day 19** Examples and Exercises
- Day 20** Review
- Day 21** Exam 2
- Day 22** Convergence and Intro to Stochastic Process
- Day 23** Bonus Presentation