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

Course Syllabus: Antenna Theory and Design - EE 222

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 222
Course Title	Antenna Theory and Design
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Atif Shamim	atif.shamim@kaust.edu.sa	+966128084507 8084507		Tuesdays 14:00-16:00 Hrs

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	The course objective is to understand the theory and fundamentals of antenna design. The course helps the students to learn key aspects of practical antenna design. A broad range of antennas such as dipole, loop, microstrip patch, horn, etc are studied during the course. After studying the single antenna element design, the course focuses on antenna array theory and design. Special topics such as on-chip antennas and printed antennas will also be introduced. Students will learn industry standard software Ansys HFSS to complete their design projects. Below are the tentative topics (based on the pace of the class), which will be covered during this course. 1. Antenna Fundamentals (gain, radiation pattern, input impedance, Friis Transmission) 2. Antenna CAD Tool (Ansoft HFSS) 3. Elementary Antennas (dipole, loop) 4. Microstrip Antennas (patch, PIFA) 5. Horn Antennas 6. Antenna Arrays 7. Introduction to Antenna Measurements 8. Special Topics (On-chip and Printed Antennas)
Course Description from Program Guide	Fundamental antenna system parameters: gain, directivity, efficiency, input impedance, radiation pattern. Theory of transmitting and receiving antennas: reciprocity, equivalence, and induction theorems. Elementary antennas: dipole, monopole, loop, traveling-wave antennas. Antenna arrays: linear and phased arrays, mutual impedance. Antenna design: log- periodic, reflector, and (corrugated) horn antennas and microstrip, integrated, and on-chip antennas. Computer aided design: student projects using antenna simulation tools.
Goals and Objectives	By the end of this course students will have good understanding of antenna fundamentals and the know how of designing various kind of antennas such as dipole, loop, micrsotrip patch antennas and arrays. Students will also learn industry standard simulation software Ansys HFSS which they will use for their design projects. Students will design an antenna from scratch, will simulate it in HFSS and at the end write a report on this project.

Required Knowledge	Basic knowledge of electromagnetics and microwaves
Reference Texts	**Texts:** A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition Course Slides/Additional Handouts **Additional Reference Book:** Wentworth, Fundamentals of Electromagnetics with Engineering Applications
Method of evaluation	**35.00**% - Exam 2 **15.00**% - Homework /Assignments **20.00**% - Exam 1 **30.00**% - Course Project(s)
Nature of the assignments	Numeric problems based 3 assignments will be given
Course Policies	For late submissions, students will have negative marking
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 01/23/2017 Thu 01/26/2017	**Introduction to Antenna Fundamentals** Intro, History, Types of Antennas, Applications, Future Trends
2	Mon 01/30/2017 Thu 02/02/2017	Radiation Mechanisms, Single and Two wire Antennas, dipole, Current distribution
3	Mon 02/06/2017 Thu 02/09/2017	Radiation Pattern, lobes, isotropic, omni, directional, Principal Patterns, Field Regions
4	Mon 02/13/2017 Thu 02/16/2017	Radiation Power Density, Intensity, Beam width, directivity, Examples Efficiency, Gain, Bandwidth, Polarization, PLF, Examples
5	Mon 02/20/2017 Thu 02/23/2017	Input impedance, rad efficiency, Effective Area, Friis Eqn, Antenna Temp, Examples
6	Mon 02/27/2017 Thu 03/02/2017	**Microwave CAD Tools** Ansoft HFSS
7	Mon 03/06/2017 Thu 03/09/2017	**Microstrip Antennas (patch, PIFA)** Basics, Feeding methods, Rectangular Patch, transmission Line Model, Design procedure
8	Mon 03/13/2017 Thu 03/16/2017	**Microstrip Antennas (patch, PIFA)** Quality Factor, Input impedance, Circular Polarization,
9	Mon 03/20/2017 Thu 03/23/2017	**Elementary Antennas (dipole, loop)** Scaler and Vector Operators, Maxwell's Equations, Radiation Auxiliary Vector Potential
10	Mon 03/27/2017 Thu 03/30/2017	Infinitesimal Dipole, Small dipole, Finite Length Dipoles,
11	Mon 04/03/2017 Thu 04/06/2017	Half wavelength Dipole, Image Theory, Antennas for Mobile Communication Small Circular Loop, Large Circular Loop, Design Procedure
12	Mon 04/10/2017 Thu 04/13/2017	Matching Techniques (Examples)
13	Mon 04/17/2017 Thu 04/20/2017	**Antenna Arrays** Theory, Two element Array
14	Mon 04/24/2017 Thu 04/27/2017	Linear Array of N uniformly spaced elements, Graphical Techniques
15	Mon 05/01/2017 Thu 05/04/2017	Grating Lobes, Broad side linear arrays, End Fire Linear Arrays
16	Mon 05/08/2017 Thu 05/11/2017	Planar Arrays, Feed Networks, Microstrip Arrays and Feed Network
17	Mon 05/15/2017 Thu 05/18/2017	**Reflector and lens Antennas (parabolic, Fresnel)**
18		Horn Antennas

Note

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