



## Course Syllabus: Wireless Communications - EE 244

<b>Division</b>	Computer, Electrical and Mathematical Sciences & Engineering
<b>Course Number</b>	EE 244
<b>Course Title</b>	Wireless Communications
<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)	04:00 PM - 07:00 PM   Mon

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Mohamed-Slim Alouini	slim.alouini@kaust.edu.sa	+966128080283		Days: Sundays Time: 11:00 AM – 11:55 AM and by appointment Location: Bldg #1 - Office #3-123

Teaching Assistant(s)	
Name	Email
Houssein Sifaou and Itsikiantsoa Randrianantenai	houssein.sifaou@kaust.edu.sa and itsikiantsoa.randrianantenaina@kaust.edu.sa

Course Information	
<b>Comprehensive Course Description</b>	This course introduces fundamental technologies for wireless communications. It addresses the following topics: review of modulation techniques, wireless channel modeling, multiple access schemes, cellular communications, diversity techniques, equalization, channel coding, selected advanced topics such as OFDM, cognitive radio, cooperative communications, space time coding, and smart antenna systems.
<b>Course Description from Program Guide</b>	This course introduces fundamental technologies for wireless communications. It addresses the following topics: review of modulation techniques, wireless channel modeling, multiple access schemes, cellular communications, diversity techniques, equalization, channel coding, selected advanced topics such as CDMA, OFDM, Multiuser detection, space time coding, smart antenna, software radio.
<b>Goals and Objectives</b>	The objective of the course is to investigate various advanced techniques for wireless communications, including statistical fading channel models, digital communication over fading channel, diversity for fading mitigation, adaptive modulations, MIMO systems and space-time coding, and multicarrier modulation/OFDM.
<b>Required Knowledge</b>	Pre-requisites/co-requisites: Probability and random processes (AMCS241) and digital communications (EE242) or approval of instructor.

<b>Reference Texts</b>	<p><b>Required Text:</b>  <b>Title:</b> Wireless Communications  <b>Author:</b> A. Goldsmith  <b>Publisher:</b> Cambridge  <b>Year:</b> 2005  <b>URL:</b> <a href="http://ebooks.cambridge.org/ebook.jsf?bid=CBO9780511841224">http://ebooks.cambridge.org/ebook.jsf?bid=CBO9780511841224</a></p> <p><b>References:</b>  <b>1- Rappaport, Wireless Communications, 2nd Ed, Prentice Hall, 2001</b>  <b>2- Principles of Mobile Communications by G. L. Stuber. 2nd Ed. Kluwer Academic Pub, 2001</b>  <b>3- Yates and D. Goodman, Probability and Stochastic processes, Wiley, 1999</b>  <b>4- Simon and M.-S. Alouini, Digital Communication over Fading Channels, Wiley, 2000.</b>  <b>5- Proakis, Digital Communications, 4th Ed, McGraw-Hill, 2000.</b></p>
<b>Method of evaluation</b>	<p><b>50.00%</b> - Research Project  <b>30.00%</b> - Midterm exam  <b>20.00%</b> - Homework /Assignments</p>
<b>Nature of the assignments</b>	<p><b>1- Homework/Assignments:</b>  Homework sets will be assigned on Mondays and will be due in class on the following Mondays. Some homework assignments may require use of a mathematical software of your choice (such as Matlab, Mathematica, Maple or Mathcad) for calculations and/or plots. Late homeworks will not be accepted (except in university established cases of illness or emergency). Homeworks will be graded and solutions will be provided.</p> <p>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).</p> <p><b>2- Exam:</b>  There will be one midterm exam on Monday March 27, 2017. The midterm counts 30 % toward the final grade. The midterm exam will be closed-book and closed-note, but you can bring one single-sided formula sheet for the midterm exam.</p> <p><b>3- Project:</b>  The term project is a research project related to any topic in the wireless area. Some suggested topics are listed below, but you are by no means limited to these topics. The project can be a literature survey, analysis, simulation, or experiment. A two pages proposal is due in class on Monday Feb 27, 2017 at 4 PM. The project has to be presented in class on Monday May 1, 2017 or Monday May 8, 2017. The project final report is due in class on Monday May 8, 2017.</p> <p><b>Few Potential Project Topics:</b></p> <ul style="list-style-type: none"> <li>- Massive MIMO Systems</li> <li>- mm-wave communications</li> <li>- Ultra-violet communications</li> <li>- THz communications</li> <li>- Free space optical communications with orbital angular momentum multiplexing</li> <li>- Device-to-Device communications</li> <li>- Full-duplex wireless communications</li> <li>- UAV/Drone communications</li> <li>- Wireless communication for high altitude platforms</li> <li>- Wireless communications in data centers</li> <li>- Optical camera communications</li> <li>- Wireless communication for the tactile internet</li> <li>- Underwater communication systems and networks</li> </ul>
<b>Course Policies</b>	<p><b>Grading:</b>  Grades will be posted on the course website. All assignments/exam/projects are required. Students who do not show up for an exam should expect a grade of zero on that exam.</p> <p>If you dispute your grade on any homework, or exam, you may request a re-grade (from the TA for the homework or from the instructor for the exams) only <u>within 48 hours</u> 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.</p> <p><b>Philosophy of Learning:</b>  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 from them in their future careers and (ii) imperative to their success and survival in the real engineering and academic worlds.</p>
<b>Additional Information</b>	

## Tentative Course Schedule

*(Time, topic/emphasis & resources)*

<b>Week</b>	<b>Lectures</b>	<b>Topic</b>
1	Mon 01/23/2017	Monday Jan 23, 2017 – Lecture 1 - Introduction to Wireless Communication Systems & Networks
2	Mon 01/30/2017	Monday Jan 30, 2017 – Lecture 2 - Propagation Modeling I
3	Mon 02/06/2017	Monday Feb 6, 2017 – Lecture 3 - Propagation Modeling II
4	Mon 02/13/2017	Monday Feb 13, 2017 – Lecture 4 - Propagation Modeling III
5	Mon 02/20/2017	Monday Feb 20, 2017 – Lecture 5 - Propagation Modeling IV
6	Mon 02/27/2017	Monday Feb 27, 2017 – Lecture 6 - Capacity of Wireless Channels
7	Mon 03/06/2017	Monday March 6, 2017 – Lecture 7 - Digital Communication over Fading Channels
8	Mon 03/13/2017	Monday March 13, 2017 – Lecture 8 - Diversity Techniques
9	Mon 03/20/2017	Monday March 20, 2017 – Lecture 9 - MIMO Systems
10	Mon 03/27/2017	Monday March 27, 2017 – Midterm Exam
11	Mon 04/03/2017	Monday April 3, 2017 – Spring Break
12	Mon 04/10/2017	Monday April 10, 2017 – Lecture 10 - Adaptive Modulation and Multicarrier Communication Systems
13	Mon 04/17/2017	Monday April 17, 2017 – Optical Wireless Communication
14	Mon 04/24/2017	Monday April 24, 2017 - Cognitive Radio Systems
15	Mon 05/01/2017	Presentation of Projects I
16	Mon 05/08/2017	Presentation of Projects II
17	Mon 05/15/2017	
18		

### **Note**

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