ECE 341 Electromagnetic Waves

Instructor Edward Wheeler, Moench C-203A, **Office Hours** 3rd and 7th MR

Text *Applied Electromagnetics* by Stuart Wentworth (Wiley)

Coverage

1. Electromagnetic waves: wave properties, power, energy, reflection and transmission
2. Transmission lines: propagation properties, transmission and reflection
3. Transmission line matching and selected microwave devices
4. Introduction to antennas

Grading

exams	35%	A	90– 100%	C	70 – 75
homework & quizzes	20%	B+	85 – 90	D+	65 – 70
modeling	10%	B	80 – 85	D	60 – 65
final exam	35%	C+	75 – 80	F	below 60

Homework

Homework will typically be due on Tuesdays and Fridays at the beginning of class. **Please, no late homework**. Late homework may be penalized 25% for each day past its due date.

HW assignments will typically include some answers.

You may discuss homework with others. You may work together. To score well on quizzes and exams, you should turn in your own work and thoroughly understand the solutions.

Homework format

1. A problem statement which could be the homework problem statement as handed out. If I were doing the problems, I would usually cut and paste from the HW handouts.

2. Include a brief, but complete, discussion of your solution strategy and method with each problem. Perhaps one sentence for a simple problem, maybe two or three sentences for a more involved one. Explain so that the grader can see you know what you truly understand the concepts and are not simply working the problem with no real understanding. For longer problems, include short explanations throughout the problems as needed. Descriptions should be clear and complete and stated so that they may be easily understood.

3. Simply put, your work should be that of a professional in training. Homework should be done in a clear and neat manner so that the grader can readily follow. This includes the description in #2 and will often involve diagrams. Box all answers and give proper units. Use vector notation properly. *Sloppy or incomplete work will be downgraded, beginning with a minimum of 20% and will increase at instructor's discretion.*

Application and simulation problems

There will likely be a few applications assignments during the term with at least one being a term paper. The others will be simulation problems using CST microwave studio, a professional grade electromagnetic simulation package. Go ahead and load the software (on the public folder on tibia, look for course software, follow instructions in the read me file).

Exams and quizzes

- **Exam 1** – October 7th **Exam 2** – November 6th
- Exams are closed book and notes. A calculator and a single-sided 8½" x 11" formula sheet are permitted.
- There will be Concept Quizzes on many Thursday's. These will be closed book and notes.
- Selected old quizzes and exams may be placed on the course web page

  http://www.rose-hulman.edu/~wheeler/
- Exams and quizzes missed due to an unauthorized absence may not be made up.

Course Learning Objectives

After successfully completing this course you should be able to:

1. Be able to analytically describe and characterize a traveling plane wave with or without loss (amplitude, polarization, power density, frequency, wavelength, speed of propagation).
2. Be able to determine the relation between incident, reflected, and transmitted waves.
3. Be familiar with the vector operations of gradient, divergence, and curl. Be able to calculate, analytically and numerically, quantities involving them and know their physical significance.
4. Understand the physical meaning of the electromagnetic field quantities and know their physical significance.
5. Understand the electromagnetic foundations of quasi-statics and the foundations and limitations of the lumped circuit approximation.
6. Be able to work with transmission lines, either with transient waves or in the sinusoidal steady-state.
7. Be able to use the Smith chart to determine transmission line characteristics and to design tuners.
8. Be able to use and define antenna characteristics.
9. Be able to analyze and simulate radiation from a variety of radiating structures.