



Course Syllabus: Stochastic Processes - AMCS 241

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| Division | Computer, Electrical and Mathematical Sciences & Engineering |
| Course Number | AMCS 241 |
| Course Title | Stochastic Processes |
| Academic Semester | Fall |
| Academic Year | 2018/2019 |
| Semester Start Date | 08/26/2018 |
| Semester End Date | 12/11/2018 |
| Class Schedule (Days & Time) | 09:00 AM - 10:30 AM Sun Wed |

Instructor(s)

| Name | Email | Phone | Office Location | Office Hours |
|----------------------|---------------------------|---------------|-----------------|----------------------------|
| Mohamed-Slim Alouini | slim.alouini@kaust.edu.sa | +966128080283 | | Sunday and Wed at 10:30 AM |

Teaching Assistant(s)

| Name | Email |
|-----------------------------------|---|
| Housseem Sifaou Chaouki Benlssaid | housseem.sifaou@kaust.edu.sa chaouki.benlssaid@kaust.edu.sa |

Course Information

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| Comprehensive Course Description | Introduction to probability and random processes. Topics include probability axioms, random vectors, expectation, probability distributions and densities, Poisson and Wiener processes, stationary processes, autocorrelation, and spectral density. |
| 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. |

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| Goals and Objectives | <p>1- Review of Probability</p> <ul style="list-style-type: none"> -Introduction -Discrete Random Variables -Continuous Random Variables -Pairs of Random Variables -Multivariate Distributions -Multivariate Gaussian Random Variables <p>2- Introduction to Random Processes</p> <ul style="list-style-type: none"> -Definitions -Stationarity -Ergodicity -Correlation Functions -Gaussian Random Processes -KL Expansion -Some Continuous Time Random Processes (Bernoulli, Binomial, Poisson, Wiener, White, and Markov) <p>3- Spectral Characteristics of Random Processes</p> <ul style="list-style-type: none"> -Power Spectral Density -Cross Power Spectral Density <p>4- Analysis and Processing of Continuous Time Random Processes</p> <ul style="list-style-type: none"> -Review of Linear Systems -Response of Linear Systems to Random Signals -Bandlimited Random Processes -Continuity, Differentiation, and Integration of Continuous Time Random Processes |
| Required Knowledge | <p>Adequate background in basic probability (including random variables, distributions and functions of random variables), linear algebra, multivariate calculus, Fourier transform and Laplace transform</p> |
| Reference Texts | <p>Z. Peebles, Probability, Random Variable and Random Signal Processing, Fourth Edition, McGraw-Hill, 2001. Ross, First Course in Probability, Sixth Edition, Prentice-Hall, 2002. D. Yates and D. J. Goodman, Probability and Stochastic Processes, Wiley, 1999. E. Ziemer, Elements of Engineering Probability and Statistics, Prentice Hall, 1997. B. Pursley, Random Processes in Linear Systems, Prentice-Hall, 2002. Stark and J W. Woods, Probability and Random Processes with Applications to Signal Processing, Third Edition, Prentice-Hall, 2002. Papoulis, Probability, Random Variables, and Stochastic Processes, Mc-Graw Hill, 2005. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006. Kobayashi, B. L. Mark, and W. Turin, Probability, Random Processes, and Statistical Analysis, Cambridge, 2012 Gallager, Stochastic Processes: Theory for Applications, Cambridge, 2014.</p> |
| Method of evaluation | <p>30.00% - Final exam 20.00% - Quiz(zes) 25.00% - Exam 2 25.00% - Exam 1</p> |
| Nature of the assignments | <p>Weekly quizzes + two exams + final exam are scheduled in class. 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 1st exam. You can bring 2 such sheets for the second exam, and 3 such sheets for the third and final exam.</p> <p>The weekly quizzes have a duration of 20 minutes and will be held at the beginning of the Sunday lectures. Problem sets, together with their solutions, will be given as ungraded homework. The quizzes will be based on these sets and examples covered during the lectures..</p> |
| Course Policies | <p>Students who do not show up for a quiz or or for an exam should expect a zero in that assessment.</p> |
| Additional Information | <p>N/A</p> |

Tentative Course Schedule

(Time, topic/emphasis & resources)

| Week | Lectures | Topic |
|-------------|----------------------------------|---|
| 1 | Sun 08/26/2018 Wed 08/29/2018 | Basic Concepts |
| 2 | Sun 09/02/2018 Wed 09/05/2018 | Combanatorics and Counting Methods |
| 3 | Sun 09/09/2018 Wed 09/12/2018 | Discrete Random Variables |
| 4 | Sun 09/16/2018 Wed 09/19/2018 | Continuous Random Variables |
| 5 | Sun 09/23/2018 Wed 09/26/2018 | Joint and Multiple Random Variables |
| 6 | Sun 09/30/2018 Wed 10/03/2018 | Exam 1 + Inequalities/Bounds |
| 7 | Sun 10/07/2018 Wed 10/10/2018 | Sum of Random Variables and Central Limit Theorem |
| 8 | Sun 10/14/2018 Wed 10/17/2018 | Convergence |
| 9 | Sun 10/21/2018 Wed 10/24/2018 | Introduction to Random Processes |
| 10 | Sun 10/28/2018 Wed 10/31/2018 | Important Random Processes |
| 11 | Sun 11/04/2018 Wed 11/07/2018 | Exam 2 + Wiener Random Processes |
| 12 | Sun 11/11/2018 Wed 11/14/2018 | Poisson Random Processes |
| 13 | Sun 11/18/2018 Wed 11/21/2018 | Processing of Random Signals 1 |
| 14 | Sun 11/25/2018 Wed 11/28/2018 | Processing of Random Signals 2 |
| 15 | Sun 12/02/2018 Wed 12/05/2018 | Processing of Random Signals 3 |
| 16 | Sun 12/09/2018 | Special Topic |
| 17 | | - |
| 18 | | - |

Note

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