جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

# Course Syllabus: Probability and Random Processes - AMCS 241

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| **Division** | Computer, Electrical and Mathematical Sciences & Engineering |
| **Course Number** | AMCS 241 |
| **Course Title** | Probability and Random Processes |
| **Academic Semester** | Spring |
| **Academic Year** | 2016/2017 |
| **Semester Start Date** | 01/22/2017 |
| **Semester End Date** | 05/18/2017 |
| **Class Schedule** (Days & Time) | 09:00 AM - 10:30 AM \| Sun Tue |

## Instructor(s)

| Name | Email | Phone | Office Location | Office Hours |
|---|---|---|---|---|
| Ganesh Sundaramoorthi | Ganesh.Sundaramoorthi@kaust.edu.sa | +966128080425 | | My office is Building 1, room # 2104. My office hour will be on Tuesday 10:30am-11:30am |

## Teaching Assistant(s)

| Name | Email |
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## Course Information

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| **Comprehensive Course Description** | This course presents the fundamentals of probability theory and random processes. Contents of this course are relevant but not limited to: communications and information systems, computer engineering, signal processing, machine learning, bioinformatics, econometrics and mathematical finance. |
| **Course Description from Program Guide** | 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. |
| **Goals and Objectives** | Students will learn the fundamentals of probability theory and stochastic processes. |
| **Required Knowledge** | Multivariable calculus and linear algebra are required, and heavily used in this class. An undergraduate probability course similar in level to the contents of the book found at the following website: http://athenasc.com/probbook.html.<br>WARNING: This course requires a high level of mathematical competency. The prerequisites are mandatory, and you must know those topics with a high degree of fluency. If you have taken those courses years ago, and forgot them, then this course is not for you! There is a 100 level course that covers prerequisite topics if you are not prepared.<br>This course is not about routine computation nor recipes for accomplishing a task, rather it is about the hows and whys. As such, mathematical proofs are an important part of this class. Problems in the homework will require you to write mathematical proofs. |
| **Reference Texts** | [2] Robert G Gallager. Stochastic processes: theory for applications. Cambridge University Press, 2013.<br>[3] H. Kobayashi, B.L. Mark, and W. Turin. Probability, Random Processes, and Statistical Analysis. Cambridge University Press, 2012. |
| **Method of evaluation** | **5.00**% - Active participation<br>**35.00**% - Midterm exam<br>**20.00**% - Homework /Assignments<br>**45.00**% - Final exam |

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| **Nature of the assignments** | Weekly homeworks |
| **Course Policies** | Homework Grading: A typical homework will contain ten problems. Solutions to all problems will be provided after the deadline. Grading will be done by the TAs, and any questions about grading should be addressed to them.<br>Homework Guidelines:<br>-You may consult other class members on the problems, but you must write up solutions on your own.<br>-Homework solutions should be written in such a way that you are explaining your solution in writing to the instructor.<br>-Homeworks should be neat, stapled, in the correct order according to problem number, and please use a new sheet of paper for each problem. Include a cover page with your name, id, and homework number.<br>-Homeworks will be assigned Sunday and collected the following Sunday and no late homework will be accepted.<br>-The lowest two homeworks will not count in the average for your homework score. Therefore, if you have a conference deadline, are sick, or any other issue, don't ask for an extension on homework; the homework can simply be dropped. |
| **Additional Information** | |

| Tentative Course Schedule<br>*(Time, topic/emphasis & resources)* | | |
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| **Week** | **Lectures** | **Topic** |
| 1 | Sun 01/22/2017<br>Tue 01/24/2017 | Syllabus / Intro., Review: Axioms of probability |
| 2 | Sun 01/29/2017<br>Tue 01/31/2017 | Review: Random variables (discrete & continuous) |
| 3 | Sun 02/05/2017<br>Tue 02/07/2017 | Review: Functions of random variables, Distributions derived from the normal |
| 4 | Sun 02/12/2017<br>Tue 02/14/2017 | Moment generating function & characteristic function |
| 5 | Sun 02/19/2017<br>Tue 02/21/2017 | Generating functions, starting next topic |
| 6 | Sun 02/26/2017<br>Tue 02/28/2017 | Inequalities, bounds, large deviation approximation |
| 7 | Sun 03/05/2017<br>Tue 03/07/2017 | Convergence of random variables and limit theorems |
| 8 | Sun 03/12/2017<br>Tue 03/14/2017 | Review, midterm |
| 9 | Sun 03/19/2017<br>Tue 03/21/2017 | Random processes (definitions & overview) |
| 10 | Sun 03/26/2017<br>Tue 03/28/2017 | Gaussian Processes |
| 11 | Sun 04/02/2017<br>Tue 04/04/2017 | Spring break |
| 12 | Sun 04/09/2017<br>Tue 04/11/2017 | Gaussian Processes |
| 13 | Sun 04/16/2017<br>Tue 04/18/2017 | Poisson Processes |
| 14 | Sun 04/23/2017<br>Tue 04/25/2017 | Poisson / Renewal Processes |
| 15 | Sun 04/30/2017<br>Tue 05/02/2017 | Renewal processes |
| 16 | Sun 05/07/2017<br>Tue 05/09/2017 | Special topic, buffer and/or review |
| 17 | Sun 05/14/2017<br>Tue 05/16/2017 | Final |
| 18 | | |

**Note**

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