



ECE 3300: Fundamentals of Electromagnetics and Transmission Lines

- Fall 2020 Overview: In this course students will learn:
- About transmission lines (what happens when the wires in a circuit are long relative to a wavelength)
 - How to use transmission lines to properly connect equipment (e.g. a signal generator to an antenna).
 - How Smith Charts can help save you time and help you avoid tedious calculations.
 - How antennas radiate, including directionality, radiation patterns, etc.
 - How electromagnetic waves radiated from antennas propagate and interact with various materials according to Maxwell's equations.
- Textbook: F. T. Ulaby *et al.*, *Fundamentals of Applied Electromagnetics*, 8th edition, Prentice Hall, 2020. (older editions are also OK, but page numbers will correspond to the 8th edition)
- Access to the 2020 version of the book is provided through course fees. You can access the book by clicking on "Bookshelf" in the menu on the left side of the Canvas page for this course.
- Required Software: Access to MATLAB
- Lectures: Online
- Instructor: Jamesina Simpson, Associate Professor, ECE
Office: MEB 2278 (Note: Prof. Simpson will not be physically on campus in Fall 2020)
Office Hours: see Canvas for time, *and by appointment!!!!*
Phone: 801-585-6929; Email: jamesina.simpson@utah.edu
- Prerequisites: PHYCS 2220 and MATH 2250 and ECE 2240 and ECE 2280

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

1. Develop initial (simplified) designs for solving specific problems of interest.
2. Calculate voltages, currents, and impedances on transmission lines. This will include time domain (TDR) analysis, frequency domain analysis (standing waves and Smith

charts), and power analysis.

3. Design matching systems for transmission lines.
4. Calculate electric and magnetic fields for a plane wave incident on, reflected from, and transmitted through conductive or dielectric materials.
5. Understand and apply Maxwell's equations.
6. Describe how an antenna works.
7. Compute the link budget for a simple wireless communication system and explain how the environment affects the received power.

Bachelor Degree Requirement: This course meets the Quantitative Intensive (QI) requirement.

Homework: Several homework sets will be assigned throughout the semester. Due dates will be posted on Canvas.

- Submit a good-quality PDF copy of your homework through Canvas so that it can be easily read by the grader.
- Late homeworks will be accepted, but the maximum score will be 50%, since the solutions will be posted after the due date.
- The homeworks may be challenging. They are an excellent opportunity to challenge yourself before it really matters (during the exam). Note that the homework score does not play a large role in the calculation of your final grade. Also, note that the midterm exams are based on the homework! Detailed homework solutions will be posted so you can check your methodology and understanding before the exam.
- Each question in the homeworks will be graded according to the following guidelines (same as your exams):
 - *All work is shown*, method correct, and no errors: 100%
 - *All work is shown*, method correct, but it contains minor arithmetic errors: -5% per error
 - *All work is shown*, but the solution contains a minor theoretical error: -10%
 - *All work is shown*, but the solution contains two minor theoretical errors or a medium error: -15%
 - Some work is not shown (the corresponding methodology cannot be checked) or the solution contains a more serious theory error: -25%
 - Much of the work is not shown (the corresponding methodology cannot be checked) or the solution contains a major theory error: -50%
 - Almost no work is shown (the corresponding methodology cannot be checked) or the solution contains more than

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one theoretical error of any kind: -70%

- No work is shown and / or I have no idea what you're trying to do: -100%
- A homework score of 0 (for the entire homework grade, not just one assignment) will be given to any students copying homeworks (anyone sharing their solutions as well as the person copying).

Midterm Exams: There will be three take-home midterm exams this semester.

