Course Information

Course Title	Engineering Probability
Course Number	ECSE 2500
Credit Hours	3
Semester / Year	Summer 2023
Prerequisite	MATH-2400

ECSE-2500 is required for EE and CSE curricula.

Instructor

Full Name / Title	Uwe Kruger, Eng.D.
Email Address	krugeu@rpi.edu

Office hours and lecture hours

No office hours during the first week of semester (schedule below is for Weeks 2 to 12).

	Monday	Tuesday	Wednesday	Thursday	Friday
8 am to 10 am	***Lecture hours*** EATON 214 **8 – 10 am**		***TA office hours*** ***DCC (Center of Gravity)*** Mahfuz Ullah ullahm@rpi.edu **4 – 6 pm** Mohaiminul Al Nahian alnahm@rpi.edu **6 – 7 pm**	***Lecture hours*** EATON 214 **8 – 9:10 am** ***Quizzes:*** **9:15 – 9:45 am**	
10 am to 1 pm	***Office hours*** Dr. Uwe Kruger JEC 7048 **11 am – 12 pm** and **1 – 2 pm**			***Office hours*** Dr. Uwe Kruger JEC 7048 **11 am – 12 pm** and **1 – 2 pm**	
1 pm to 4 pm					

- For Week 1: ***Lecture hours*** on 05/22 and 05/25 are from **8:30 - 10:05 am**
- The time slot on Thursdays between 9:15 and 9:45 am are for quizzes taken in-person. If quizzes are taken online on Thursday evenings **6 to 10 pm** (requires purchase of textbook), attendance to in-person quizzes is not required, accordingly!

Course Description

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

Course Textbook (Required for Online Quizzes)

U. Kruger & X. Wang. Modeling and Analysis of Uncertainty – A Theoretical Foundation and Practical Guide to Engineering Probability, Statistics and Regression Analysis. 2nd Edition, ISBN: 978-1-60797-970-8. Linus Learning, 2023.
Hard copy: https://linuslearning.com/product/modeling-and-analysis-of-uncertainty/ (recommended) or RPI bookstore.
eBook: https://linusebooks.com/product/modeling-and-analysis-of-uncertainty/
Either the hard copy or the eBook provides the access code to LINUS LMS (https://mau.linuslearning.net/), ***which contains the solutions to book exercises and access to all online quizzes to be taken.***

Supplementary Text

A. Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, 3rd Edition., Pearson/Prentice-Hall, Upper Saddle River, 2008.

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.

Student Learning Outcomes

Students will be able:

1. to apply basic probability theory.
2. to apply concepts of probability to model typical computer and electrical engineering problems.
3. to evaluate the performance of engineering systems with uncertainty.

Course Assessment Measures

Three examinations during class and ten weekly quizzes.

Quizzes	25%
Exam 1	25%
Exam 2	25%
Exam 3	25%

- Exam 1: June 12 (Monday).
- Exam 2: July 17 (Monday).
- Exam 3: August 17 (Thursday)

Let me know of conflicts NOW. ***There will be no make-up exams. For an excused and verified absence for an exam, the average of the other two exams will be used to calculate the final grade.***

Course Policies

Missing exams or quizzes: Missing exams or quizzes are only allowed if there is an emergency verified by the Dean of Student's office. There are ***no makeups*** for any exam or quiz. The average of the exam grades will be used to replace the excused missing assessments. Missing exams or quizzes without official excuses will receive a grade of 0.

Special testing accommodations: Testing accommodations can be applied to quizzes and exams. Make sure to email your memo at the beginning of the semester to Dr. Uwe Kruger (krugeu@rpi.edu). As such accommodations require planning, any accommodation request must be received two days before a quiz/exam to be entertained for that quiz/exam.

Attendance: The three exams will be during class times and attendance on those dates is mandatory. Other than that, class attendance is highly recommended but not required.

Course notes: My handwritten course notes will not be made available on LMS, as the material is covered in great detail in the course textbook.

Grading concerns: Each quiz is multiple choice, *i.e*. you are not required to submit a detailed worked solution. It is recommended that you keep the worked solution in case you have questions on how to solve a particular quiz questions during office hours. For each exam, however, it is required to submit detailed solutions for each problem. Graded exam scripts will be returned within one week after the exam date. There is a one-week window to seek clarification during the TA office hours after a graded exam was returned.

