Syllabus for UCSD ECE 109 in Winter 2023

Instructor: Prof. Ken Zeger, Jacobs Hall Room 6605, email: ken@zeger.us
Office Hours: Thursdays 1:00pm-1:50pm (via Zoom)

Teaching Assistant:
Mr. Spencer Congero, scongero@ucsd.edu
Study Time with the TA:

Mondays:	5:00pm-6:00pm	(via Zoom)
Wednesdays:	2:00pm-4:00pm	(via Zoom)
Fridays:	11:00am-1:00pm	(via Zoom)

Lectures:
Tuesdays & Thursdays 6:30pm - 7:50pm

In-person lectures at Center Hall Room 113. During the first week, the Tuesday lecture will be in person and the Thursday lecture will be via Zoom. After that it will change as follows. Starting the second week, the lectures will alternate between in person (every Thursday) and via Zoom (every Tuesday). All lectures (both in person and Zoom) will be recorded and posted on Canvas within a day, but usually quickly. after the lecture ends usually. The in person lectures will also be broadcast live via Zoom so they can be watched remotely live.

Discussion:

Mondays 4:00pm-4:50pm In person at Center Hall Room 113

Class web site:
All information for the class will be distributed through UCSD Canvas and the course Piazza site. However, Piazza will only be used for postings/questions/answers and Canvas will be used for all other matters (grades, practice exams, syllabus, etc.). It is helpful if you are able to post equations etc. using latex style input in Piazza.

Prerequisites:
Here are the REAL prerequisites for ECE109: Math 20A-B-C.

The only thing you really need from Math 20C (sometimes taught in Math 20E) is double integration, change of variables, and polar coordinates. From Math 20AB you need to be able to differentiate and integrate. You also need to be able to do sums such as geometric series and understand factorials and combinations.

You do NOT need to have taken Math20D, Math20F (or Math18 or Math 31AH), or ECE101 in order to take ECE109.

Discussion Classes:
The discussion classes will be prerecorded and posted on Canvas each Saturday. These videos will present clarifications of lecture material and will work out in detail specific examples of important problems. In contrast, regular class lectures will be more theoretically oriented, often with fewer or no examples. The office hours are where you can ask for help on specific problems you are having trouble with. The actual Discussion session from 4:00pm-4:50pm each Monday will consist of a 15-minute quiz (see the "Quizzes" section below) followed by a Study Time with the TA session.

Quizzes: There will be a 15-minute quiz every Monday during the 1st fifteen minutes of Discussion, starting the second week of the quarter. The last (9th) quiz will be on March 13, 2023. All Monday quizzes will be 4:00pm-4:15pm, Each quiz will be online via Zoom. You may take the quiz anywhere you want (e.g. at home or library or outside), including in the Center Hall class room where the discussion will be given.

However, there are two Monday holidays (i.e. January 16 and February 20), so the quizzes for these two days will instead be the next day (Tuesday January 17 and Tuesday February 21) during the first 15 minutes of lecture. More precisely, there will be 9 quizzes as follows: January 23, 30, February 6, 13, 27, March 6, 13 during 4:00pm-4:15pm, and January 17 and February 21 during 6:30pm-6:45pm.

All of the Discussion classes will start in person at 4:15pm, right after the quizzes end. Each quiz will typically consist of three questions. The material for each quiz will focus on the two lectures preceeding it (i.e. the Tue and Thu from the previous week). The lowest of the 9 quiz grades will be droppped, and the remaining 8 grades will collectively count towards 40% of the class grade. Each of the 8 quizzes that count will equally contribute 5% to the total class grade. Missed quizzes count as zero and cannot be made up.

Many copies of old quizzes, midterm exams, and final exams are posted. Solutions may not be posted, but feel free to discuss them on piazza or privately. Copies of final exams from other web sites are also posted.

Final Exam:
Tuesday, March 21, 2023, 7:00pm-10:00pm.

Proctoring:
All quizzes will be proctored on Zoom with cameras turned on.

Grading: Your final grade will count as follows:
Homework = 0%
Quizzes = 40%
Final exam = 60%

Average class letter grades will be roughly in the B- range.

What Can Be Used During Exams Policy:
The Quizzes will be open books/notes and you may search the internet at will for previously posted results. You may use calculators and computers if you think it will help you. However, you may not consult with any people during the exam, nor email, text, post, or otherwise send any portion of the exam to any person or website during the exam.

The Final exam will be in person, closed book, and no electronic devices will be allowed. However, one sheet of 8.5 x 11 paper with writing or typing on both sides is allowed during the exam.

All headphones, earbuds, and other listening accessories are **prohibited** during quizzes and the final exam.

Missed Quiz Policy:
No makeup quizzes will be given.

Homework:
There are no formal homeworks and none are are to be handed in nor graded. Instead, (many) old quizzes, midterm exams, and final exams are given for practice. Many of these have answers or solutions written up, but others do not. You are however encouraged to work them out and check the posted solutions. You can also ask the TA for help or post questions to Piazza about them. These will serve as "homeworks" in a sense.

Text:
"A First Course in Probability", 9th Edition, by Sheldon Ross, Prentice-Hall, 2001
(ISBN13: 978-0321794772 or ISBN10: 032179477X).
Note: The older 5th, 6th, 7th, or 8th editions of this text will be fine for this class, so you may be able to save money that way.

Academic Integrity:
Don't cheat. Be honorable.

Approximate Schedule of Topics Covered:

- **Week 1 (lectures 1, 2)**: Experiment, sample space, event, occurence, null event, sure event, sets, union, intersection, complement, disjoint, coin flipping. DeMorgan's law, Venn diagrams, probability axioms, probability of unions, subsets, equiprobable outcomes, permutations, combinations, binomial theorem.
- **Week 2 (lectures 3, 4)**: Equiprobable outcomes, conditional probability. Axioms of conditional probability, partition rule, chain rule of probability, Baye's formula.
- **Week 3 (lectures 5, 6)**: Independent events, disjoint vs. independent, three independent events, conditionally independent events. Independent trials, random variables.
- **Week 4 (lectures 7, 8)**: Random variables, cummulative distribution function (CDF). Discrete random vasriables, probability mass function (pmf), uniform discrete random variable, binomial random variable. Poisson random variable, geometric random variable.
- **Week 5 (lectures 9, 10)**: Continuous random variable, probability density function (pdf), uniform continuous random variable, Gaussian random variable. Standard (or unit) Gaussian, expectation,
- **Week 6 (lectures 11, 12)**: Expectation of functions of one random variable, moments, variance, standard deviation. Functions of one random variable, Leibniz rule, joint cummulative distribution function (joint CDF).
- **Week 7 (lectures 13, 14)**: Joint CDF, marginal CDF, joint probability mass function (joint pmf), marginal pmf, joint probability density function (joint pdf). Computing joint pdf from joint CDF and vice versa, marginal pdfs.
- **Week 8 (lectures 15, 16)**: Computing probabilities from joint pdfs, independent random variables. pdf of a Sum of random variables, convolution integral, maximum and minimum and product. random variables,
- **Week 9 (lectures 17, 18)**: Two functions of two random variables, sum and difference random variables, expectation of functions of multiple random variable, epxectation of sums, covariance, correlation coefficient, uncorrelated. Independence versus uncorrelated, variance of sums, correlation coefficient bounds, estimation, jointly Gaussian.
- **Week 10 (lectures 19, 20)**: Limit theorems, Law of Large Numbers, Central Limit Theorem, Markov inequality, Chebychev inequality, sample averages.