ENGR 120: Probability and Random Signals – Summer 2023 (Online)

Instructor: Dr. Mohammed Eltayeb
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Office Hours: Thursday 10:00 am -12:00 pm and by appointment. Zoom Link: https://csus.zoom.us/j/85234187012

Course and Schedule:

- Online – Asynchronous. All course materials will be available in Canvas and Panopto.
- The online material may include pre-recorded videos, online quizzes, outside class reading and computer assignments and other online sessions.
- Please pay special attention to course announcements and discussion boards. These will be the main tools for communication with students.

Course Description:

Prerequisites: EEE 180, may be taken concurrently.
Probability and random signals and their application in engineering systems. Topics include the random sample space model, concept of axiomatic probability, conditional probability, discrete and continuous random variables, probability density and distribution functions, functions and statistics of random variables, random vectors multivariate distributions, and correlation and covariance of random vectors. Applications include estimation, risk, signal detection, random signals and noise in linear systems, reliability, and estimation.

Objectives:

After successfully completing the course, the students will be able to

- Understand and apply basic concepts of probabilities.
- Understand the use of random variables in solving engineering problems.
- Explain the basic concepts of random processes.
- Understand the basic concepts of system analysis using random inputs.

Text Book:

- C. Therrien and M. Tummala, "*Probability and Random Processes for Electrical and Computer Engineers*", CRC Press, 2nd Edition, 2011. – *Check CSUS library for soft (pdf) and hard copies.*

Other References:

- P. Z. Peebles, "*Probability, Random Variables, and Random Signal Principles*", McGraw-Hill, 4th Edition, 2001.
- D. P. Bertsekas, J. Tsitsiklis, "Introduction to *Probability*", Athena Scientific, 2nd Edition, 2008.
- M. Carlton and J. Devore, "*Probability with Applications in Engineering, Science and Technology*", Springer, 2nd Edition, 2017.
- A. Leon-Garcia, "*Probability and Random Processes for EE*", Addison Wesley, 2nd Edition, 1994.

Homework:

- Homework will be regularly assigned (at least once per week).
- Homework will be collected, but not returned.
- MATLAB software will be needed for the some of the homework assignments.
- Periodically review your grade in the Canvas Gradebook. Bring to my attention any error or anomaly as soon as possible.

Exams and Quizzes:

- There will be five 30-minutes quizzes and a two-hour final exam during the semester. The exam and quizzes are a timed test completed online using Canvas Quiz module. The student will use the online access of their choice and should make appropriate arrangements to take the exam online during the scheduled day/time. Multiple submissions are allowed for quizzes, however, the final comprehensive exam is "once and done"

with only one submission allowed. It is highly recommended that you upload your worksheet (solutions to quiz answers) at the end of the quiz for partial credit.

Course Grading:

5%: Homework
15%: Computer Assignments
30%: Quizzes (weekly)
50%: Final exam (comprehensive)
$A \geq 95$; $90 \leq A- < 95$; $87 \leq B+ < 90$; $83 \leq B < 87$; $80 \leq B- < 83$; $77 \leq C+ < 80$; $73 \leq C < 77$; $70 \leq C- < 73$; $67 \leq D+ < 70$; $63 \leq D < 67$; $60 \leq D- < 63$; F: Below 60.

Tentative Schedule:

Week	Topics	Reading Assignment
1	**Probability** Introduction, Set definitions and set operations Axioms of probability, Conditional probability, independent events, Bayes' law	1.1-1.2, 2.1, 2.2.1, 2.2.2-2.4
2	***Quiz 1 (07/17)*** **Random Variables** Discrete random variables, PMF, Some common discrete distributions, Continuous random variables, CDF, PDF	3.1,3.2, 3.3
3	***Quiz 2 (07/24)*** Some important random variables, Expectation, Moments, Moment generating functions	3.4, 4.1-4.3
4	***Quiz 3 (07/31)*** **Multiple random variables** Pairs of random variables, Properties of joint distribution and joint density, Joint expectation/moment	5.1-5.3
5	***Quiz 4 (08/7)*** Markov, Chebyshev inequalities, Law of large numbers, central limit theorem Estimation, sample mean, variance	6.1-6.3
6	***Quiz 5 (08/14)*** **Random Processes** Concept of a random process, Stationarity and independence, First and second moments of a random process, cross correlation **Final Exam (08/19)**	8.1-8.2, 9.1-9.2, 10.1

Campus Support:

- If you have a disability and require accommodations, please contact me as soon as possible, and the SSWD office at located in Lassen Hall 1008, phone (916) 278-6955, (916) 278-7239 (TDD only) or via email at sswd@csus.edu.
- Student Health and Counseling Services staff are committed to continuing to provide exceptional service to our campus community. Though many students may be away from campus, most services are offered using secure remote technology.