Probability and Random Processes - Course Syllabus

Course Number: AMCS 241

Course Title: Probability and Random Processes

Academic Semester:	Spring	**Academic Year:**	2015/ 2016
Semester Start Date:	Jan, 24, 2016	**Semester End Date:**	May, 19, 2016

Class Schedule: Sundays & Wednesdays, 9:00 to 10:30 AM

Classroom Number:

Instructor(s) Name(s): Ahmed Kamal Sultan Salem
Email: ahmed.salem@kaust.edu.sa

Teaching Assistant name:
Email:

Office Location: 3110 Khawarizmi West

COURSE DESCRIPTION FROM PROGRAM GUIDE

Prerequisites: Advanced and multivariate calculus. Introduction to probability and random processes. Topics include probability axioms, sigma algebras, random vectors, expectation, probability distributions and densities, Poisson and Wiener processes, stationary processes, autocorrelation, spectral density, effects of filtering, linear least-squares estimation and convergence of random sequences.

COMPREHENSIVE COURSE DESCRIPTION

The course presents the fundamentals of probability theory and random processes needed by students in communications, signal processing, computer science and other disciplines. Topics include: axiomatic probability theory; discrete and continuous random variables; functions of random variables; generating functions and transform methods; inequalities, bounds and large deviation theory; convergence and limit theorems; random processes; spectral representation; Gaussian processes; Poisson and birth-death processes; Markov chains; random walks, Brownian motion, diffusion and Ito processes.

GOALS AND OBJECTIVES

At the end of this course, students should:

1. Understand concepts of probability, conditional probability and independence.

2. Understand random variables and probability distributions.

3. Be familiar with some of the commonly encountered random variables, in particular the Gaussian random variable.

4. Be able to obtain the distributions of functions of random variables.

5. Be able to relate probability theory to real statistical analysis.

6. Understand moment generating and characteristic functions.

7. Understand and apply the inequalities often encountered in probability and statistics such as Jensen's and Chebyshev's inequality.

8. Understand and apply large deviation theory and Chernoff's bounds.

9. Understand convergence of a sequence of random variables. This include the weak and strong laws of large numbers and the central limit theorem.

10. Understand the classifications of random processes and concepts such as strict stationarity, wide-sense stationarity and ergodicity.

11. Understand the concepts of correlation functions and power spectral density.

12. Understand and apply Poisson, birth-death and renewal processes.

13. Understand Markov chains.

14. Understand Random walks and Brownian motion.

15. Understand and apply the concepts of filtering and prediction of a random process.

REQUIRED KNOWLEDGE

Basic probability (including random variables and distributions), multivariable calculus, and linear algebra

REFERENCE TEXTS

- Required Textbook:

H. Kobayashi, B. L. Mark, and W. Turin, Probability, Random Processes, and Statistical Analysis, Cambridge, 2012.

- Reference Books:

R. Gallager, Stochastic Processes: Theory for Applications, Cambridge, 2014.

A. Papoulis, Probability, Random Variables, and Stochastic Processes, Mc-Graw Hill, 2005.

Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Third Edition, Prentice-Hall, 2008.

METHOD OF EVALUATION

Percentages %	**Graded content** (Assignments, Oral quizzes, Projects, Midterm exam, Final Exam, Attendance and participation, etc)
• **40 %**	**Homework**
• **25 %**	**Midterm exam**
• **35 %**	**Final exam**

COURSE REQUIREMENTS

Assignments

Nature of the assignments (assigned reading, case study, paper presentation, group project, written assignment, etc)
- About 8 to 10 problem sets. -Students have to solve 7--10 problems weekly. -The problem sets contain challenging problems. -Collaboration among students is strictly prohibited.

Course Policies (Absences, Assignments, late work policy, etc.)

Late submissions are not accepted.

Additional Information

-The course requires a high level of mathematical competency.

-Mathematical proofs are an important part of this class.

-Considerable parts of the textbook should be studied by the students on their own.

NOTE
The instructor reserves the right to make changes to this syllabus as necessary.