

# Electrical and Computer Engineering 670 – Stochastic Processes

Fall Semester 2009

Section 001 Tu Th, 490 CB, 8:00 AM - 9:15 AM

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## Required Text

*An Introduction to Statistical Signal Processing*

By Robert M. Gray

ISBN: 0521838606

EAN: 9780521838603

Cambridge University Press (2005-01-24)

## Optional Text

*Schaum's Outline of Probability, Random Variables, and Random Processes* (1st edition)

By Hwei Hsu

ISBN: 0070306443

EAN: 9780070306448

McGraw-Hill (1996-10-01)

## Course Description

This course will give you the mathematical tools to model and analyze random phenomena that evolve in time. It is central to the analysis of communications, biological interactions, and even financial markets. Through this course, you will learn the mathematical tools to quantitatively handle a variety of cases in both discrete and continuous time. The principles taught in this course will strengthen your basic understanding of probability theory.

## Prerequisites

ECEn 370, ECEn 380, or equivalent.

## Grading Policies

Homework grades are a matter of completion and effort. If you can clearly document your reasoning, then you will receive credit for your work. This matches the instructor's teaching philosophy that understanding is gained by working through problems individually and then consulting with others on solutions. Homework will be posted on the course website. Homework is due at the beginning of class on the day that it is due. Solutions will be posted after class on the day that homework is due. To accommodate illness and possible absence, the two lowest homework grades will be removed in final computation of the homework grade.

Every two weeks a ten-minute, in-class quiz will be given at the beginning of class. The material for these quizzes will be taken from the text, lecture notes, and homework. These quizzes are meant to review and reinforce important concepts taught in this course. Because two quizzes will be dropped to accommodate illness and absence, no make-up quizzes will be offered.

All exam grades in this course will be assigned after considering the average on the exam and the distribution of scores. As this is a graduate class, I have no difficulty with everyone in the class receiving an A. However, the following rubric will inform decisions about grades.

## Grading Scale

<b>A</b>	93-100	<b>B-</b>	79-81	<b>D+</b>	67-69
<b>A-</b>	89-92	<b>C+</b>	76-78	<b>D</b>	63-66
<b>B+</b>	86-88	<b>C</b>	73-75	<b>D-</b>	60-62
<b>B</b>	82-85	<b>C-</b>	70-72	<b>E</b>	59 and lower

**Point Breakdown**

Assignment	Points
Homework	20
In-class Quizzes	20
Midterm	25
Final	35
Total Points	100

**Class Schedule**

Date	Topics	Reading	Assignments
9/1	Background; Probability Spaces	Chapter 1; 2.1-2.3	-
9/3	Discrete probability space	2.4	-
9/7 Labor Day	No Class	-	-
9/8	Continuous probability spaces	2.5	-
9/10	Independence; Elementary conditional probability	2.6-2.7	HW 1 Due; Quiz 1
9/15	Random variables	3.1-3.3	-
9/17	Random vectors; Independence	3.4-3.6	-
9/22	Conditional distributions; Statistical detection and classification	3.7-3.8	-
9/24	Additive noise; Binary detection in Gaussian noise; Statistical estimation	3.9-3.11	HW 2 Due; Quiz 2
9/29	Characteristic functions; Gaussian random vectors	3.12-3.13	-
10/1	Random processes	3.14-3.16	-
10/6	Averages; Expectation	4.1-4.2	-
10/8	Functions of Random Variables; Properties of Expectation	4.3-4.4	HW 3 Due; Quiz 3
10/13	Properties of Expectation; Examples	4.5-4.6	-
10/15	Conditional expectation; Expectation as estimation	4.7-4.9	-
10/20	Correlation and linear estimation	4.10-4.12	-
10/22	Central limit theorem; Sample averages; Convergence of random variables	4.13-4.15	HW 4 Due; Quiz 4
10/27	Weak law of large numbers; Strong law of large numbers	4.16-4.17	-
10/29	Stationarity; Asymptotically uncorrelated processes	4.18-4.19	Start Midterm - until Monday 11/03
11/3	Linear filtering; Linear systems I/O relations	5.1-5.2	-
11/5	Power spectral density; Linearly filtered uncorrelated processes	5.3-5.4	HW 5 Due; Quiz 5
11/10	Linear modulation; white noise	5.5-5.6	-
11/12	Time averages	5.7	-

11/17	Mean square calculus	5.8-5.8.2	-
11/19	Linear estimation and filtering	5.8.3-5.9	HW 6 Due; Quiz 6
11/24 Friday Instruction	Vacation from 670	No Class	No Class
11/25 Thanksgiving Holiday	No Class	-	-
11/26 Thanksgiving Day	No Class	-	-
11/27 Thanksgiving Holiday	No Class	-	-
11/28 Thanksgiving Holiday	No Class	-	-
12/1	Discrete time linear models	6.1-6.6	-
12/3	Compound and Composite processes	6.7-6.11	-
12/8	Exponential modulation; Thermal noise; Ergodicity; Random fields	6.12-6.15	-
12/10	-	Summary and review.	HW 7 Due; Quiz 7
12/11 Exam Preparation Day	No Class	-	-
12/12 Exam Preparation Day	No Class	-	-
12/14 Finals	-	-	-
12/15 Finals	-	-	-
12/16 Finals	-	-	-
12/17 Finals	-	-	-
12/18 Finals	-	-	-

### BYU Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

### Preventing Sexual Discrimination and Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU's policy against sexual harassment extends not only to employees of the university, but to students as well. If you encounter unlawful sexual harassment or gender-based discrimination, please talk to your professor; contact the Equal Employment Office at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

### Students with Disabilities

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the Services for Students with Disabilities Office (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by the SSD Office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.

**Academic Honesty Policy**

The first injunction of the BYU Honor Code is the call to be honest. Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character.

President David O. McKay taught that 'character is the highest aim of education' (The Aims of a BYU Education, p. 6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

**The professor has a zero tolerance policy for Academic Honesty violations. You will receive a failing grade and be reported to the Honor Code office for Academic Honesty infractions.**