

ECE 592-070

Antennas and Arrays

Instructor(s): Dr. Jacob J. Adams

Objective or Description: This course studies theoretical and practical principles of antenna and array design. From deep space observatories to 4G and 5G wireless networks to millimeter wave radar, antennas are an essential part of any electromagnetic communication or sensing system. In this course, students will learn antenna fundamentals and the electromagnetic theory needed to analyze radiation problems. Several common types of antennas as well as array theory and beamforming methods will be studied. The course introduces students to common CAD tools used for electromagnetic simulation, and they will design a variety of antennas and arrays through several CAD-based projects.



Prerequisites: ECE 422 or equivalent (graduate level electromagnetics or microwave circuits would be helpful but not required). This course assumes familiarity with the fundamentals of Maxwell's equations, electromagnetic waves, and transmission line theory.

Textbook: *Antenna Theory: Analysis and Design* by C.A. Balanis (Wiley), 4th Ed.

Selected Topics:

1. Antenna Properties – radiation pattern characteristics, field regions, circuit characteristics.
2. Linear and Planar Antennas – dipole and loop antennas, duality, ground effects, image theory, microstrip and slot antennas
3. Aperture Antennas – aperture theory and equivalence principle, horn antennas, reflector antennas, lens arrays and reflect arrays, antenna synthesis
4. Array Theory – linear and planar array factor, phased arrays and beamsteering, amplitude tapering, mutual coupling and scanning behavior
5. Electromagnetic CAD Tools
6. Antenna Measurements

Grading:

Homework	20%
CAD projects	20%
Midterm	20%
Final Project	20%
Final Exam	20%

