



## Course Syllabus: Introduction to Probability & Statistics - AMCS 143

<b>Division</b>	Computer, Electrical and Mathematical Sciences & Engineering
<b>Course Number</b>	AMCS 143
<b>Course Title</b>	Introduction to Probability & Statistics
<b>Academic Semester</b>	Spring
<b>Academic Year</b>	2016/2017
<b>Semester Start Date</b>	01/22/2017
<b>Semester End Date</b>	05/18/2017
<b>Class Schedule</b> (Days & Time)	02:30 PM - 04:00 PM   Mon Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Maria Alexandra Gomes	Alexandra.Gomes@KAUST.E DU.SA	+966128080652		Available to students anytime I am in my office or email me for an appointment.

Teaching Assistant(s)	
Name	Email

Course Information	
<b>Comprehensive Course Description</b>	Introduction to probability and statistics. 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, linear regression and hypothesis testing.
<b>Course Description from Program Guide</b>	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.

<b>Goals and Objectives</b>	<p>At the end of this course, students should:</p> <ol style="list-style-type: none"> <li>1. understand concepts of discrete probability, conditional probability, independence, and be able to apply these concepts to engineering applications (selected by instructor);</li> <li>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;</li> <li>3. be familiar with some of the more commonly encountered random variables, in particular the Gaussian random variable;</li> <li>4. be able to calculate various moments of common random variables including at least means, variances and standard deviations;</li> <li>5. be able to calculate the distribution of a function of a random variable;</li> <li>6. be able to apply the concepts of random variables to engineering applications (selected by instructor);</li> <li>7. be able to mathematically characterize multiple random variables using joint PMFs, joint CDFs and joint PDFs;</li> <li>8. understand how to formulate the joint PDF of multiple Gaussian random variables;</li> <li>9. understand correlation, covariance, correlation coefficient and how these quantities relate to the independence of random variables;</li> <li>10. be able to apply the concepts of multiple random variables to engineering applications (selected by instructor);</li> <li>11. be able to compute the sample mean and sample standard deviation of a series of independent observations of a random variable;</li> <li>12. be able to estimate the CDF and PDF of a random variable from a series of independent observations;</li> <li>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);</li> <li>14. be able to compute confidence intervals associated with sample means;</li> <li>15. be able to use statistical concepts to analyze and interpret engineering data, with particular emphasis on linear regression and hypothesis testing.</li> </ol>
<b>Required Knowledge</b>	Undergraduate Calculus.
<b>Reference Texts</b>	<p>Required Textbook:  R. D. Yates and D. J. Goodman, Probability and Stochastic Processes, Wiley, 1999.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> <li>1. Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Third Edition, Prentice-Hall, 2008.</li> <li>2. P. Z. Peebles, Probability, Random Variable and Random Signal Processing, Fourth Edition, McGraw-Hill, 2001.</li> <li>3. S. Ross, First Course in Probability, Sixth Edition, Prentice-Hall, 2002.</li> <li>4. R. E. Ziemer, Elements of Engineering Probability and Statistics, Prentice Hall, 1997.</li> <li>5. M. B. Pursley, Random Processes in Linear Systems, Prentice-Hall, 2002.</li> <li>6. H. Stark and J W. Woods, Probability and Random Processes with Applications to Signal Processing, Third Edition, Prentice-Hall, 2002.</li> <li>7. A. Papoulis, Probability, Random Variables, and Stochastic Processes, Mc-Graw Hill, 2005.</li> <li>8. S. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006.</li> <li>9. H. Kobayashi, B. L. Mark, and W. Turin, Probability, Random Processes, and Statistical Analysis, Cambridge, 2012.</li> <li>10. R. Gallager, Stochastic Processes: Theory for Applications, Cambridge, 2014.</li> </ol>
<b>Method of evaluation</b>	<b>40.00%</b> - Final exam <b>20.00%</b> - Quiz(zes) <b>20.00%</b> - Exam 2 <b>20.00%</b> - Exam 1

<b>Nature of the assignments</b>	<p>The final grade is given in a Satisfactory(S)/Unsatisfactory(U) system. There are three components to the final grade: weekly quizzes every Monday, 2 tests and a final exam. The contribution of each component to the course grade is as follows:</p> <p>Weekly Quizzes, 20 % in total  2 Tests, 20 % each  Final Exam, 40 %</p> <p>Grades will be posted on the course Blackboard page. If you dispute your grade on any quiz or exam, you may request a re-grade (from the TA for the quizzes or from the instructor for the exams) only within 48 hours of receiving the graded evaluation.</p> <p>The weekly quizzes have a duration of 20 minutes and will be held at the beginning of the Monday lectures. The two 80-minute tests will be held during lecture time on the 5th and 10th week of classes. The final exam is scheduled during the 15th week of classes.</p> <p>All quizzes, tests and the final exam are closed book and closed notes.</p> <p>You are allowed to bring notes, formulas, or any other information you would like for the two tests and final exam. The note sheet should be limited to one sheet of paper (8.5 x 11 inches: A4 format) for the 1st test, 2 such sheets for the second test, and 3 such sheets for the final exam.</p> <p>Problem sets, together with their solutions, will be given as ungraded homework. The quizzes will be based on these sets.</p>
<b>Course Policies</b>	The students are required to attend all lectures and to take notes. Students that do not show up for a quiz, a test or for the exam should expect a zero in that assessment.
<b>Additional Information</b>	

### Tentative Course Schedule

*(Time, topic/emphasis & resources)*

<b>Week/Lecture</b>	<b>Topic</b>
1	Set Theory and Probabilistic Models.
2	Conditional Probability, Independence, Law of Total Probability, Baye's Theorem.
3	Counting Methods, Binomial, Multinomial.
4	Single Discrete RV: PMF, CDF, MGF, Mean, Variance, Moments, Chebyshev inequality.
5	Continuous RV: PDF, CDF, MGF, Expectations, Characteristic Function, and Markov, Chernoff and Chebyshev inequalities.
6	Useful Discrete and Continuous Random Variables.
7	Pairs of Discrete and Continuous Random Variables.
8	Multivariate Distributions. Jointly Gaussian Random Variables.
9	Sum of Random Variables.
10	Parameter Estimation Using the Sample Mean. Confidence Intervals Estimation.
11	Hypothesis Testing.
12	Estimation of a Random Variable - Part I.
13	Estimation of a Random Variable - Part II.
14	Review.
15	Final Exam.
16	
17	
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**Note**

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