**EE 503**

 **PROBABILITY FOR ELECTRICAL AND COMPUTER ENGINEERS**

 **(4 units) SPRING 2023**

**Instructor**: George P. Papavassilopoulos

**Office**: EEB 114

**Email:** yorgos@usc.edu

**Office Hours**: Monday 1:00pm-3:00pm

Location: EEB114

Please make appointment by email at least 3hrs earlier.

**TAs**:

|  |  |
| --- | --- |
|  Neuman, Michael, | mikeneum@usc.edu |

Office Hours: TBA (PST), Location: TBA

 Chan, Chin-Cheng, chinchen@usc.edu

 Office Hours: TBA (PST), Location: TBA

 Riabukhina, Daria, riabukhi@usc.edu

 Office Hours: TBA (PST), Location: TBA

**Graders**: TBA

**Lecture**: Mon, Wed 10:00-11:50am, OHE 122 and DEN@Viterbi

**Discussion:** Friday 9:00am-9:50am, [OHE](https://maps.usc.edu/?id=1928&reference=OHE)122 and DEN@Viterbi

**Webpages**:

DEN

**Prerequisites**: Calculus, Linear Algebra and Matrices.

**Grading**:

Assignments 20pts

Two Midterm Exams 25 pts+25pts=50pts

Final Exam 30pts

Letter Grade Distribution:

 100.00-93.00 A 73.00 - 76.99 C

90.00 - 92.99 A- 70.00 - 72.99 C-

87.00 - 89.99 B+ 67.00 - 69.99 D+

83.00 - 86.99 B 63.00 - 66.99 D

80.00 - 82.99 B- 60.00 - 62.99 D-

77.00 - 79.99 C+ 59.99- F

The letter grade distribution table guarantees the minimum grade each student will receive based on their total final score.

**Catalogue Description**: Rigorous coverage of probability, discrete and continuous random variables, functions of multiple random variables, covariance, correlation, random sequences, Markov chains, estimation, and introduction to statistics.

**Course Objectives**: The course focuses on reasoning with probabilistic uncertainty. This involves acquiring the basic notions of probability, random variables and stochastic processes and applying these skills to a wide range of problems in probabilistic and statistical inference from signal processing and decision theory to machine learning.

**Exam Dates**:

**Midterm Exam** **1:** Wednesday February 15, 10:00-11:50am

**Midterm Exam** **2:** Wednesday March 22, 10:00-11:50am

**Final Exam**: Monday, May 8, 8-10am

**Textbook**:

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

In the course we follow this textbook to a large extent.

Handouts on certain topics will be distributed.

Other recommended Textbooks:

1. Leon-Garcia, A., Probability, Statistics, and Random Processes for Electrical Engineering, Prentice Hall, 2008.

2. Athanasios Papoulis, S. Unnikrishnan Pillai, Probability, Random Variables and Stochastic Processes, McGraw-Hill ,4th ed.

3. S. R. S. Varadhan, Probability Theory, Courant Institute of Mathematical Sciences, New York University, August 31, 2000 (Notes).

**Homework**

 Homework is assigned on a weekly /biweekly basis. No late homework will be accepted.

**Exam Policy**

No make-up exams.

Exceptions: In case of emergency a signed letter from your manager or physician must be submitted. This letter must include the contact of your physician or manager.

Midterms and final exams will be closed book and notes. No calculators are allowed nor are computers and cellphones or any devices that have internet capability. One letter size cheat sheet (back and front) is allowed for the midterms. Two letter size cheat sheets (back and front) are allowed for the final.

All exams are cumulative, with an emphasis on material presented since the last exam.

 **Attendance:**

 Students are expected to attend the lectures and discussion sessions and actively participate in class discussions.

**Important Notes**:

 ***Textbooks are secondary to the lecture notes and homework assignments.***

***By “Material covered and examined” is meant what is taught in class.***

 Handouts and course material will be distributed.

**COURSE OUTLINE (Roughly following the textbook and the handouts)**

• Outcomes, Events, Sigma-algebras. Probability axioms, Uncountability, Borel sigma-algebra, Probabilities, Conditional Probabilities, Independence, Bayes’ Rule, Combinatorics.

 • Discrete Random Variables, Continuous Random Variables, Expectation, Functions of Random Variables

 • Jointly Distributed Random Variables, Conditional Probability for Discrete and Continuous Random Variables, Iterated Expectations, Random Vectors

• Modes of Convergence for Random Variables, Laws of Large Numbers, Central Limit Theorem

• Random Processes, Wiener Process**\***, Poisson Process**\***.

• Discrete Time Markov Chains

• Martingales**\***

• Statistics: Maximum likelihood Estimation, Parameter estimation and least squares, Confidence Intervals, Hypothesis Testing.

(Chapter 1 :1-7, Chapter 2 :1-4, Chapter 3 :1-5, Chapter 4:1-5,

Chapter 5:1-6, Chapter 6:1-6, Chapter 7:1-5, Chapter 8:2-3,

Chapter 9:1-5, Chapter 10:1-3, Chapter 11:1-3, Chapter 12:1-4,

Chapter 13:1-4, Chapter 14:1-3)

**Note**: Items marked by \* will be covered only if time permits.

**Statement for Students with Disabilities**

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 (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.– 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. IV. Statement on Academic Integrity USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/ publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/. Academic Conduct Plagiarism - presenting someone else's ideas as your own, either verbatim or recast in your own words - is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriatesanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/ scientific-misconduct/. 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/contact-us. This is important for the safety 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/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

**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 blackboard, teleconferencing, and other technology.