Department of Electrical Engineering
University of Southern California

EE 562 – RANDOM PROCESSES IN ENGINEERING Fall 2018

Instructor: Urbashi Mitra, Professor
536 EEB, 213 740 4667,ubli@usc.edu

TA: TBD

Course Web Page: DEN Blackboard `www.uscden.net`
Contains homework, solutions, and relevant handouts. Course announcements, homework hints and modifications will be posted on this page – please check it regularly.

Lectures: MW 11:00 pm - 12:20pm, OHE 100B

Discussion: F 5:00pm–5:50pm, OHE 100C

Course Objectives: To provide a fundamental understanding of concepts and techniques of random processes. The emphasis will be on developing the analysis and design tools needed to apply random process theory to graduate electrical engineering courses and research. This is a first course in random processes for engineers, and is a prerequisite for many courses in communications, controls and signal processing.

Prerequisites: 1. Linear Algebra, matrix theory, linear spaces, bases, eigenvectors, eigenvalues, *etc.* (EE 510). 2. Probability theory and random variables, moments, transformations of random variables, characteristic functions, *etc.* (EE 503).

Other Requirements: Basic computer skills (*i.e.* programming, plotting, random variable generation, familiarity with Matlab is helpful although not necessary.). Fourier, Laplace, and z transforms, complex variables, contour integrals, and residue theory (EE 401 or equivalent).

Text: Random Processes for Engineers, by B. Hajek, Cambridge University Press, 2015.

Grading: (tentative) 15% Homework
35% Midterm
50% Final
Final grades will be assigned by a combination of student score distribution (curve) and the discretion of the instructor.

Exams: **Midterm** Wednesday, October 3, 2018, 11:00 am - 12:20pm
Final Wednesday, December 5, 2018, 11:00am-1:00pm

Office Hours: TBD
Use of email to set up appointments encouraged: ubli@usc.edu. Attending office hours in person is encouraged.

Late Policy: Homework is due at 5pm on Tuesdays in the 562 box (EEB basement). No late homework will be accepted. A late assignment results in a zero grade.

Make-up Material: Homework assignment dates are non-negotiable. Your lowest homework score will be thrown out before computing final grades. No make-up exams will be given. In the case of a required business trip or a medical emergency, a signed letter from your supervisor or doctor is required. This letter must include the telephone number of your doctor or supervisor.

Grade Adjustment: If you dispute any scoring of a problem on an exam or homework set, you have **one week** from the date that the graded paper is returned to request a change in the grade. After this time, no further alterations will be considered. All requests for a change in grade must be submitted in writing to me.

Attendance: Lecture attendance is encouraged; many examples and applications not in the text will be covered in the lectures. The student is responsible for all assignments, changes of assignments, announcements, lecture notes *etc.* All such changes should be posted on the course web-site.

References:

1. Random Processes for Engineers, by R. A. Scholtz (will be posted on DEN web-site)
2. Intuitive Probability and Random Processes using MATLAB, Steven Kay, Springer 2006 (ISBN-13: 978-0387241579)
3. Probability, Statistics, and Random Processes for Engineers , Henry Stark and John Woods, 4th ed., Prentice Hall 2011 (ISBN-13: 978-0132311236)
4. Probability and Random Processes, Yannis Viniotis, McGraw-Hill 1997 (ISBN-13: 978-0070674912)

Outline:

1. Review of random variables.
2. Convergence of random sequences; limit theorems.
3. Random vectors and minimum mean-squared error estimation.
4. Random processes introduction.
5. Mean-square calculus, representations of random processes.
6. Random processes in linear systems and spectral analysis.
7. Optimal filtering of random processes.
8. (time permitting) Martingales.
9. (time permitting) Advanced applications.

Suggestions:

1. Remember the big picture.
2. Read the book and supplementary sources.
3. Prepare your own summaries from texts and notes.
4. Work as many problems as you can.

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-appropriate-sanctions/https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. 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/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/http://equity.usc.edu/ or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us 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/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.

Students with Disabilities: 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/alihttp://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 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/willhttp://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.