ECSE 2500 section 01

ENGINEERING PROBABILITY

Course Information

ECSE 2500 01 : ENGINEERING PROBABILITY (3 Credits)

Mondays and Thursdays, 2:00-3:20 PM
DARRIN 337

Course Websites:

https://piazza.com/rpi/spring2023/ecse2500/resources
https://www.gradescope.com/courses/485144

Online Resources from **Prof. Rich Radke**:

This course will use a variety of online resources to share and collect course content. These include:

- Youtube: all of the ”Probability Bites” mini-lectures are available at the following playlist: https://www.youtube.com/playlist?list=PLuh62Q4Sv7BXkeKW4J_2WQBlYhKs_k-pj As discussed below, you are expected to watch 2-3 of these videos before and after each lecture.

- Piazza: all the homeworks and class materials will be posted and linked here. This is also the preferred discussion forum for asynchronous chat and threads about specific homework or exam questions.

- Gradescope: all assignments will be submitted and graded here. Make sure you have a way to capture your handwritten solutions on a piece of paper to upload to Gradescope (the phone app makes this easy).

Note that we aren't using either RPI's LMS or a Webex Teams space this semester.

The instructor will add you to these various sites using your RCS email before the start of class, and you should download the various apps for your phone and other devices. If you can't get access to any of these online resources, please send me an email as soon as possible. Please

do not hesitate to contact me if events occur that disrupt your access to the internet such as power outages.

Prerequisites or Other Requirements:

Prerequisite: MATH-2400 (Differential Equations). ECSE-2500 is required for EE and CSE curricula. ENGR-2600 (MAU) is not considered to be a substitute for ECSE-2500.

HW Assignments and Discussion:

We will be using Piazza for course materials and class discussion, and Gradescope for collecting and grading homeworks. Rather than emailing questions to the teaching staff, please post your questions on Piazza. Homework assignments, solutions, and back exams will be posted on Piazza; you are responsible for knowing any information that appears there.

Instructor Information

Dr. Tianyi Chen	chent18@rpi.edu
Office Location: JONSSN 6036	518-276-3173
Office Hours: M 5:00PM-6:00PM	

Teaching Assistant(s)

Name	Office Hours	Email Address
Weiqin Chen	Wednesdays 1:00-3:00 PM	chenw18@rpi.edu
Hongji Guo	Fridays 3:00-5:00 PM	guoh11@rpi.edu

Course Description

Axioms of probability, joint and conditional probability, random variables, probability density, mass, and distribution functions, functions of one and two random variables, characteristic functions, sequences of independent random variables, central limit theorem, and laws of large numbers. Applications to electrical and computer engineering problems.

Course Text(s)

A. Leon-Garcia, *Probability, Statistics, and Random Processes for Electrical Engineering*, 3rd ed., Pearson/Prentice-Hall, 2008. ISBN 978-0-13-147122-1. E-book is about $85 on Amazon (or rent it for cheaper).

Note that while I won't assign homework problems out of the book, I think it's important to have some sort of systematically organized reference material besides my class notes and Youtube lectures.

Course Goals

To understand basic probability theory and statistical analysis and be able to apply them to modeling typical computer and electrical engineering problems such as noisy signals, decisions in the presence of uncertainty, pattern recognition, network traffic, and digital communications.

Course Content

Topics by chapter of Leon-Garcia (time permitting):

Chapter 1: Probabilistic Models, Experiments and Outcomes, Empirical Distribution Function.

Chapter 2: Sample Space and Events, Axioms of Probability, Combinatorics, Conditional Probability, Statistical Independence, Sequences of Experiments.

Chapter 3: Discrete Random Variables, Probability Mass Functions, Cumulative Probability Distribution, Expected Value and Moments.

Chapter 4: Continuous Random Variables, Probability Density Functions, Cumulative Distribution Function, Functions of a Random Variable, Mathematical Expectation.

Chapter 5: Pairs of Discrete and Continuous Random Variables, Joint, Conditional and Marginal Probability Distribution and Density Functions, Independence of Two Random Variables, Covariance and Correlation, Bivariate Normal Distribution.

Chapter 7: Sample Mean and Law of Large Numbers, Central Limit Theorem.

Chapter 8: Sampling, Parameter Estimation, Maximum Likelihood and MMSE Estimation, Hypothesis Testing; Fitting Distributions to Data

Note that we will not cover all of the topics in the same order as the textbook.

A preliminary schedule is attached to this syllabus.

Learning Outcomes

An understanding of basic concepts of probability, such as axioms of probability, conditional probability, independence of events, and sequential experiments

An understanding of discrete and continuous random variables, including probability mass and distribution functions, and moments and functions of random variables

An understanding of joint random variables, sums of random variables, and laws of large numbers

An ability to apply statistical analysis to data, such as maximum likelihood estimation and hypothesis testing

Learning Outcomes Assessment Measures:

Assessment	Due Date	Learning Outcome #s
Exam 1	2/13/2023	1, 2
Exam 2	3/23/2023	2, 3
Exam 3	Finals period	1, 2, 3, 4
Homework	Weekly-Biweekly	1, 2, 3, 4

Grading Criteria

The grade will be based on the average homework grade (worth 30%), best two out of three exams (worth 35+35%).

Homework will be assigned roughly weekly and posted on Piazza; there will be 8 total assignments. These are intended to be short problems that test your understanding of basic concepts. The only way you will learn the material is to solve problems yourself; that is, you must prepare your solution independently. No collaboration or copying! Use office hours, chat, and Piazza to ask questions; we are very responsive!

Homework is due at 11:59PM on the date indicated and will be digitally collected via Gradescope. Late homework will not be accepted. The TAs will be responsible for homework grading and any questions about grading should be directed to the TAs.

