

ECE6310 Advanced Electromagnetic Fields
Spring 2012
Monday, Wednesday, and Friday 11:50-12:40 PM
1248 Warnock Engineering Building
Credits 3
Pre-requisites: ECE3300

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Office hour: TBD

Textbooks

Required: Advanced Engineering Electromagnetics (2nd Edition) - Constantine A. Balanis

If you already own the first edition that will probably be fine. I can provide material from the second edition that is absent from the first as needed.

Learning Objectives

Review of Maxwell's macroscopic equations in integral and differential forms including boundary conditions, power and energy computations, and time-harmonic formulations. Macroscopic-electrical properties of matter. Oblique incidence planewave propagation and polarization in multi-layered media. Separation of variable solutions of the wave equation in rectangular, cylindrical and spherical coordinates. Vector potential theory and the construction of solutions using Green's theorem. Electromagnetic theorems of duality, uniqueness, reciprocity, reaction, and source equivalence. Waveguide, cavity, antenna, and scattering applications in rectangular, cylindrical, and spherical geometries.

Students will use an electromagnetic simulation software package, [Microwave Studio](#), to solve some problems not tractable by analytical methods. Significant guidance will be provided for the students not familiar with this package.

Computer Lab

Microwave Studio is installed in the Windows computer lab, 2555 Merrill Engineering Building. You can obtain access to this room by filling out the form available in the ECE teaching labs.

Topics

Time-Varying and Time-Harmonic Electromagnetic Fields	Chapter 1	3 lectures
Electrical Properties of Matter	Chapter 2	4 lectures
Wave Equation and its Solutions	Chapter 3	3 lectures
Wave Propagation and Polarization	Chapter 4	4 lectures
Reflection and Transmission	Chapter 5	5 lectures
Auxiliary Vector Potentials, etc.	Chapter 6	4 lectures
Electromagnetic Theorems and Principles	Chapter 7	4 lectures
Rectangular Cross-Section Waveguides and Cavities	Chapter 8	6 lectures
Circular Cross-Section Waveguides and Cavities	Chapter 9	4 lectures
Scattering	Chapter 11	5 lectures

Exams

There will be two take-home exams. The second is not a final, and will not cover material from the first half of the course. Each exam will count toward your grade equally. You will have at least a few days to complete them. You may consult any printed or online resources for the exams, but you may not work with or consult other people.

Problem Sets

There will be about six or seven problem sets. You may work together on these but every student is responsible for being able to explain their submitted work. Please consider the importance of aesthetics and clarity when submitting your work. Typeset solutions will be greatly appreciated. Also, work the problems analytically to a reasonable conclusion and then plug in the numbers, preferably with Mathematica, Matlab or a similar tool. I really do not want to see numeric algebra in your solutions. Problem sets will typically include some computational problems to be simulated with Microwave Studio. For these problems I will specify what results should be submitted. These will usually be in graphical form. You should thoroughly and legibly label your plots and the data should be clearly presented.

Grades

Grades will be based on the exams (50%) and problem sets (50%). I do not anticipate any substandard grades being given out, unless you egregiously neglect the assignments.

Academic Integrity

Students may work together on assignments, but every student must be able to explain their submitted work. Students may not work together on exams. Students are expected to exhibit integrity in their conduct and are subject to the [University of Utah Code of Student Rights and Responsibilities](#).

Students with Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. See the [Center for Disability Services](#) for information on obtaining accommodations and other policies.