SYLLABUS – EE 503: Summer 2025 (4 units)

Probability for Electrical and Computer Engineers

Instructor:	Brandon Franzke	Office:	EEB 504B
Email:	franzke@usc.edu	Hours:	Monday: 16:30 – 18:00
			Thursday: TBA

This course focuses on **reasoning** with probabilistic uncertainty. This involves developing careful skills in logical reasoning and applying those skills to a wide range of problems in probabilistic and statistical inference from signal processing to machine learning. The course depends primarily on lecture material and handouts. Attendance is **mandatory**. There are weekly exams and no make-ups. Unexcused absences or early departures result in an automatic exam score of zero.

Lecture	Monday (section: 30401)	12:00 – 16:10
Discussion	Friday (section: 30402)	10:00 – 10:50

Enrollment is in-person and DEN ONLY. Attendance is mandatory to all lectures. Taping or recording lectures or discussions is strictly forbidden without the instructor's explicit written permission.

Teaching assistants

TA:	TBA	Grader:	TBA
Email:		Email:	
Office:	(see BrightSpace)	Office:	(by appointment)

Course materials

Required: *Probability and Random Processes for Electrical and Computer Engineers*, Gubner, J.A., Cambridge University Press, 2006.

Required: *Probability, Statistics, and Random Processes for Electrical Engineering*, Leon-Garcia, A., Pearson, 2008.

Recommended: *Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*, Efron, B., and Hastie, T., Cambridge University Press, 2016.

Recommended: *Introduction to probability for computing*, Harchol-Balter, M., Cambridge University Press, 2023.

NOTE: Texts are secondary to in-class lecture material and homework sets.

"No AI" policy. The use of AI tools is strictly prohibited and considered a serious violation of academic integrity. This includes all artificial intelligence technologies, including but not limited to large language models, text generators, and AI-assisted writing software, for any aspect of coursework—be it research, outlining, drafting, editing, or proofreading. Any suspected use of AI will be thoroughly investigated. Violations may result in severe consequences, including course failure and referral to the Office of Student Judicial Affairs and Community Standards for further disciplinary action.

Course Outline (tentative)

	week of	
1	**21 May**	Logic and sets. Proof technique. Sigma-algebras. Probability axioms.
2	26 May	**No class, Memorial Day.**
	28 May	Uncountability. Borel sigma-algebra. Independence. Total probability.
3	02 Jun	Combinatorics. Limits of sequences and sets. Borel-Cantelli Lemma.
4	09 Jun	Discrete probability and approximations. Poisson Theorem.
5	16 Jun	Random variables. Continuous densities. Bayes conjugate inference.
6	23 Jun	Expectations and moments of random variables.
7	30 Jun	Covariance. Correlation. Uncertainty principles and applications.
8	07 Jul	Stochastic convergence. Laws of large numbers.
9	14 Jul	Conditional expectations. Maximum likelihood estimation.
10	21 Jul	Transformed densities. Monte Carlo. Entropy and mixtures.
11	28 Jul	Central limit theorem. Confidence intervals. Queues.
12	04 Jul	Discrete time Markov processes. Optimal estimation and least squares.
	11 Aug	**Final, 12:00 - 14:30**

Grading Procedure

Class grade depends on weekly exams and the final exam. Homework problems are optional. Homework handouts count as extra credit. Homework problems from the text do not count.

Weekly Exams. 60 Points. 11 weekly exams. **Closed book.** 10 minutes at the start of each Monday lecture (and Wednesday on week 2). No make-up exams. Each weekly exam is worth 6 points. Missed exams earn 0 points. The total weekly exam score sums your 9 best weekly exam scores. Algorithm: label your weekly exam scores from lowest to highest: $w_1 \leq \cdots \leq w_{11}$. Then $W = 6 + w_3 + \cdots + w_{11}$ is your total weekly-exam score. Synchronous class attendance is *mandatory*. **Unexcused absences get an automatic exam score of zero for that week's exam grade.**

Final Exam. 40 Points. Cumulative. The final exam is **closed book with no note sheets**. You are expected to bring a non-graphing scientific calculator.

Homework. *Textbook* problems are checked but not graded. *Handout* problems are graded but count only as extra points. They count at most as 10 points if all homework sets turned in and accurately worked. Your grade remains as is if only some homework turned in. How much homework affects which cases is at the discretion of the instructor. You may discuss homework problems with classmates but each student must submit their own orginal work. Turning in identical homework sets counts as cheating. Cheating warrants an F in the course.

Course Grade

A if 90.00 - 100 points, **B** if 80.00 - 89.99 points, **C** if 70.00 - 79.99 points, **D** if 60.00 - 69.99 points, **F** if 0 - 59.99 points. ("+" and "–" at $\approx$ 1.5% of grade boundary).

Cheating

Cheating is not tolerated on homework or exams. Penalty ranges from F on exam to F in course to recommended expulsion.

Academic Accommodations

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 08:30 - 17:00, Monday through Friday. The phone number for DSP is (213) 740-0776.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of brightspace, teleconferencing, and other technology.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contactus. This is important for the safety of the whole USC community. Another member of the university community - such as a friend, classmate, advisor, or faculty member - can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/studentaffairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Academic Conduct

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the *USC Student Handbook*. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the *Office of Academic Integrity*.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (*e.g.*, falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

Academic dishonesty has a far-reaching impact and is considered a serious offense against the university. Violations will result in a grade penalty, such as a failing grade on the assignment or in the course, and disciplinary action from the university itself, such as suspension or even expulsion.

For more information about academic integrity see the student handbook https://policy.usc.edu/studenthandbook/, or the Office of Academic Integrity's website https://academicintegrity.usc.edu/, and university policies on Research and Scholarship Misconduct https://policy.usc.edu/research-and-scholarship-misconduct/.