ECE 333 - Fields and Waves I

Department of Electrical and Computer Engineering
University of Massachusetts Amherst

Syllabus

Fall 2019

Instructor

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Teaching Assistant

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Time and Location

Lecture: 11:30AM-12:45PM Tuesdays and Thursdays, Engineering Lab. 303
Instructor office hours: 3:10PM-4:00PM Tuesdays and Thursdays, Knowles 113D
TA office hours: 5:30PM-6:30PM Mondays and Wednesdays, TBD

Prerequisite:

Math 233, ECE 202, and a grade of C or better in ECE 244.

Course Objectives

In this course, students should acquire the following skills. They should:

1. Understand basic principles of waves and transmission lines/distributed circuits.
2. Understand the basic principles of electromagnetism including, electromagnetic wave propagation, absorption, transmission, and reflection.
3. Understand the interaction of electromagnetic fields with materials.
4. Be able to apply these principles to analyze and design simple electrical engineering components/devices, interconnects or systems.

Resources

Textbook:
F. T. Ulaby and U. Ravaioli, *Fundamentals of Applied Electromagnetics*, 7th ed., Prentice Hall, 2014.
Note: 8th edition of the book has recently become available in eText and loose-leaf formats and is also acceptable. 5th and 6th editions of the book and paperback versions have similar contents as the 7th edition.
Other resources:
D. K. Cheng, *Field and Wave Electromagnetics*, 2nd ed., Addison-Wesley, 1992.
S. Ramo, J. R. Whinnery, and T. Van Duzer. *Fields and Waves in Communication Electronics*, 3rd ed., John Wiley & Sons, 1994.

Grading

Homework: 20%	Approximately 10 sets, plus extra credit computational exercises
Midterms I: 25%	October 7 (Monday) 7:00PM-9:00PM in ILC S131
Midterm II: 25%	November 7 (Thursday) 7:00PM-9:00PM (location: TBD)
Final Exam: 30%	December 13 (Friday) 1:00PM-3:00PM in Elab 303

Homework Policies

Weekly problem sets (approximately 10 sets) will be assigned. Assignments will be posted on the Moodle course website (https://moodle.umass.edu/) and are due at the beginning of the class on the due date. Late homework assignments will **not** be accepted. Assignment solutions will be posted on Moodle after their due dates.

Exam Policies

The class will have two in midterm and the final exams. The exams are closed-book and closed-notes, but students are allowed to bring one double-sided page of handwritten notes. Use of SHARP EL-531TG calculators is also allowed.

Course Topics

1. Waves and phasors (Chapter 1)
    - Electric and magnetic fields, units
    - Traveling waves, complex numbers
    - Lossless and lossy media
2. Transmission lines (Chapter 2)
    - Transmission line models and geometries, TL equations
    - Wavelength and propagation constant, loaded transmission lines
    - Reflection coefficient, standing waves, power flow
    - Transients on transmission lines
3. Review of vector analysis (Chapter 3)
    - Coordinate systems
    - Vector algebra and vector calculus (gradient, divergence, curl)
4. Time-varying fields and Maxwell's equations (Chapter 6)
    - Magnetic induction, Faraday's law, displacement current
    - Maxwell's equations, boundary conditions, continuity equation
    - 3D wave equation, time-harmonic fields, Helmholtz equation
    - Poynting theorem and electromagnetic energy
5. Electromagnetic waves (Chapters 7 and 8)
    - Plane waves in lossless and lossy media, polarization, Poynting vector
    - Plane wave reflection at conductor and dielectric boundaries
    - Introduction to guided waves

Note on Inclusivity

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued or respected for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing, speak with Assistant Dean Paula Rees (rees@umass.edu, 413.545.6324, Marston 128), or submit your concern through the College or Engineering Climate Concerns and Suggestions on-line form (tinyurl.com/UMassEngineerClimate). We are all members of an academic community with a shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.