

**CE695: Stochastic Processes**  
**Department of Computer Engineering**  
**Sharif University of Technology**  
**Fall 2023: Sunday & Tuesday: 10:30-12:00**

**Instructor:**

**Hamid R. Rabiee**

Office: CE-804 & DML (CE 803)

Office Hours: By Appointment (Through Email)

Office Phone: 6616-6683

Email: rabiee@sharif.edu

URL: <http://sharif.edu/~rabiee/>

**TAs:**

**Zahra Dehghanian**

Email: zahraDehghanian97@sharif.edu  
, zahraDehghanian97@gmail.com

**Mohammad Ostadmohammadi**

Email: ostadmohammadi@ce.sharif.edu

**Rassa Ghavami**

Email: rassa.gh@gmail.com

**Mohamad javad Feizabadi**

Email: smjfas@gmail.com

**Gita Sarafriz**

Email: gita.sarafriz@gmail.com

**Armin Behnamnia**

Email: arminbehnamnia@gmail.com

**Mina Rafiee**

Email: rafiei.mina73@gmail.com

**Morteza Abolqasemi**

Email: a.re.morteza@gmail.com

**Taha Teimuri**

Email: teimurijervakanai@gmail.com

**Amirhossein Hadian**

Email: a.h.hadian@gmail.com

**Amirhosein Abedi**

Email: amirhoseinabedi80@gmail.com

**Ali Derakhshesh**

Email: ali.derakhshesh79@gmail.com

**Mohammadali Sadrai**

Email: mohammadalisadraei@gmail.com

**Sepehr Qobadi**

Email: sepehr1377.sg@gmail.com

**Course Website:**

<https://stoch-sut.github.io/>;

Quera: <https://quera.org/course/14901/>, Password: `stoch-sut2023`: Delivery of exercises and announcements will be done entirely through Quera. Make sure you enter an email on Quera that you check regularly. Your questions from the exercises will also be answered in Quera.

**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%
- Quiz: 20%
- Project: 20%
- Mid-Term Exam: 15%
- Final Exam: 25% (Comprehensive)
- Practical Homework: 5% (Extra point)
- Presentation: 5% (Extra Point)

**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**

**Classes:**

The classes will be held in person on Sunday and Tuesday from 10:30 AM to 12:00 AM in CE-204 (The attendance is mandatory). In special circumstances, virtual classes will be held on <https://vc.sharif.edu/rabiee>. The schedule of the classes is shown in the next page.

**TA Classes:**

TA classes will be held in person on Sundays from 12:30 PM to 13:30 PM every week in CE-204, including:

- Problem solving TA classes: sessions to solve additional to deepen the learned concepts. 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!
- Exams Exclusive TA classes: In particular, for the midterm and the final exam, a TA class will be held so that students can prepare adequately for the exams.

Tentative Class Schedule:

Week	Date	Topic	Readings	HW/Quiz	Deadline
1	07/04	Course overview, and Review of Probability Theory	Ch. 1-7		
	07/09	Introduction to Stochastic Processes	Ch. 9	Quiz0	
2	07/16	Stochastic Processes	Ch. 9	HW1	
	07/18	Stationary Stochastic Processes	Ch. 9	Quiz1	
3	07/23	Ergodicity	Ch. 12, Ch. 9		
	07/25	Stochastic Analysis of Linear Systems I	Ch. 9	Quiz2, HW2	HW1
4	07/30	Stochastic Analysis of Linear Systems II	Ch. 9		
	08/02	Power Spectrum	Ch. 9	Quiz3	
5	08/07	Point Process	Handout		
	08/09	Poisson Process	Handout	Quiz4, HW3, Practical1	HW2
6	08/14	Gaussian Process	Handout		
	08/16	Estimation Theory - Motivation and Basic Concepts	Ch. 8, CB: Ch 6,7	Quiz5	
7	08/21	Estimation Theory I	Ch. 8, CB: Ch 6,7		HW3
	08/23	Estimation Theory II	Ch. 8, CB: Ch 6,7		
	<b>08/28</b>	<b>Midterm Exam</b>	<b>up to lecture 08/16</b>		
8	08/30	Estimation Theory III	Ch. 8, CB: Ch 6,7	HW4	
	09/05	Estimation Theory IV	Ch. 8, CB: Ch 6,7	Quiz6	Practical1
9	09/07	Estimation Theory V	Ch. 8, CB: Ch 6,7	Practical2	
	09/12	Hypothesis Testing I	Handout	Quiz7	
10	09/14	Hypothesis Testing II	Handout		HW4
	09/19	Markov Chains I	Ross Ch. 4	Quiz8	
11	09/21	Markov Chains II and Introduction to HMM	Ross Ch. 4	HW5	
	09/28	HMM I	Ross Ch. 4		Practical2
12	10/03	HMM II	Ross Ch. 4	Project	
	10/05	Sampling of Stochastic Processes I	Bishop Ch. 11	Quiz9	HW5
13	10/10	Sampling of Stochastic Processes II	Bishop Ch. 11	HW6	
	10/12	Applications of Stochastic Processes	Handout	Quiz10	(10/19)HW6
	<b>10/21</b>	<b>Final Exam 15:00-17:00</b>	<b>Comprehensive</b>		
	<b>10/28</b>	<b>Paper Presentation</b>			
	<b>11/05</b>	<b>Project Deadline</b>			Project
	<b>11/06</b>	<b>Project Presentation</b>			

### **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 Python. If needed there will be learning materials and classes on how to use Python for problem solving.

Each student is allowed to have a total of 10 days delay and for each homework only 3 days of it can be used, for next 3 days, 15% penalty is applied and no submission is accepted after 6 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)

### **Quiz & Exams:**

Each Tuesday there will be a quiz, at the beginning of the lectures. Each quiz will cover the issues discussed in the previous week. Midterm Exam covers the materials up to lecture 08/16 (end of Gaussian Process). The Final Exam is comprehensive.

### **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.

### **Feedback:**

We would be grateful if you could send us your valuable feedback. You can contact instructor via email. You can also use this google form <https://forms.gle/WsGNkCx2P2H49WBcA> to send your feedback anonymously to instructor.

**Enjoy the course & Good Luck!**