

**SAN JOSE STATE UNIVERSITY**  
**COLLEGE OF ENGINEERING**  
**DEPARTMENT OF ELECTRICAL ENGINEERING**  
**EE 250, Probability, Random Variations and Stochastic**  
**Processes, Section 01 Spring 2018**

<b>Instructor:</b>	Khosrow Ghadiri
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<b>Office Hours:</b>	MW 14:00-15:00 Thursday 12:00-13:00
<b>Class Days/Time:</b>	MW 15:00-16:15
<b>Classroom:</b>	Engr. 341
<b>Prerequisites:</b>	Graduate student standing

### **Course Description**

This course is a graduate-level course on probability theory, random processes and their applications in electrical engineering. Topics covered include review of probability, random variables; transform techniques, random processes, filtering of random signals and Markov chains. The course covers random processes in detail: discusses autocorrelation, power spectral density, and stationary effect of filtering and estimation of random signals. We will also discuss applications of random processes in signal processing, communications and queuing theory.

### **Course Goals and Student Learning Objectives**

- LO1-An ability to analyze fundamentals of probability and set theories.
- LO2-An ability to analyze fundamentals of probability axioms, conditional probability, and independence.
- LO3-An ability to analyze sequential experiments, counting methods, and independent trials.
- LO4-An ability to analyze discrete and continuous random variables, and PMF, PDF, and CDF.
- LO5-An ability to analyze useful discrete and continuous random variables such as Gaussian and Poisson.
- LO6-An ability to analyze functions of a random variable, variance, and standard deviation, conditional probability mass function.
- LO7-An ability to analyze multiple discrete and continuous random variables.
- LO8-An ability to analyze correlation and covariance of multiple random variables.
- LO9-An ability to analyze joint and marginal PMF, PDF, and CDF, functions of multiple random variables.
- LO10-An ability to analyze random (stochastic) processes.
- LO11-An ability to analyze stationary and wide-sense stationary random processes.
- LO12-An ability to analyze auto-correlation and auto-covariance of random processes.
- LO13-An ability to analyze random signal processing.
- LO14-An ability to analyze Markovian processes and Markov chains.

## In-class Assessment Methods

- Homework
- Quizzes
- Project
- Midterm Exam
- Final Exam
- Semester-end course and instructor evaluation

## Required Texts/Readings

### Textbook

*Probability and Random Processes for Electrical Engineering* by A. Leon-Garcia, 3<sup>rd</sup> edition, Prentice Hall, 2008. ISBN: 0306016413

### References

1. *Probability and Random Processes with Applications to Signal Processing* by Stark and Woods, 3<sup>rd</sup> edition, Prentice Hall, 2002
2. *Probability and Random Processes for Engineers* by Helstrom, MacMillan, 1984.
3. *Probability, Random Variables, and Stochastic Processes* by A. Papoulis and S. U. Pillai, 4<sup>th</sup> edition, McGraw Hill, 2002

## Assignments and Grading Policy

### Homework

Homework assignments represent a minimum number of suggested practice problems for the students to solve for the purpose of testing their understanding of the material covered in lecture. Homework assignments will be picked up and graded. They should be treated as an invaluable tool for getting a good grasp of the material covered in this course. Working out additional appropriate problems available to the student for practice purposes is highly recommended. Its relationship to exams is like batting practice before a baseball game.

### Course Grading

Letter grade will be assigned based on the distribution curves for each exam. Using the following schedule of weights, the weighted sum of these numerical scores (rounded to the nearest integer) will be used to determine the course grade:

97% and above	A+
94% - 96%	A
90% - 93%	A-
87% - 89%	B+
83% - 86%	B
80% - 82%	B-
77% - 79%	C+
73% - 76%	C
70% - 72%	C-
67% - 69%	D+
63% - 66%	D
60% - 62%	D-
Below 59%	F

Using the following schedule of weights, the weighted sum of these numerical scores (rounded to the nearest integer) will be used to determine the course grade:

Homework	10%
Quizzes	10%
Project	10%
Midterm Exam	30%
Final exam	40%
Total	100%

**Note that except for extraordinary, documented situations, make-up exams will not be allowed. Thus, at the beginning of the semester make sure that you have no exam conflicts. Students having disabilities, which require special exam conditions are urged to consult the Disabled Students Office immediately and are asked to inform the instructor of any special needs**

## **Classroom Protocol**

Students are expected to participate actively in class. Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class.

