Department of Electrical and Computer Engineering
University of Massachusetts Amherst

ECE 214: Probability and Statistics

Description: *Probability:* Experiments, models and probabilities; conditional probability and independence; single discrete and single continuous random variables; Gaussian random variables; expectation; pairs of random variables; random vectors; sums of random variables and the Central Limit Theorm. *Statistics:* Parameter estimation and confidence intervals; hypothesis testing, estimation of random variables (4 credits)

Objectives: Students completing this course will:

1. Have an understanding of the foundations of probability theory.
2. Have a working knowledge of single discrete and continuous random variables..
3. Have a working knowledge of vectors of discrete and continuous random variables..
4. Be able to use probability theory and random variables to model and analyze random phenomena encountered in engineering applications.
5. Be able to perform statistical analysis of data.

Instructors:

Hossein Pishro-Nik
Marcus 215K
Responsibilities: Overall course management, lectures, exams
Office Hours: Wednesdays 12:30pm-2:30pm.

Dennis Goeckel
Marcus 215L
Responsibilities: Recitations, homeworks, quizzes
Office Hours: Mondays 12:15pm-2:15pm

TAs:

Cameron Foss
Office Hour: Wednesdays, 5:30-7:30 pm
Location: Marston 15

Samaneh Ghandali
Office Hours: Thursdays 5:15-7:15 pm
Location: Announced weekly by the TA on Moodle.

Shayan Moini
Office Hours: Tuesday 5:15-7:15 pm
Location: Announced weekly by the TA on Moodle.

Yang Tao
Office Hours: None.

Supplemental Instruction (SI) Leader

Cassius Peter

Textbook: H. Pishro-Nik, *Introduction to Probability, Statistics, and Random Processes* Available freely online at www.ProbabilityCourse.com

The digital version of the book is available for free. If you like to have the print version of the book, you can purchase it at Amazon (not required).

Week-by week topics outline:

Week	Topics	Readings from text	Assignment
1	Introduction and applications; set theory; probability spaces and the three axioms	Sec. 1.0-1.3	Homework 1
2	Conditional probability and independence; equally likely events and an introduction to outcome counting	Sec. 1.4; Sec 2.1.0	Homework 2
3	Counting outcomes. Bernoulli trials.	Sec. 2.1.1-2.1.4	Homework 3
4	A single discrete random variable: probability mass function (pmf); the probability distribution function; working with pmfs.	Sec. 3.1, Sec. 3.2.1	Homework 4
5	Expectation and functions of a discrete random variable; introduction to a single continuous random variable.	Sec. 3.2.2-3.2.4; Sec. 4.1.0	Exam 1 (covers up to Week 4)
6	Probability distribution function revisited; probability density functions; mixed random variables; expectation revisited.	Sec. 4.1.1-4.1.3	Homework 5
7	Uniform, exponential and Gaussian random variables. Introduction to multiple random variables.	Sec. 4.2; Sec. 5.1.0	Homework 6
8	Multiple random variables: joint probability distribution, density, and mass functions. Conditional probability density and mass functions.	Sec. 5.1.1-5.1.5; Sec. 5.2	Homework 7
9	Random vectors: introduction, mean vector and covariance matrix.	Sec. 6.0-6.1	Exam 2 (covers up to week 8)
10	Sums of random variables and the Central Limit Theorem.	Sec. 7.1.0-7.1.2	Homework 8
11	Parameter estimation: point estimation and confidence intervals	Sec. 8.1-8.2	Homework 9
12	Hypothesis testing and linear regression	Sec. 8.3-8.4	Homework 10
13	Bayesian inference and review.	Sec. 9.1	
Final Exam (comprehensive)			

Grading Policy: The course grade will be based on the following components:

1. Ten homework assignments - 15% of total grade. (*Note*: Some homework assignments will require the use of MATLAB or other mathematical software.)
2. Statistics Mini-project – 5%
3. Discussion Games (APEs) – 5% of total grade
4. In-Class worksheets-5% of total grade
5. Pre-Exam Quizzes – 5% of total grade
6. Two Midterm Exams – 40% of total grade (20% each):
    a. Midterm #1 is scheduled on Wednesday Feb 27, 2019 from 7-9:00 pm, Mahar 108 Auditorium.
    b. Midterm #2 on Wednesday, April 3, 2019 from 7-9:00 pm in Mahar 108
7. Final Exam – 25% of total grade.

(Please see topics outline for assignment schedule.)

Academic Honesty: Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

Accommodation Policy: The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Inclusivity and Diversity: The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with the instructor privately. If you wish to communicate anonymously, you may do so in writing or speak with Dr. Paula Rees, Director of Engineering Diversity Programs (rees@umass.edu, 413.545.6324, Marston 128). We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.