

School of Electrical, Computer and Energy Engineering

Ira A. Fulton Schools of Engineering

Arizona State University

EEE 443/591 Antennas for Wireless Communications 3 hours rec.

Prerequisites: **EEE 341 or equivalent**

Text: **Antenna Theory: Analysis and Design** (4th Edition, 2016) by Constantine A. Balanis

Reference **Microwave Antenna Theory and Design** by S. Silver

Books: **Antennas** by J. D. Kraus and R. J. Marhefka

Antenna Theory and Design by W. L. Stutzman and G. A. Thiele

Antenna Theory and Design by R. S. Elliott

Syllabus:

The course introduces the fundamental principles of antenna theory and applies them to particular antennas for *wireless* communications systems and other *advanced antenna systems*. In addition, the course develops appreciation for research issues of antennas for mobile wireless and advanced communications systems.

Particular topics covered are: Introduction and examples of wireless communications; overview of wireless communications systems; antenna types; fundamental parameters of antennas; engineering principles; radiation integrals; linear wire antennas; loops; arrays; smart/intelligent/adaptive antennas; numerical computations; measurements.

OUTLINE

TOPIC	Approximate number of 75-minute periods
I. Antennas	1
a. Types of antennas	
b. Radiation mechanism	
c. Current distribution	
d. Historical advancement	
II. Fundamental Parameters of Antennas	6
a. Antenna	
b. Radiation mechanism	
c. Radiation pattern	
d. Radiation intensity	
e. Directivity	
f. Gain	
g. Efficiency, beamwidth, and bandwidth	
h. Polarization	
i. Impedance	
j. Antenna as an aperture	
Test 1	1

III.	Radiation Integrals	1
	a. Vector potential A	
	b. Vector potential F	
	c. Far-field radiation	
	d. Duality, reciprocity, and reaction theorem	
IV.	Wire Antennas	6
	a. Short wire	
	b. Finite length dipole	
	c. Ground effects	
V.	Loop Antennas	3
	a. Small circular loop	
	b. Large circular loop	
	c. Ground effects	
	d. Polygonal loops	
	Test 2	1
VI.	Arrays	6
	a. Linear array	
	1. Broadside	
	2. Endfire	
	3. Scanning	
	4. Binomial	
	5. Dolph-Tchebyscheff	
	b. Planar array	
	c. Circular array	
	d. Designs	
	1. Dolph-Tschebyscheff	
	2. Yagi-Uda	
	3. Log-Periodic	
	d. Smart/Intelligent/Adaptive Antennas	
VII.	Synthesis Methods-Overview	1
VIII.	Microstrip Antennas	2
IX.	Smart Antennas/Adaptive Arrays	1
X.	Measurements	1
	a. Antenna ranges	
	b. Radiation patterns	
	c. Gain measurements	
	d. Directivity	
	e. Polarization measurements	
	f. Scale model measurements	
	Final Exam	

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September 21, 2017