Introduction to Probability and Statistics - Course Syllabus

Course Number: AMCS 143

Course Title: Introduction to Probability and Statistics

Academic Semester:	Summer	**Academic Year:**	2015/ 2016
Semester Start Date:	June, 5, 2016	**Semester End Date:**	August,4, 2016

Class Schedule: Sunday and Wed from 2 PM to 5 PM

Classroom Number: LH 1 in Building 9

Instructor(s) Name(s):	Mohamed-Slim Alouini
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Office Hours: Mon 1:00 PM-2:00 PM, Tue 1:00 PM-2:00 PM and Thu 1:00 PM-2:00 PM.

COURSE DESCRIPTION AS PER THE PROGRAM GUIDE

This course provides an elementary introduction to probability and statistics with applications. Topics include: basic probability models; combinatorics; random variables; discrete and continuous probability distributions; statistical estimation and testing; confidence intervals; and an introduction to linear regression.

COMPREHENSIVE COURSE DESCRIPTION

Topics include probability axioms, conditional probability, the law of total probability, Bayes' theorem, independence, discrete and continuous random variables, multiple random variables, sum of random variables, the sample mean, and introduction to statistical inference.

GOALS AND OBJECTIVES

At the end of this course, students should:

1. Understand concepts of discrete probability, conditional probability, independence, and be able to apply these concepts to engineering applications (selected by instructor).

2. Understand mathematical descriptions of random variables including probability mass functions (PMFs), cumulative distribution functions (CDFs), probability distribution functions (PDFs), conditional mass, conditional distribution and conditional density functions.

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

4. Be able to calculate various moments of common random variables including at least means, variances and standard deviations.

5. Be able to calculate the distribution of a function of a random variable.

6. Be able to apply the concepts of random variables to engineering applications (selected by instructor).

7. Be able to mathematically characterize multiple random variables using joint PMFs, joint CDFs and joint PDFs.

8. Understand how to formulate the joint PDF of multiple Gaussian random variables.

9. Understand correlation, covariance, correlation coefficient and how these quantities relate to the independence of random variables

10. Be able to apply the concepts of multiple random variables to engineering applications (selected by instructor).

11. Be able to compute the sample mean and sample standard deviation of a series of independent observations of a random variable.

12. Be able to estimate the CDF and PDF of a random variable from a series of independent observations.

13. Understand the law of large numbers and the central limit theorem and how these concepts are used to model various random phenomena (selected by instructor).

14. Be able to compute confidence intervals associated with sample means

15. Be able to use statistical concepts to analyze and interpret engineering data.

PREREQUISITES

Calculus

REFERENCE TEXTS

- *Required Textbook*:

R. D. Yates and D. J. Goodman, Probability and Stochastic Processes, Wiley, 1999.

- *Reference Books*:

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

P. Z. Peebles, Probability, Random Variable and Random Signal Processing, Fourth Edition, McGraw-Hill, 2001.

S. Ross, First Course in Probability, Sixth Edition, Prentice-Hall, 2002.

R. E. Ziemer, Elements of Engineering Probability and Statistics, Prentice Hall, 1997.

M. B. Pursley, Random Processes in Linear Systems, Prentice-Hall, 2002.

H. Stark and J W. Woods, Probability and Random Processes with Applications to Signal Processing, Third Edition, Prentice-Hall, 2002.

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

S. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006.

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

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

METHOD OF EVALUATION

Percentages %	Graded content
• **10 %**	**Weekly Homework**
• **25 %**	**Weekly Quiz**
• **30 %**	**Midterm-Exam**
• **35 %**	**Final Exam**

COURSE REQUIREMENTS

Assignments

Nature of the assignments
• *Homework and Quizes*: There will be problem sets assigned once a week (on Wed). These assignments will be will be due in class on the following Sundays. Solutions of homework will be provided. In addition, there will be each Wed at 2 PM a short quizz based on the problems covered during recitations or assigned in homeworks. Hence, it is very important that you attend all classes and be on time. All quizzes will be closed-book /closed-notes. Along with the homework, on some weeks there will also be given MATLAB problems, which will have to be turned in. Collaboration and checking answers on homeworks is allowed and encouraged. Of course copying homework is not tolerated. In brief you are allowed to collaborate on all homework problems according to the following rules: You must first attempt to solve each problem on your own. If you get stuck you can then talk to any student currently enrolled in the class about the problem, as well as the instructor. However solutions should not be exchanged (i.e., you still must work through the details of the problem after you have gotten help, write the final solutions alone, and understand them fully). • *Exams*: Two exams are scheduled in class during the term. The exams are closed books and closed notes. However, you are allowed to bring one sheet of notes, formulas, or any other information you would like to put on the page (no photocopy is allowed). This note sheet should be limited to one sheet of paper (8.5 x 11 inches: A4 format) for the mid-term exam. However, you can bring 2 such sheets for the final exam.

Course Policies

All homework assignments, quizzes, and exams are required. Students who do not show up for a Quiz or an exam should expect a grade of zero on that exam.

If you dispute your grade on any homework, quiz, or exam, you may request a re-grade (from the TA for the homeworks and quizzes or from the instructor for the exams) only within 48 hours of receiving the graded exam. Incomplete (I) grade for the course will only be given under extraordinary circumstances such as sickness, and these extraordinary circumstances must be verifiable. The assignment of an (I) requires first an approval of the dean and then a written agreement between the instructor and student specifying the time and manner in which the student will complete the course requirements.

Additional Information

Engineers are required to practice “continuous” or “life-long” learning. This course will cover a lot of material which will require the students to do a lot of self-study, reading of the textbooks and handouts, learning how to use equipment and software, etc…Although the instructor and the TAs are committed to help the students in this course, the students are also expected to take initiatives and to get used to this notion of self-study that will be anyway (i) expected form them in their future careers and (ii) imperative to their success and survival in the real engineering and academic worlds.

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