Course Syllabus

Course Information

Engineering Probability		**ECSE 2500**	**Fall 2021**
Lecture	MR	04:00PM-05:20PM	DARRIN 318

Course Websites:
http://lms.rpi.edu (recording grades)
https://piazza.com/class/ksoorntvxjs1kg (notes, HW, discussions)
https://www.gradescope.com/ (Gradescope for HW submissions and grading)

Corequisite: ECSE-2410 (Signals and Systems).

Prerequisites: Since ECSE-2010 (Circuits) and MATH-2400 (Differential Equations) are prerequisites for ECSE-2410, these are therefore prerequisites for Engineering Probability as well.

HW Assignments and Discussions: We will be using Piazza for course material class discussion. The system is highly catered to getting you help quickly and efficiently from classmates, the TAs, and the professors. **Rather than emailing questions to the teaching staff, please post your questions on Piazza**.

We will be using Gradescope for collecting and grading assignments and exams.

Instructor

Dr. Ali Tajer
Office Location: JONSSN 6040
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(518) 276-8237

Office Hours:
Mondays 3:00-3:50pm (in-person)
Thursday 3:00-3:50pm (WebEx)

Homework and Midterm Exam Schedules

There will be 12 homework sets assigned in this course. Assignment schedule is available on page 5.

Exam	Date	Location
Mid-term 1	**September 30, 2021**	Lecture classroom
Mid-term 2	**November 8, 2021**	Lecture classroom
Final Exam	**Exam Week**	TBD

Teaching Assistant(s)

Name	Office	Hours	Email
Cynthia Li	WebEx	**Tuesdays** 4 - 5:30pm	lic20@rpi.edu
Weiyi Piao	WebEx	**Wednesdays** 3 - 4:30pm	piaow@rpi.edu
Hanjing Wang	WebEx	**Thursdays** 2 - 3pm	wangh36@rpi.edu
Xuefei Li	WebEx	**Fridays** 3 - 4pm	lix46@rpi.edu
Weiyi Piao	WebEx	**Saturdays** 1:30 - 3pm	piaow@rpi.edu
Cynthia Li	WebEx	**Sundays** 1:30 - 3pm	lic20@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.

Supplemental Reference

S. Lipschutz and M. Lipson, Schaum's Outline of Probability, 2nd edition. McGraw Hill, 2011. ISBN: 978-0071755610. This outline contains hundreds of fully solved problems and is a good reference for learning a concept better and studying for exams.

Course Goals / Objectives

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

The attached course calendar gives a tentative sequence of topics and corresponding sections of the book.

Student Learning Outcomes

1. An understanding of basic concepts of probability, such as axioms of probability, conditional probability, independence of events, and sequential experiments
2. An understanding of discrete and continuous random variables, including probability mass and distribution functions, and moments and functions of random variables
3. An understanding of joint random variables, sums of random variables, and laws of large numbers
4. An ability to apply statistical analysis to data, such as maximum likelihood estimation and hypothesis testing

Course Assessment Measures

Assessment	Due Date	Learning Outcome #s
Exam 1	09/30/2021	1, 2
Exam 2	11/08/2021	2,3
Final Exam	Finals week	1, 2, 3, 4
Homework	12 assignments	1, 2, 3, 4

Grading Criteria

Two in-class midterm exams – 20% each
Final exam – 40 %
Homework assignments -- 20 %

The **two lowest homework** grades will be dropped when computing the overall grade. This is done only to provide for sickness, interviews, emergencies, personal problems and other such exigencies that inevitably occur during the semester. No official excuses for these dropped homework assignments is necessary.

Other Course Policies

Homework Policy: All assignments have to be submitted electronically through Gradescope before the deadline. The submission website will close automatically at deadline. Late homework will not be accepted. You may work in groups, but you must write up your solution individually and independently. Copied homework will receive a grade of zero. Repeated violations will lead to failing the course.

Assignment Grade Appeal: To appeal an assignment grade, you should submit a written request to the TA who has graded the assignment contact **within a week** after receiving your graded assignment. In your request you must specify why you believe you deserve a higher credit for the solutions you are appealing.

Exam Grade Appeal: To appeal an assignment grade, you should submit a written request to the professor **within a week** after receiving your graded assignment. In your request you must specify why you believe you deserve a higher credit for the solutions you are appealing.

