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	2018/2019
Semester Start Date	01/27/2019
Semester End Date	05/23/2019
Class Schedule (Days & Time)	09:00 AM - 10:30 AM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Hakan Bagci	hakan.bagci@kaust.edu.sa	+966128084330		Tuesdays 15:30-17:30

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	The objective of this course is to teach students the theory of electromagnetic radiation and the design principles and fundamentals of antenna systems. The course helps the students to learn mathematical and physical aspects of electromagnetic radiation as well as key antenna parameters including gain, directivity, efficiency, input impedance, and radiation pattern. After discussing the radiation from single-antenna systems in detail, the course focuses on antenna arrays starting with fundamental concepts including array factor and pattern multiplication. The course continues with more advanced as well as practical topics including the study of patch, aperture, and horn antennas. Below is a list of tentative topics that will be covered during this course. - Review of Phasors, Time Harmonic Fields, Maxwell Equations, Wave (Helmholtz) Equation, Boundary Conditions - Radiation Integrals and Auxiliary Potential Functions - Fundamental Parameters and Linear Wire and Loop Antennas - Arrays: Linear, Planar, and Circular - Antenna Synthesis and Continuous Sources - Aperture, Reflector, and Horn Antennas - Advanced Topics: Frequency Independence, Microstrip, Smart, and Fractal Antennas, Antenna Miniaturization, Moment Method
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 a good understanding of electromagnetic radiation and antenna fundamentals. They will develop practical skills that are useful in designing transmitting and receiving antenna systems.
Required Knowledge	Undergraduate-level course on Electromagnetic Theory Undergraduate-level course on Antenna Theory and Design

Reference Texts	Required text book: Antenna Theory: Analysis and Design, C. A. Balanis, Third Edition, 2005 Referene books: - Antenna Theory and Design, R. S. Elliott, Revised Edition, 2003 - Antennas and Radiowave Propagation, R. E. Collin, 1985
Method of evaluation	**40.00**% - Final exam **25.00**% - Midterm exam **10.00**% - Homework /Assignments **25.00**% - Course Project(s)
Nature of the assignments	Homework: Consists of 4-5 problem sets on theory of electromagnetic radiation and fundamentals of antennas. Project: Two different options 1) Compherensive literature review on advanced antenna topics. 2) Develop a numerical tool to compute the input impedance of linear antennas. Both optios will require a written report and an oral presentation.
Course Policies	Attendance is not mandatory however students arriving late will not be admitted to the lecture. Late homeworks are only accepted with a valid excuse (such as a medical report).
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/28/2019 Wed 01/30/2019	Phasors, time harmonic fields, and Maxwell equations
2	Mon 02/04/2019 Wed 02/06/2019	Wave (Helmholtz) equation, boundary conditions
3	Mon 02/11/2019 Wed 02/13/2019	Radiation integrals and auxiliary potential functions
4	Mon 02/18/2019 Wed 02/20/2019	Radiation integrals and auxiliary potential functions
5	Mon 02/25/2019 Wed 02/27/2019	Fundamental antenna parameters
6	Mon 03/04/2019 Wed 03/06/2019	Linear wire and loop antennas
7	Mon 03/11/2019 Wed 03/13/2019	Antenna arrays: Linear element distributions
8	Mon 03/18/2019 Wed 03/20/2019	Antenna arrays: Linear element distributions
9	Mon 03/25/2019 Wed 03/27/2019	Spring break
10	Mon 04/01/2019 Wed 04/03/2019	Antenna arrays: Planar element distribution
11	Mon 04/08/2019 Wed 04/10/2019	Midterm
12	Mon 04/15/2019 Wed 04/17/2019	Aperture antennas
13	Mon 04/22/2019 Wed 04/24/2019	Aperture antennas
14	Mon 04/29/2019 Wed 05/01/2019	Horn antennas
15	Mon 05/06/2019 Wed 05/08/2019	Electromagnetic theorems: Duality and Babinet principle
16	Mon 05/13/2019 Wed 05/15/2019	Overview of advanced topics: Frequency independence, fractal antennas, antenna miniaturization
17	Mon 05/20/2019 Wed 05/22/2019	Project presentations

Note

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