

## **ECE 3300 – Introduction to Electromagnetics**

**Course Taught: MWF 9:40-10:30 WEB 2230**

**This year, we will experiment with not having class on Fridays.**

**Professor:** Dr. Cynthia Furse, 585-7234, [cfurse@ece.utah.edu](mailto:cfurse@ece.utah.edu)

Scheduled Office Hours: MW 10:45-12:00 MEB3102.

Open Door Policy: When my door is open, you are welcome to come in.

**Texts:** F.T. Ulaby, Fundamentals of Applied Electromagnetics, Prentice Hall 2009

**Reference Material:** Students will need access to MATLAB.

### **ECE 3300 Website:**

<http://www.ece.utah.edu/~ece3300/>

Lecture notes, portfolio assignments, labs, announcements, schedule, etc.

Wiley also has a website with many student 'helps'. Check it out.

### **Prerequisites:**

PHYCS 2220 and MATH 2250 and ECE 1270

**Course Material:** Introduction to electromagnetics. Fundamentals of wave propagation, transmission lines, impedance matching, electrostatics, magnetostatics, Maxwell's equations, plane waves in free space, lossy media, and reflections from planar interfaces, wireless communication systems. Electromagnetic safety. Applications include wireless communication systems, high speed digital circuits, electromagnetic sensors, and bioelectromagnetics.

### **Course Outcomes:**

At the conclusion of ECE 3300 students should be able to:

1. Calculate voltages, currents, and impedances on TEM transmission lines. This will include time domain (TDR) analysis, frequency domain analysis (standing waves and Smith charts), and power analysis.
2. Calculate electric and magnetic fields from a plane wave impinging on a metallic or dielectric material from either normal or oblique incidence.
3. Design matching systems for transmission lines and plane waves.
4. Calculate the electric and magnetic fields from simple charge and current distributions.
5. Compute the link budget for a simple wireless communication system and explain how the environment affects the received power.
6. Identify potentially hazardous electromagnetic environments.

**Home work Problems:** Homework will be assigned daily. To learn the material most efficiently, do this homework before the next day of class. Due dates (see below) are once a week, on Monday, but it is not advisable to wait until Sunday night to work on your homework. Do it each day before the next class, and bring questions to class if needed.

**Portfolio Questions:** Each day you will be asked to answer a portfolio question associated with the lecture. The question might be "How do you design a matching network?", which you should answer in your own words. The instructions (typically about a page) should be written so YOU can understand them and should include all necessary equations, constants, etc. Exams will be open portfolio, closed book, so include everything you need to solve the problems. You may include tables and figures copied from the text, but please don't copy the text itself. Portfolios will be checked for completeness only. You are responsible for checking your own homework solutions. Solution manuals will be available in the library on reserve and in the ECE office, and some answers are in the back of your book.

**Homework and Portfolio Questions are due at 5 pm on Monday. Homework assigned Monday is due the following Monday. If we do not have class on Monday, it is due Wednesday instead.** Turn HW in to the ECE homework lockers (at the top of the stairs near the ECE office, MEB 3280). Please STAPLE them together, with the Portfolio Question page on the top. Include your name and Random Student ID #.

**Picking up Homework:** Your homework, exams and labs will be returned in your student mailbox across the hall from the ECE office. Please sign a sheet allowing us to place your materials there. If you prefer NOT to have your materials left in your mailbox, please pick them up during Dr. Furse's office hours. All homework, exams, labs should be returned within 1 week of when they were turned in (not counting holidays/breaks). If they are not, please complain to Dr. Furse.

**Random Student ID #:** You will be assigned a random number, which will be prominently written in RED on the first homework you turn in. Please write this number on everything you turn in. Your grades will be posted on the website according to this number.

**Laboratory:** This lab is part of a new curriculum development project in the ECE department. In collaboration with the ECE3500 lab, we will integrate the components of the lab into an FSK communication system for a cardiac pacemaker. It is strongly advised that you take ECE3300 and 3500 concurrently. It is not required. You should choose lab partners that you can work with through the entire semester. Do all work in your (bound) lab notebook, in ink. The lab write up will be done separately, one writeup for each student individually. You will be receiving more information (standard format, etc.) on the first week of the lab.

**Lab Schedule:** See website **Labs Begin August 29.**

**Exams:** Three midterms are scheduled as shown on the lecture schedule. Please check your schedule to be sure that you do not have conflicts with these exams. The final exam will be comprehensive, however it is optional (see grading):

**Grading (you will automatically receive the grade for whichever is higher) :**

Midterm I or Final Part 1	25%
Midterm II or Final Part 2	25%
Midterm III or Final Part 3	25%
Labs	15%
Portfolios & Homework	10%

(To do well in this class: Keep up in class, study hard, do well on your midterms, and you do not have to take the final exam. But, if you bomb a midterm, or all of them for that matter, all is not lost. You can completely erase mistakes made during the semester and make up your grade on the final.)

**The Lab Grade will be based on:**

**101% Attendance (mandatory)**

Do not miss a lab. If you are traveling, contact Dr. Furse in advance to determine how to make up a lab. If you have an emergency or serious illness, contact Dr. Furse immediately upon your return to determine how to make up a lab. We have a very limited supply of EM lab equipment (it is extremely expensive), so there is no extra lab space.