All exams will be closed book, with specified numbers of handwritten crib sheets allowed. Exams will be digitally scanned and graded via Gradescope.

Course Calendar

A tentative course calendar is attached at the end of this syllabus.

Policies

Attendance Policy

This class will be taught in a flipped fashion. That is, you will watch 2-3 short videos any time before the start of lecture, and the class period itself will focus on working examples, answering questions, and going deeper into the material. You are expected to attend the in-person classes.

Digital Tools Policy

The online tools in the Online Resources section above provide services designed to assist schools, teachers and other educational partners to improve student learning outcomes. In some circumstances, these online tools may receive personally identifiable information about students (Student Data) from the instructor in the course providing this service. For example, an instructor will provide a class roster, email addresses of all students in the class, as well as coursework data that may be linked to a particular student. All listed online resource companies used by the instructor consider Student Data to be strictly confidential and have physical, administrative and technical security protections in place to protect such data. They do not use personally identifiable Student Data for any purpose other than to provide the services to the instructor, and they do not share personally identifiable Student Data with any third party except as authorized or required by the instructor. The online tools above may collect, analyze, and share anonymized or aggregated data or data derived from Student Data for certain purposes, but only if the disclosure of such data could not reasonably identify a specific individual or specific School. Collection and use of Student Data provided by the instructor is governed by Terms of Service for each platform and by the provisions of the Family Educational Rights and Privacy Act (FERPA). Student Data is provided and controlled by the instructor. If you have questions about reviewing, modifying, or deleting your personal information, please contact the instructor.

Students will be asked to sign this statement to agree to the use of these online tools and to acknowledge understanding of their use to facilitate online content for the course.

Other Course Policies

If you require extra time on exams or another form of accommodation, please contact the Dean of Students Office. Please do this early in the term so that we have plenty of time to plan.

You are expected to approach the instructor with any issue that may affect your performance in class ahead of time. This includes absence from important class meetings, late assignments, inability to perform an assigned task, the need for extra time on assignments, etc. You should be prepared to provide sufficient proof of any circumstances based on which you are making a special request as outlined in the Rensselaer Handbook of Student Rights and Responsibilities. See more information in the Inclusivity and Accessibility section below.

Grade appeals on a homework should be made directly to the TA that graded it within 72 hours of its return to the class (not 72 hours after you get around to picking it up!). Please take the time to carefully compare your solution to the posted homework solutions before appealing.

Grade appeals on an exam should be made to the professor within 72 hours of its return to the class. I will not consider appeals immediately after an exam is handed back unless they relate to an error in adding up points. Please take the time to carefully compare your solution to the posted exam solutions before appealing.

Any letter grade assignment posted before the end of the class should be regarded as tentative and subject to change.

This is a unique time that requires flexibility, patience, and communication. Communication is vital. Any changes to the course and policies will be presented to the entire class through designated channels (email, Piazza, in lecture). One thing that will not change is the grading structure (relative weight of homeworks and exams).

Academic Integrity

Intellectual integrity and credibility are the foundation of all academic work. A violation of Academic Integrity policy is, by definition, considered a flagrant offense to the educational process. It is taken seriously by students, faculty, and Rensselaer and will be addressed in an effective manner. If found responsible for committing academic dishonesty, a student may be subject to one or both types of penalties: an academic (grade) penalty administered by the professor and/or disciplinary action through the Rensselaer judicial process described in the student handbook. Three relevant academic integrity violations to emphasize include:

Collaboration: Collaboration is defined as deliberately facilitating an act of academic dishonesty in any way or form; for example, allowing another student to observe an exam paper or allowing another student to "recycle" one's old term paper or using one another's work in a paper or lab report without citing it as another's work.

Copying: Copying is defined as obtaining information pertaining to a graded exercise by deliberately observing the paper of another student; for example, noting which alternative a neighboring student has circled on a multiple-choice exam.

Plagiarism: Plagiarism is defined as representing the work or words of another as one's own through the omission of acknowledgment or reference. Examples include using sentences verbatim from a published source in a term paper without appropriate referencing, or presenting as one's own the detailed argument of a published source, or presenting as one's own electronically or digitally enhanced graphic representations from any form of media.

The Rensselaer Handbook of Student Rights and Responsibilities defines the full list of forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. If you have any questions concerning this policy before submitting an assignment, please ask for clarification.

Specific examples: Some assignments, like exams, have a clearly marked place on the front page that requires a signature confirming academic integrity. If you forget to sign the document before submitting it, a TA or instructor will contact you directly to ask you to sign before grading your assignment. We require that you take exams without speaking to other students via another communication channel. We expect you to use any permitted crib sheets just like you would in class. You cannot interact with Chegg.com or any other online/internet assignment sharing system for any graded assignment. Interaction with it results in an automatic failure for the entire course. A result of the violation using online resources to assist in graded assignments will result in a formal report. As a warning, there are ways that we can easily detect your use of these online resources that compromise academic integrity.

Submission of any assignment that is in violation of the policies described above will result in a penalty of an F in the class, and may be subject to further disciplinary action.

If you have any question concerning this policy before submitting an assignment, please ask for clarification.

Disability Services

Rensselaer Polytechnic Institute strives to make all learning experiences as accessible as possible. In this course, we will strive to provide an environment that is equitable and conducive for learning for all students. Please contact me as soon as possible if you anticipate or experience academic barriers based on a disability. Please let me know of such issues immediately so that we can discuss your options. To establish reasonable accommodations, please register with The Office of Disability Services for Students. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. To receive any academic accommodation, you must be appropriately registered with DSS (dss@rpi.edu; 518-276-8197, 4226 Academy Hall).

Disability Services for Students