Random Signals & Systems *ECEN303.200/501, Spring 2017*

Course Syllabus

Course number:	15333/15334	
Lecture:	M/W/F 8:00–8:50	**Location:** THOM 122
Recitation:	F 12:40–13:40	**Location:** EDCT 632
Instructor:	Xiaoning Qian	(xqian@ece.tamu.edu)
	Office: WERC 205J	979-845-6268
Teaching assistant:	TBA	
Course webpage:	http://www.ece.tamu.edu/~xqian/courses/ECEN303_501/	

Required notes: Undergraduate Probability I (UPI)
(http://www.ece.tamu.edu/~xqian/courses/ECEN303_501/classnotes_2017.pdf)

Required textbook: There are several books that may help you have a better understanding of fundamental concepts in probability theory. A few such books have been placed on reserve at the library, http://library-reserves.tamu.edu.

1. *A First Course in Probability* (FCP) by S Ross
2. *Introduction to Probability* (IP) by DP Bertsekas and JN Tsitsiklis

Note: Recitations sessions are an important integral part of the course. Your attendance is **required**.

Course Description: This course will introduce the students to the fundamental concepts of probability theory applied to engineering problems. Its goal is to develop the ability to construct and exploit probabilistic models in a manner that combines "common sense" and mathematical precision. The proposed treatment of probability includes elementary set operations, sample spaces and probability laws, conditional probability, independence, and notions of combinatorics. A discussion of discrete and continuous random variables, common distributions, functions, and expectations forms an important part of this course. Transform methods, limit theorems, modes of convergence, and bounding techniques are also covered. In particular, special consideration will be given to the law of large numbers and the central limit theorem. Many examples from engineering, science, and statistics will be provided.

Learning Objectives: The students should obtain the following knowledge and skills after the course:

1. Basic notions of set theory and simple operations such as unions, intersections, differences and De Morgan's laws; Cartesian products and simple combinatorics and their applications with the counting principle, permutations, combinations, and partitions.
2. Basic concepts of sample spaces, probability laws, and random variables; Conceptual difference between events and outcomes, and the ability to compute their probabilities.
3. Concepts of independence and conditional probabilities; The total probability theorem and Bayes' rule with their applications to tangible engineering problems.
4.. Mathematical descriptions of random variables including probability mass functions, cumulative distribution functions and probability density functions; Ability to handle with commonly encountered random variables, in particular the Gaussian random variable.
5. Notions of expectations and moments, including means and variances; Calculation of moments of common random variables; Derivation of the distributions of functions of random variables.
6. Properties of multiple random variables using joint probability mass functions and joint probability density functions; Understanding correlation, covariance, the correlation coefficient, and how these quantities relate to the independence of random variables.
7. Ability to compute the sample mean and standard deviation of a random variable from a series of independent observations; Estimation of the cumulative distribution function from a collection of independent observations; Understanding the law of large numbers and the central limit theorem, and their applications to model random phenomena.
8. Concept of confidence intervals associated with sample means; Ability to calculate confidence

intervals and use this statistical tool to interpret engineering data.
9. Skills in independent and active learning through problem solving and real-world examples.

Tentative Schedule: Here is the tentative course outline with approximately assigned lecture time:

Unit	Topics	Hours	Lecture Number	Reading
1	Introduction and Mathematical Review	1.5	1	Ch. 1
2	Combinatorics and Intuitive Probability	3	2-3	Ch. 2
3	Basic Concepts of Probability	3	4-5	Ch. 3
4	Conditional Probability	4.5	6-8	Ch. 4
5	Discrete Random Variables	3	9-10	Ch. 5
6	Meeting Expectations	4.5	11-13	Ch. 6
7	Continuous Random Variables	4.5	14-16	Ch. 8
8	Functions and Derived Distributions	3	17-18	Ch. 9
9	Expectations and Bounds	4.5	19-21	Ch. 10
10	Multiple Discrete Random Variables	3	22-23	Ch. 7
11	Multiple Continuous Random Variables	3	24-25	Ch. 11
12	Markov Chains	3	26-27	FCP 9.2
13	Real-World Applications	1.5	28	
	Total Hours	42	28	

Grading: Grading is relative. The plus/minus grading system will be applied. The final grade will be based on the following weights:

Six Bi-weekly Assignments + Quizzes	(20%)
Six Bi-weekly Exams (during recitations, taking the best five)	(40%)
Final exam	(40%)

Course requirements include homework assignments (20%), bi-weekly exams (40%) and a final exam (40%). All exams are closed-books and closed-notes. Each bi-weekly exam is based on a problem set, which will be assigned two weeks prior to the exam. The solutions to the problem set will be discussed during the recitation the week before the exam.

During the semester, I and TA will try to be available as much as we can and help you understand all of the materials covered in class. We emphasize again that recitation attendance is required for both bi-weekly exams and homework problem discussion for your better preparation for the exams. The course is demanding but through homework assignments, recitations, and timely exams, you will be able to learn more from this course.

Final grades are determined numerically based solely on individual standing to reflect how well students did on their exams. Unfortunately, they do not always reflect the amount of work and time invested in the class. This is the nature of learning. If your overall grade falls within one of the prescribed ranges, then you are guaranteed to receive at least the letter grade indicated. Ultimately grades are assigned fairly, if not pleasantly. They are therefore very unlikely to change, unless I made a mistake in grading exams or adding numbers.

A	(90–100%)
B	(80–89%)
C	(70–79%)
D	(60–69%)
F	(0–59%)

Exam Dates (subject to change):

Bi-weekly Exam 1:	02/03 during recitation
Bi-weekly Exam 2:	02/17 during recitation
Bi-weekly Exam 3:	03/03 during recitation
Bi-weekly Exam 4:	03/24 during recitation
Bi-weekly Exam 5:	04/07 during recitation
Bi-weekly Exam 6:	04/21 during recitation
Final Exam 1	05/04/2017, 10:00 am – 12:00 noon

Notes: The class shall follow all established policies of TAMU. This includes the Aggie Honor Code and the Americans with Disabilities Act (ADA). The honor code, "An Aggie does not lie, cheat, or steal or tolerate those who do.", is rather straightforward but details can be found at `http://www.tamu.edu/aggiehonor`. The ADA is a federal anti-discrimation statute that provides comprehensive civil rights protection for persons with disabilities and more information is available from `http://disability.tamu.edu`. Links to these and other policies can be found at`http://student-rules.tamu.edu/`.

Full attendance is expected. Missed classes and late arrivals must be discussed with me. It's the responsibility of the student to monitor eLearning site for each class for course specific communication, and the main TAMU, College, and Department websites, emails, and Code Maroon messages for important general information.

Relevant Course from Statistics:

1. *STAT 110: Probability* by Dr. Joe Blitzstein (`http://projects.iq.harvard.edu/stat110/`)

Fun in Probability:

1. *Probability by surprise* (`http://www-stat.stanford.edu/~susan/surprise/`)