**50% Lab Notebook**

**50% Lab Reports**

**Extra Credit for missing homework assignments**

Extra Credit can be used if you forget to turn in your homework, if you just don't do it, if you don't want to attend the required class after Thanksgiving, etc. These can be used to give you a maximum of 100% on your portfolios/HW/Lab scores. Extra credit assignments can be turned in to the HW box through the last day of class. You can find extra credit throughout the semester on the class website.

**Work Load:**

It is anticipated that a typical student will need to spend

- 3 hours in class per week
- 3 hours in lab for 8 weeks
- 6-9 hours on homework each week
- 2-3 hours on lab writeup each week for 8 weeks
- 2-3 hours on the final report
- Additional time studying for exams.
- 17+ hours per week**

***PLEASE plan your schedule so that you have time to learn the material.*** I am delighted to have the opportunity to teach you about electromagnetics, a subject that is truly exciting and magical. I am very confident that you will find many times in your career when you will be able to apply this material, and I hope that you will not only learn from the class but enjoy it as well. ☺

**Disability Accommodations:** The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

### **Cheating Policy: Just don't**

**Here are some things that constitute cheating in this class:**

- 1) ***Copying someone else's work on an exam.*** If you accidentally see another student's work on an exam, WRITE a NOTE in your exam *and* tell me during the exam. Honesty is of great value. You will not be penalized for this. Do not pass any papers to anyone for any reason during the exam. Do not sit near your study partners during the exam. If you use any scratch paper for doing exam problems, please just staple it at the back of your exam. Loose scratch paper could look like notes passed between students.
- 2) ***Copying someone else's work on portfolio homework.*** I hope you WILL work in groups on your homework, labs, software assignments, etc. And I hope that every team member will contribute to this work. If you do not contribute (had to work late and couldn't make the group meeting), then don't copy their work.
- 3) ***Copying things (ANYthing) from a book, web, magazine, etc.*** Give a complete reference and clearly "quote" anything that you want to reference that someone else has done. Even if you don't use their words, but you mention or discuss their ideas, give them a reference. If you are asked to write a report or essay, it must all be in your own work. Just rearranging the words is called paraphrasing. (Paraphrasing is just rearranging the words.) Paraphrasing is also NOT your work.

### **What happens if you cheat?**

Under [UofU policy](#), you could receive an F in the class, be suspended from school, be fined, or be expelled from the university. So just don't cheat.

### **What happens if someone else cheats?**

Statistically, this could lower YOUR grade. Please tell me or the TA or any other professor or TA (anonymously is fine) if you see instances of cheating in this or any other class. The ECE Department is committed to reducing instances of cheating in our labs and classes in order to provide the best possible education for all students.

### **Errata:**

If you find a mistake in the online lecture notes, textbook, solution manual, lab handouts, etc., turn in a copy of the mistake plus your corrections. Clearly label where the mistake occurs, so I can fix it. You will receive an extra 5 homework points (each day is 10 points, so this is good for half a day's extra credit).

**NOW HERE IS THE FUN PART: ECE 3300 is NOT your average lecture class.**

**The average lecture:** Your professor prepares the material, writes up some notes, explains it on the board, asks if you have any questions, answers a few, and then leaves. You sit more or less passively, take notes, it seems to make sense at the time. Someone asks a question or two, or maybe none. You usually think you 'got it'. Then you sit down to do your homework, and .... Probably you start to have questions. At this point, you are on your own and you have to struggle to figure out how the too-sparse lecture notes relate to the problems you are trying to do. The book may help, or maybe not. Your mind is actively engaged NOW, but your professor / TA is not there to help you. Eventually you work it out, though, and understand the material.

**Now try this instead:** Your professor pre-records a video lecture, in a few short (5 minute) segments, which you watch on YouTube before the class. You take notes, and hopefully it seems clear at the time. If you have a few questions, WRITE THEM DOWN and bring them to class with you. (I'll record a few 'frequently asked questions' during the semester). When you get to class, we remind you of the steps you learned about in the video, answer questions, and (mostly!) help you get started on your homework. In groups of 2-3, you work through the first confusing questions of how the lecture applies to the problems.

**What if I don't have YouTube.** Dang. Let me know. I can put a CD of lectures and course material in the ECE office, and you can borrow it and download it to your PC. Anything new I record during the semester, you may have to watch at the U. The ECE computer lab now allows access to YouTube.

**Have I tried this before?** Yes! This is the 3<sup>rd</sup> year. It works great.

**What does it take to make it work?** You HAVE to watch the lectures the night before. Really. Absolutely. Positively. In exchange, I'll help you do your homework. If you haven't watched the videos, you will be wasting everyone's time in class. So, to preserve time for the students who made this small effort, I will ask you to leave. So ... watch the lectures, and come to class with your book, pencil and paper.

Please tell me about yourself: (turn this in at the end of class)

Name\_\_\_\_\_

Are you a Senior or Junior?

What area of electrical engineering have you found most interesting?

What do you hope to learn in this class? (What part of electromagnetics sounds interesting?)

What have you heard about this class?

How do you like to learn things?

Lectures  
Interactive software  
Web research  
Library research  
Reading the text, other books, or magazine articles  
Hands-on / In the Lab  
Demos  
Studying with friends  
Other \_\_\_\_\_

Circle things you need review on:

Integration (single, double, triple integrals)  
Differentiation  
Complex numbers  
Fourier Transform (DFT)

Thank you!