## **Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the [current academic calendar](http://www.sjsu.edu/provost/Academic_Calendars/) web page at [http://www.sjsu.edu/provost/Academic\\_Calendars/](http://www.sjsu.edu/provost/Academic_Calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

## **University Policies**

### **Academic integrity**

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University's Academic Integrity policy](http://www.sjsu.edu/senate/S07-2.htm), located at <http://www.sjsu.edu/senate/S07-2.htm>, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Integrity Policy S07-2 requires approval of instructors.

### **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at [http://www.sjsu.edu/president/docs/directives/PD\\_1997-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) requires that students with disabilities requesting accommodations must register with the [Disability Resource Center](http://www.drc.sjsu.edu/) (DRC) at <http://www.drc.sjsu.edu/> to establish a record of their disability.

## **EE Department Honor Code**

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

## **Measures Dealing with Occurrences of Cheating**

Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University. A student’s second offense in any course will result in a Department recommendation of suspension from the University.

## Schedule

WEEK	DATE	TOPICS	READING
1	Wed. 01/24/18	Axioms of Probability	Ch. 2.2
2	Mon. 01/29/18	Review of Event Theory and Probability Model	Ch. 2.1
	Wed. 01/31/18	Conditional Probability, Total probability theorem, Bayes' rule	Ch. 2.4
3	Mon. 02/05/18	Independent Events and Sequence of independent events	Ch. 2.5-2.6
	Wed. 02/07/18	Cumulative Distribution function, Probability Density Function	Ch. 4, 1, 2
4	Mon. 02/12/18	Conditional CDF and PDF	Ch. 4.1-4.2
	Wed. 02/14/18	Expected value of a random variable	Ch. 4.3
5	Mon. 02/19/18	Fundamental theorem of expectation	Ch. 4.3, 5,4
	Wed. 02/21/18	Conditional expected value and variance	Ch. 5.7
6	Mon. 02/26/18	Total expected value	Ch. 4.3
	Wed. 02/28/18	Moments of a random variable	Ch. 3.3
7	Mon. 03/05/18	Markov and Chebyshev inequalities, law of large numbers	Ch. 4.6, 7.2
	Wed. 03/07/18	Characteristic functions	Ch. 4.7
8	Mon. 03/12/18	Moment theorem, probability generating function	Ch. 4.7
	Wed. 03/14/18	Multiple random variables and independence	Ch. 5.1-5.5
9	<b>Mon. 03/19/18</b>	<b>MIDTERM EXAM</b>	
	Wed. 03/21/18	Joint and marginal PDF	Ch. 5.6
10	<b>Mon. 03/26/18</b>	<b>SPRING RECESS</b>	
	<b>Wed. 03/28/18</b>	<b>SPRING RECESS</b>	
11	Mon. 04/02/18	Conditional expectation, functions of two random variables	Ch.5.7,8
	Wed. 04/04/18	Expected values, correlation and covariance	Ch. 5.6
12	Mon. 04/09/18	Bivariate characteristic function	Ch. 5.9
	Wed. 04/11/17	Central limit theorem	Ch. 7.3
13	Mon. 04/16/18	Random vectors and multiple transformations	Ch. 4.7, 6
	Wed. 04/18/18	Expectation vector, covariance and correlation matrices	Ch. 6.3
14	Mon. 04/23/18	Random processes	Ch. 9
	Wed. 04/25/18	Mean, autocorrelation and autocovariance functions	Ch. 9.2
15	Mon. 04/30/18	Stationary random processes, white noise	Ch. 9.4
	Wed. 05/02/18	Power spectral density, response of LTI systems to stationary random input signals	Ch. 10
16	Mon. 05/07/18	Discrete-time Markov Chains	Ch. 11.2
	Wed. 05/09/18	Markov Chains	
17	Mon. 05/14/18	Markov State Machine	
	<b>Thurs. 5/17/18</b>	<b>COMPREHENSIVE FINAL EXAM 12:15-14:30</b>	