Important Note: The only circumstance under which an appeal in the assignment or exam grades will be considered is a demonstrable factual error in grading, meaning either that scores were incorrectly totaled, or a correct answer was marked incorrect. Uniform standards for partial credit are applied for the class, so we will not revisit the amount of points awarded for an incorrect or incomplete solution.
Exam Policy: 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.
Mid-term exams: All students are expected to take all midterm exams given during the semester.
Review sessions will be held in the workday evenings prior to exams. Attendance is encouraged, but optional.
No crib sheets or calculators or any kind of electronic device will be allowed during the exams. Tables of transforms & properties will be provided.

Attendance Policy

Attendance is expected in every class period, unless previously discussed with the instructor, and if necessary, officially documented by the Student Experience. We will cover a lot of ground in this course, so attendance is important.

Academic Integrity

Student-Professor relationships are built on trust. Students must trust that professors have made appropriate decisions about the structure and content of the courses they teach, and professors must trust that the assignments that students turn in represent their own work. Acts that violate this trust undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various 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 unofficial help was received, or significant teamwork was involved, a notation on the assignment should indicate your collaboration.

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

- Any violation of this policy will result in a 0 score for the related evaluation.
- Repeated violation will result in F grade.
- We have a zero-tolerance policy in exams, and any violation of the policies result in an F grade.
- For any case of academic dishonesty, a report will be filed to the Dean of Students.
- If you have any concerns pertinent to how an exam has been administered, you must communicate your concerns to the instructors immediately, and no lather than 12 hours after the exam.

Session	Date	Day			Topic	Readings	HW Out	HW Due	HW Return
1	08/30/21	Monday	Lecture	1	Syllabus, experiments, sample spaces, events	1.1-1.6, 2.1	1		
2	09/02/21	Thursday	Lecture	2	Axioms, counting methods	2.2-2.3			
3	09/07/21	Tuesday	Lecture	3	Conditional probability	2.4	2	1	
4	09/09/21	Thursday	Lecture	4	Independence, Bernoulli trials	2.5-2.6			
5	09/13/21	Monday	Lecture	5	Discrete random variables	3.1-3.2, 3.5	3	2	1
6	09/16/21	Thursday	Lecture	6	Expected value and moments	3.3			
7	09/20/21	Monday	Lecture	7	Conditional probability mass functions, continuous random variab	3.4	4	3	2
8	09/23/21	Thursday	Lecture	8	General random variables PDF	4.1, 4.2, 4.4			
9	09/27/21	Monday			Review session			4	3
10	09/30/21	Thursday	Exam		Exam 1 (in class)				
11	10/04/21	Monday	Lecture	9	CDF, expected value	4.1, 4.3	5		4
12	10/07/21	Thursday	Lecture	10	The Gaussian random variable, Q function, Gamma random variable	4.4			
	10/11/21	Monday			No class -- Columbus day				
13	10/14/21	Thursday	Lecture	11	Functions of a random variable	4.5	6	5	
14	10/18/21	Monday	Lecture	12	inequalities, Two random variables (discrete)	4.6, 5.1-5.3			
15	10/21/21	Thursday	Lecture	13	Two random variables (discrete, continuous)	5.1-5.3	7	6	5
16	10/25/21	Monday	Lecture	14	Two random variables (discrete, continuous)	5.1-5.3			
17	10/28/21	Thursday	Lecture	15	Joint Gaussian RVs; independence	5.4-5.5	8	7	6
18	11/01/21	Monday	Lecture	16	Joint expectations, correlation, covariance	5.6			
19	11/04/21	Thursday			Review session	5.6		8	7
20	11/08/21	Monday	Exam		Exam 2 (in class)				
21	11/11/21	Thursday	Lecture	17	Conditional PDFs; Bayesian and maximum likelihood estimation	5.7.1, 8.3, 8.6	9		8
22	11/15/21	Monday	Lecture	18	Conditional expectations	5.7.2			
23	11/18/21	Thursday	Lecture	19	Sums of random variables	7.1-7.2	10	9	
24	11/22/21	Monday	Lecture	20	Central limit theorem; confidence intervals	7.3, 8.4			
	11/25/21	Thursday			No class -- Thanksgiving				
25	11/29/21	Monday	Lecture	21	MAP, ML, and MMSE estimation	6.5, 8.2	11	10	9
26	12/02/21	Thursday	Lecture	22	Hypothesis testing	8.5-8.6			
27	12/06/21	Monday	Lecture	23	Testing the fit of a distribution; generating random samples	3.6, 4.9, 5.10, 6.6, 8.7	12	11	10
28	12/09/21	Thursday	Lecture	24	Review session				
	12/13/21	Monday						12	11
	12/16/21	Thursday							12