Examinations: The examinations are in-person (a remote option will not be entertained) in EATON 214 during class hours on June 12th (Exam 1), July 17th (Exam 2) and August 17th (Exam 3). The duration of each exam is 90 minutes and the exams start from 8 am. You are not permitted to leave the classroom during an exam unless you have completed and submitted your exam solutions. An answering booklet will be provided together with a sheet containing the problems to be solved for each exam (no need to bring any paper with you to an exam).

Use of Electronics: The use of computers and cellphones is not permitted during lectures. The use of cellphones during exams is considered a violation of RPI's academic integrity policy and result in a grade of F being given for ECSE 2500.

Communication: The use of email for communication is discouraged and should be limited to a necessary minimum, as I will not check and respond to emails after 5 pm (Monday to Friday) and on weekends. I have regular office hours that can be taken advantage of and I am available after class or by appointment to discuss issues related to the course material. I will not respond to emails inquiring about information that can be found in this syllabus or that you are unable to attend a particular lecture, as attendance is highly recommended but not mandatory. If you cannot attend an exam, I will only accept a note from the Dean of Students. If you are unable to attend an exam, however, I would appreciate a short note by email. There is also a WebEx TeamSpace forum, where you can post questions but also answer questions submitted by other students.

Academic Integrity

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. 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. Submission of any assignment that is in violation of this policy will result in a penalty:

A grade of F will be given to students in ECSE 2500 on the first infraction, *e.g.* cheating on an exam or a quiz.

If you have any questions concerning this policy, please ask for clarification.

Course Calendar

This is a tentative schedule and subject to change depending upon the progress of the class.

Week	Monday Lecture (**120 minutes**)		Thursday Lecture (**70 minutes**)	
1	05/22	Sample spaces, events, axioms of probability, addition rule, (Sections 1.2 and 1.3)		Conditional probability, independent events, total probability rule, Bayes' theorem (Sections 1.4 to 1.7)
2	05/31	Probability mass function, cumulative distribution function, mean and variance (Sections 2.1 and 2.2)	06/01	Discrete uniform distribution, binomial distribution (Sections 2.3 and 2.4) **Quiz 1 (up to 05/31)**
3	06/05	Poisson distribution, Probability density function, cumulative distribution function, mean and variance (Sections 2.4, 3.1 and 3.2)	06/08	Continuous uniform distribution, normal distribution (Sections 3.3 and 3.4) **Quiz 2 (up to 06/05)**
4	06/12	Examination 1 (Exam 1 covers up to 06/08)	06/15	Exponential distribution, joint probability distributions of discrete random variables (Sections 3.4 and 4.1) **Quiz 3 (up to 06/08)**
5	06/19	Marginal and conditional probability distributions of discrete random variables (Section 4.1)	06/22	Independent random variables, covariance and correlation (Section 4.3) **Quiz 4 (up to 06/19)**
6	06/26	Linear functions of random variables, (Section 4.4)	06/29	Propagation of uncertainty (Section 4.4) **Quiz 5 (up to 06/26)**
7	07/10	Central limit theorem (Section 6.1 and 6.2)	07/13	Generalized probability density functions (Section 6.6.1) **Quiz 6 (up to 07/10)**
8	07/17	Examination 2 (Exam 2 covers up to 07/13)	07/20	Characteristic functions I (Section 3.7.3) **Quiz 7 (up to 07/13)**
9	07/24	Characteristic functions II (Section 6.3)	07/27	Markov and Chebyshev inequalities (Section 6.3) **Quiz 8 (up to 07/24)**
10	07/31	Weak and strong law of large numbers (Section 6.4)	08/03	Change of random variable (Section 3.7.4) **Quiz 9 (up to 07/31)**
11	08/07	Transformation of random variables I (Section 4.7.2)	08/10	Transformation of random variables II (Section 4.7.2) **Quiz 10 (up to 08/07)**
12	08/14	*(study day)*	08/17	Examination 3 (Exam 2 covers up to 08/10)