Syllabus – ECE 353: Introduction to Probability and Random Signals

Winter 2018 / Xiao Fu

Catalog description:


**Instructor:**

Xiao Fu

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**TAs:**

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**Course Webpage:** [http://people.oregonstate.edu/~fuxia/ece353.html](http://people.oregonstate.edu/~fuxia/ece353.html)

**Lecture Section:** MWF 02:00 PM – 02:50 PM (50 minutes)

**Textbook (required):**

Roy D. Yates, and David Goodman,

*Probability and Stochastic Processes:*

*A Friendly Introduction for Electrical and Computer Engineers,*


Note: In this third edition, some of the more advanced material has been taken out (and made available through a companion website), and some more problems and examples have been included. The second edition includes the more advanced material in You can use the second edition if you wish.
Prerequisites:
MTH 254 or MTH 254H (Calculus), ECE 351, ECE352 (Signals and Systems).

Course objectives:
In a nutshell, to teach you how to reason under uncertainty. Learn the basics of applied probability, random variables and random processes, and how to use analytical tools to come to grips with randomness and uncertainty in science and engineering.

Course outcomes:

1) An understanding of the laws of probability, conditional probability, and the Bayes principle.
2) An understanding of discrete and continuous random variables, to compute expected values and variances, as well as an understanding of the meaning of these concepts.
3) An understanding of basic univariate probability models such as the uniform, Gaussian, binomial, and Poisson models.
4) An ability to use correlation properties to design linear least squares estimators.
5) An understanding of the bivariate and multivariate (vector) probability models.
6) An understanding of the central limit theorem and its implications
7) An understanding of basic concepts of random processes, including Gaussian processes and the Poisson process, autocorrelation and power spectral density functions, as well as an ability to estimate these from observations of random data.
8) An understanding of the effect of linear filtering on a random process sufficient for elementary optimum filtering design problems.

Measurable Student Learning Outcomes:
At the completion of the course, students will be able to…

1) Apply the concept of probability to experiments that have random outcomes (ABET outcomes: A, B, L, m, n)
2) Recognize a random variable and its properties (ABET outcomes: A, L, m, n)
3) Recognize a bi-variate random vector and its properties (ABET Outcomes: A, L, m, n)
4) Apply the concept of statistical estimation (ABET outcomes: A, b, L, n)
5) Identify random phenomena incorporating the element of time that are embedded in real-life physical processes in electrical engineering systems (ABET outcomes: A, e, L, m, n)

Course outline (tentative; Chapter # in blue refers to the third edition; [Chapter #] in black refers to the second edition):

- Introduction: experiments, outcomes, events, laws of probability, frequency interpretation, conditional probability, Bayes rule [1+1/3 week]
  - Chapters 1&2 [Chapter 1]: Experiments, Models, and Probabilities
- A single random variable [2+1/3 weeks]
  - Chapter 3 [Chapter 2]: Discrete Random Variables
  - Chapter 4 [Chapter 3]: Continuous Random Variables
- Multiple random variables, sums of random variables, limit theorems [2+1/3 weeks]
  - Chapters 5, 6, 7 [Chapter 4]: Pairs of Random Variables
  - Chapter 8 [Chapter 5]: Random Vectors
- Chapter 9 [Chapter 6]: Sums of Random Variables (selected parts)
- Estimation [1 week]
  - Chapters 10, 12, supplement [Chapter 9]: Estimation of a Random Variable (selected parts)
- Random processes [3 weeks]
  - Chapter 13 [Chapter 10]: Stochastic Processes
  - Supplement [Chapter 11]: Random Signal Processing (selected parts)

**Important dates (may slightly change):**

- In-class Mid-term Exam I, Friday, Feb. 2.
- In-class Mid-term Exam II, Friday, Mar. 2.
- Final Exam, the Week of March 19.

**Grading:**

- 15% Homework (~ 8 assignments)
- 25% Hourly Exam I, closed book, one sheet of notes of your choice allowed
- 25% Hourly Exam II, closed book, one sheet of notes of your choice allowed
- 35% Final Exam, closed book, one sheet of notes of your choice allowed

**Group collaboration and homework grading policy:**

- It is allowed to discuss homework with fellow students, but the solutions that you turn in should reflect your own work. Verbatim copies, identical code segments, identical unusual mistakes will be investigated. More importantly, doing your homework will make a big difference in your ability to do well in the exams.
- Each homework assignment is due **AT THE BEGINNING** of class on the due day (I may discuss selected homework problems and solutions in class). Late homework is not accepted. Homework must have a cover page with your name, ID number, and e-mail address. The problems must be solved in order.

**Instructor’s office hours:**

Monday and Wednesday, right after class: 3:00-4:00 pm, KEC 3003

**TAs’ office hours:**

Leila: T 9:00 am – 11:00 pm

Hamid: F 3:00 pm – 5:00 pm
Students with disabilities

The Oregon State University is committed to providing equitable access to learning opportunities for all students. Disability Access Services (DAS) provides accommodations, education, consultation and advocacy for qualified students with disabilities at Oregon State University. DAS works with students at OSU, OSU-Cascades, across Oregon and around the world through the OSU E-campus program.

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. Oregon State University services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via http://counseling.oregonstate.edu/

Student Academic Integrity and Scholastic Dishonesty
http://studentlife.oregonstate.edu/studentconduct/academicmisconduct

Academic, research, and scholarly integrity is of the upmost importance to Oregon State University, as an international public research university and the state’s Land Grant university. Faculty and students share responsibility in preserving the integrity of the academic experience at Oregon State. Academic misconduct damages the educational experience and ultimately hurts many parties, including faculty, other students, and the value of OSU credits and degrees. Students and faculty are encouraged to understand the expectations outlined by the Code of Student Conduct (Code) and professional standards of academic colleges and programs, to report suspected incidents of academic misconduct, and to hold each other to a high standard when it comes to the integrity of academic work.

Make-up exams and Incompletes:

I will make every attempt to provide reasonable accommodations if you miss an exam because of verified illness or family emergency. You should provide written verification from your doctor or hospital/clinic, and commensurate documentation in case of family emergency. Incomplete work should be completed within 1 month after the final exam date. A student is not permitted to submit extra work in an attempt to raise his or her grade.