CE695: Stochastic Processes
Department of Computer Engineering
Sharif University of Technology
Fall 2022: Sunday & Tuesday: 13:30-15:00

Instructor:

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Course Website:
> https://stoch-sut.github.io

Online Lectures:
> https://vc.sharif.edu/rabiee

Prerequisites:
> Engineering Probability and Statistics (40-181)

Course Objectives:
To make the graduate students acquainted with the fundamental concepts of stochastic processes and their applications in Electrical & Computer Engineering.

Course Textbooks & References:

1. A. Papoulis and S. Pillai, Probability, Random Variables and Stochastic Processes, 4th Edition, McGraw Hill, 2002.

2. S. Ross, Introduction to Probability Models, Academic Press, 2009.

3. G. Casella and R. L. Berger, Statistical Inference, Wadsworth Press, 1990 (reference for Estimation Theory part of the course).

4. Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006.

5. Instructor Handouts.

Grading:
Based on your performance on Homework, Quiz, Project, Mid-Term and Final Exam. The grade will be determined by:

- Homework: 20%

- Practical Homework: 5% (Extra point)

- Presentation: 5% (Extra Point)

- Quiz: 20%

- Project: 20%

- Mid-Term Exam: 15%

- Final Exam: 25% (Comprehensive)

Course Description:
The course includes fundamental concepts of Probability Theory, Stochastic Processes, Stochastic Linear Systems, Stationary and Ergodic Processes, Power Spectral Density, Estimation Theory, Spectral Estimation, Markov processes, Markov Chains, Sampling, and Selected Advanced Topics. For each topic instructor handout is the main reference.

Course Regulations

Homework Problems:
Homework problems will be handed out on their designated dates and will be due about 10 days later. The problems will also cover the following week's materials so do not expect to cover the whole problem set right after its release. There might be some simple programming Homework and a Project using MATLAB or Python. If needed there will be learning materials and classes on how to use MATLAB or Python for problem solving. Course policy for late submission is 10% penalty for each day and no submission is accepted after 3 days.

Homework Submission:
Hand in your answers at the start of your class session and also submit your answers in .pdf file in course page on quera website, with the following format:
HW[HW#]-[std#] (For example HW3-400100111)

Quizzes & Exams:
Each Tuesday there will be a quiz, at the beginning of the lectures. Each quiz will cover the facts discussed in the previous week, so use your Fridays to study!

Problem Solving Classes:
As a fundamental course, "Stochastic Processes" needs practice through problem solving; Therefore, Problem solving classes are mandatory. Do not be disappointed, as it is an obligatory help!

Week	Topic	Readings	HW/Quiz
1 06/27, 06/29 07/02	Course overview, and Review of Probability Theory Introduction to Stochastic Processes	Ch. 1-7 Ch. 9	 HW#1 (Take-Home, won't be graded)
2 07/10, 07/12	Stochastic Processes Stationary Stochastic Processes	Ch. 9 Ch. 9	Quiz#1 HW#2
3 07/17, 07/19 **Extra Class**	Ergodicity Stochastic Analysis of Linear Systems and Power Spectrum LTI Systems	Ch. 12, Ch. 9 Ch. 9	Quiz#2
4 07/24, 07/26	Point Process Poisson Process	Handout Handout	Quiz#3,HW#2 Due, HW#3
5 08/01, 08/03	Renewal Process Gaussian Process I	Handout Handout	Quiz#4
6 08/08, 08/10	Gaussian Process II Estimation Theory - Motivation and Basic Concepts	Handout Ch. 8, CB: Ch 6,7	Quiz#5, HW#4
7 08/15, 08/17	Estimation Theory I Estimation Theory II	Ch. 8, CB: Ch 6,7 Ch. 8, CB: Ch 6,7	HW#3Due, Quiz#6, Practical-HW#1
8 **08/22** 08/24	**Midterm Exam** Estimation Theory III	**Comprehensive** Ch. 8, CB: Ch 6,7	
9 08/29, 09/01 **Extra Class**	Estimation Theory IV Estimation Theory V Hypothesis Testing I	Ch. 8, CB: Ch 6,7 Ch. 8, CB: Ch 6,7 Handout	Quiz#7,HW#4Due, HW#5
10 09/06, 09/08	Hypothesis Testing II Markov Chains I	Handout Ross Ch. 4	Quiz#8, Practical-HW#1Due, Practical-HW#2
11 09/13, 09/15	Markov Chains II	Handout	Quiz#9
12 09/20, 09/22	HMM Sampling of Stochastic Processes I	Ross Ch. 4 Bishop Ch. 11	Quiz#10, HW#5Due, HW#6
13 9/27, 09/29	Sampling of Stochastic Processes II Introduction to Martingales	Bishop Ch. 11 Handout	Quiz#11, Practical-HW#2 Due, Course Project Release
14 10/04 10/06	Application: Mathematical Finance	Handout	Papers List Release HW#6Due

Week	Topic	Readings	HW/Quiz
1401/10/20	Final Exam 9:00-12:00	Comprehensive	
1400/11/05	Paper Presentation		
1400/11/06	Course Project Due		
1400/11/08	Course Project Presentation		

Statement on Collaboration, Academic Honesty, and Plagiarism:

We encourage working together whenever possible on homework, working problems in tutorials, and discussing and interpreting reading assignments. Talking about the course material is a great way to learn. Regarding homework, the following is a fruitful (and acceptable) form of collaboration; discuss with your classmates possible approaches to solving the problems, and then have each one fill in the details and write her/his own solution *independently*. An unacceptable form of dealing with homework is to copy a solution that someone else has written. We discourage, but do not forbid, use of materials from prior terms that students may have access to. Furthermore, at the time that you are actually writing up your solutions, these materials must be set aside; copy-editing from other's work is not acceptable. At the top of each homework you turn in, we expect you to briefly list all sources of information you used, except known course materials like Text Book, Lectures, etc. A brief note such as "Did homework with ABC and ABD in study group" or "Looked at old solution for Problem 4" would be sufficient. Besides the morality issues, it will help TAs on grading your hand outs. There will be a zero tolerance policy for Cheating/Copying HW's. The first time you are caught, you will receive a zero for the task at hand. If you are caught for a second time, you will fail the course. In general, we expect students to adhere to basic, common sense concepts of academic honesty. Presenting other's work as if it was your own, or cheating in exams will not be tolerated.

Enjoy the course & Good luck :)