

IE 502 STOCHASTIC PROCESSES (3 0 3) (ECTS: 7.5) Spring 2018 - Tentative Syllabus

Catalog Description. Introduction to probability theory; random variables; expectations; conditional probability; discrete-time Markov chains; exponential distribution and Poisson process; continuous-time Markov chains; renewal theory.

Course Objectives. Main aims of this course are to:

- create awareness of stochastic nature of problems and classification of stochastic problems,
- develop further skills in understanding, formulating and building probabilistic models,
- provide methods and techniques in solving stochastic problems.

Learning Outcomes. On successful completion of the course, all students will develop:

1. knowledge and understanding of probability theory and basics of stochastic process,
2. understanding of classification of stochastic problems.
3. skills in modeling discrete time and continuous time Markov chains,
4. ability in analyzing transient and limiting behavior Markovian systems,
5. ability in analyzing Poisson processes,
6. understanding of birth and death processes and their application to queuing systems,
7. understanding of renewal theory and its applications.

Instructor. Gonca Yıldırım, Office: L-320, Email: goncayildirim@cankaya.edu.tr

Class Meeting Times and Locations. Tuesday (18:00-20:50) in A-202 (Balgat Campus).

Textbook. Ross, S. M. (2010). *Introduction to Probability Models*. 10th Ed. Elsevier.

Supplementary Texts.

- Pinsky, M. A., and Karlin, S. (2011). *An Introduction to Stochastic Modeling*. 4th Ed. Elsevier.
- Ross, S. M. (1996). *Stochastic Processes*. 2nd Ed. Wiley.

Class Website. Announcements, class-related materials such as lecture slides, homework assignments and solutions, etc., will be posted on *Webonline* (<https://webonline.cankaya.edu.tr/>). Please make sure that you check the course page on *Webonline* and your emails frequently.

Honesty Policy. All students admitted to Çankaya University should declare his/her understanding and belief in the Honor Code stated by the department for the examinations and assignments. If you conduct any dishonest act during an examination or for the completion of an assignment (i.e., cheating on an exam, using any extra material that you are not allowed to use during an exam, copying material off of someone else's homework or assignment, using solution keys from previous years, copying material from published and electronic sources without paraphrasing and/or citing appropriately), you will get a credit of zero on that particular exam or assignment. Necessary disciplinary action, as dictated by the rules of the University, will also be taken.

Class Policies.

- You are responsible for all announcements made in class and on class web page, as well as for printing the lecture notes and other materials from the class web page.
- Please remember to turn off cellular telephones, tablets or any device that beeps or disturbs the class before you come to class.

Attendance requirements. Graduate School requires a minimum of 70% class attendance. An attendance sheet will be distributed every hour. It is best if you fully attend every hour.

Course Requirements and Grading. All assignments and exams should be done individually; no collaboration is allowed. Late submissions will not be accepted. All exams will be closed books and closed notes unless otherwise stated.

- **30% Homework.** There will be 5 homework assignments, each is 6%.
- **30% Midterm Exam.** There will be one midterm exam.
- **40% Final Exam.** There will be a *comprehensive* final exam.

Grading Policy. Letter grades will be *mainly* based on the standard scale (i.e., catalog grading system) described in Çankaya University Rules and Regulations Governing Graduate Studies. However, if your collected total weighted average is close to the higher cut-off point and depending on the gaps between the totals collected as well as your attendance and involvement in the class, a higher letter grade *may* be considered. Note that not attending the midterm exam (or its makeup) or the final exam (or its makeup) will lead to the letter grade NA.

Make-up Policy. There will be no makeup for the homework. Exams may be considered for makeup with valid, verifiable, documented excuses. Students need to contact the instructor for requesting a makeup exam as soon as possible.

Course Topics. A tentative outline of topics is given below and the instructor reserves the right to make changes as she sees necessary.

1. Introduction to Probability Theory
2. Random Variables
3. Conditional Probability and Conditional Expectation
4. Markov Chains: Transient Analysis, Chapman-Kolmogorov Equations
5. Markov Chains: Classification of States, Limiting Probabilities
6. Markov Chains: Mean Time Spent in Transient States, Absorption Probabilities and Absorbing Chains
7. Applications of Markov Chains
8. Exponential Distribution and Poisson Process
9. Superposition and Decomposition of Poisson Process
10. Nonhomogeneous Poisson Process, Compound Poisson Process
11. Continuous-Time Markov Chains: Birth-and-Death Processes, Transition Probability Function
12. Continuous-Time Markov Chains: Limiting Probabilities, Queueing Applications
13. Renewal Theory and Its Applications: Limit Theorems
14. Renewal Theory and Its Applications: Renewal Reward Processes, Regenerative Processes

NOTE THAT EVERYTHING ON THIS SYLLABUS IS SUBJECT TO CHANGE. STUDENTS WILL BE NOTED ABOUT SIGNIFICANT CHANGES.