- Each question (and / or each part of multi-part questions) on the exam will be graded using the following scoring scheme:
 - *All work is shown*, method correct, and no errors: 100%
 - *All work is shown*, method correct, but it contains minor arithmetic errors: -5% per error
 - *All work is shown*, but the solution contains a minor theoretical error: -10%
 - *All work is shown*, but the solution contains two minor theoretical errors or a medium error: -15%
 - Some work is not shown (the corresponding methodology cannot be checked) or the solution contains a more serious theory error: -25%
 - Much of the work is not shown (the corresponding methodology cannot be checked) or the solution contains a major theory error: -50%
 - Almost no work is shown (the corresponding methodology cannot be checked) or the solution contains more than one theoretical error of any kind: -70%
 - No work is shown and / or I have no idea what you're trying to do: -100%
- Late exams will be accepted, but the maximum score will be 50%.
- All midterm exams must average to a passing grade in order to pass this course.
- If you find an error / issue with your exam grade, you must submit a formal request in writing to Prof. Simpson for re-grading within two weeks of the exams being returned. The formal request must include an explanation of why you feel a re-grading is needed. After two weeks, requests for regrading will not be considered.
- Students are required to use their own brains to complete the take-home exams. If a student does anything that would constitute cheating, they will receive a 0 on the exam, and Prof. Simpson may need to report them. If you are aware of anyone else cheating in this class, please report them to Prof. Simpson so that the course is fair to all students, and so we can make sure all students are learning to exercise their own brains and prepare for their future careers.

How to Succeed in this Course:

- Although the homework is only 10% of the final grade, make sure you complete all of it and understand all of the questions and solutions. The exams are based on the homework questions, practice problems, and exam review questions.

- Keep up with the course and submit all assignments on time!
- Complete all of the in-class projects. The in-class projects will introduce you to related applications and will help prepare you for the final project.
- View all the lectures and complete all of the modules.
- Complete extra practice problems as needed.
- Ask questions! Attend Prof. Simpson and the TA's office hours. Make an appointment or email, etc. if you are unable to make the formal office hours and you need to set up a separate appointment, or if you need an answer sooner.

Grading: I do not curve the grades for this class (up or down). If you earn a 93 or above, you will receive an A. If you earn an 87 – 92.9, you will receive an A- or B+ (depending on your participation in the course, whether your scores improved throughout the course, etc.). If you earn an 83 – 86.9, you will receive a B, etc. Your total score is determined via the following:

- Exam I: 20%
- Exam II: 20%
- Exam III: 20%
- Final Project: 10%
- In-Class Project Notebooks: 10%
- Online Quizzes: 10%
- Homework: 10%
- Errata (extra credit)

Regarding late assignments:

- Late assignments (including homeworks, quizzes, practice problems, in-class project notebooks, and exams) will be given a maximum score of 50%.

NOTE: You must complete all of the exams, the final project, and the in-class project notebooks in order to pass this course.

Errata: If you find a mistake in Prof. Simpson's notes, lecture slides, examples, 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 for each instance.

Work Load: Per University of Utah regulations, "a University credit hour shall represent approximately three clock hours of student's time a week for one semester." Since this is a 3-credit course, this translates to at least 9 hours of work per week for a total of 135 hours worth of work. It is anticipated that a typical student will need to spend on average:

- 3-5 hours on the modules each week (posted videos, reading assignments, and practice problems)
- 4-6 hours on homework and/or practice problems each week

- Additional time studying for exams
= **9+ hours per week (Please plan accordingly!)**

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: The purpose of this course is for all students to exercise their brains and prepare for future careers, so I take cheating very seriously. Here are some things that constitute cheating:

- ***Copying someone else's homework.*** I hope you WILL work in groups on your homework, etc. However, every team member must contribute, understand, and complete each assignment / homework themselves.
- ***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, reference their work. If you are asked to write a report or essay, it must all be in your own words. Note that just rearranging the words or equations is called paraphrasing, and paraphrasing is also NOT your work.

What happens if you cheat? Under UofU policy (<http://www.saff.utah.edu/code.html>), you could receive an F in the class, be suspended from school, be fined, or be expelled from the university. ***So please don't cheat.***

What happens if someone else cheats? Statistically, this could lower YOUR grade. Please tell the instructor 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.

Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union

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Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, SSB 328, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

College of Engineering Guidelines: Additional guidelines that govern all courses in the University of Utah College of Engineering are found here:

<https://www.coe.utah.edu/semester-guidelines>

Your comments and feedback are appreciated! Please stop by, email me, drop a note in my mailbox in the ECE office, or talk to me in person about what I can do to help you in this course.