

Syllabus for ECE 3025: Introduction to Electromagnetics

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Instruction Team Information

Professor Information:

Name:	Professor Benjamin B. Yang
Lecture Hours:	Monday / Wednesday, 4:35 PM – 5:55 PM
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Teaching Assistant / Grader Information:

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Course Information:

Description

Welcome to ECE 3025: Electromagnetics. My goal is for you to walk out of this course with a basic understanding of concepts relating to electromagnetics that you take with you in your career, regardless of whether your future work is in the field of electromagnetics. If you have not chosen a concentration yet, then I hope the learning activities in this class inspire you to pursue future coursework and a career in the area of fields and waves.

Even if you have already chosen a specialty¹ that is not electromagnetics, we are in a world where research and engineering is becoming increasingly interdisciplinary. I wish to help your future success by enabling you to effectively communicate with team members that work in this area. Furthermore, this class is a unique opportunity to learn specific mathematical tools that are often used in other disciplines, such as heat transfer, quantum mechanics, and plasmas.

This course is also listed as a [Sustainable Communities](#)² course. We will fulfill the requirements of this course through a project that focuses on reflecting on technology implications and communicating them to the public. The project will hone your speaking skills and also have the side benefit of helping you explore follow-on electromagnetic electives at Georgia Tech.

This semester is my first attempt at implementing this course and will contain some experimentation. I appreciate your feedback throughout the semester on what is or is not enhancing your learning experience. Thank you in advance for your commitment to doing well in this course. I will in turn commit to doing what my best for this course to help make you a more effective, driven engineer.

¹ That said, I later learned as a young engineer that a specialty at the B.S. level doesn't mean much. Employers assume they need to teach you everything anyway. This reality is actually quite convenient for job searches. You can be anything or anybody. The menu in life will be much more expansive than you may think.

² Visit <http://serve-learn-sustain.gatech.edu/> for more information

Course Goals and Learning Outcomes

By the end of this course, you will be able to:

- Analyze a transmission line system and develop loading strategies
- Explain Maxwell's Equations in plain English
- Calculate basic quantities in electrostatics and magnetostatic problems
- Predict wave propagation performance in free space, waveguides, and antenna systems
- Communicate clearly and eloquently on at least one research area in electromagnetics to a general audience.

We will accomplish these objectives through a combination of homework problems, exam preparation, and a special project.

Textbook Information:

Required:

- Peterson/Durgin, *Transient Signals on Transmission Lines*, Available on T-Square and library
- Peterson, *Fields and Waves Notes*, Available on T-Square

Extra Resources:

- Hayt/Buck, *Engineering Electromagnetics*, 8th ed., McGraw-Hill, 2012.
- Walter Lewin's (MIT) awesome electromagnetics lectures and demonstrations:
http://videlectures.net/mit802s02_electricity_magnetism/

Course Information

Please visit T-Square (<https://t-square.gatech.edu/>) for resources pertaining to the course.

Use Piazza (<https://piazza.com/class/is2ihkp9f3i6wa>) for relevant course discussions.

All official announcements will be made and archived through the T-Square announcement system. Please use that as your official source for information such as schedule changes and the like. The syllabus will also be updated at that location.

In addition, a Piazza page will be set up so you can ask questions to myself or the teaching assistant. **As a courtesy, please look through the Piazza conversations for answers to your questions before asking for help.**

Course Prerequisites:

- ECE 2040
- MATH 2403

Course Requirements and Grading

The grading distribution for this course are as follows.

Item	Weight
Homework	20%
Project	10%
Quiz 1 (9/26)	15%
Quiz 2 (10/26)	15%
Quiz 3 (11/21)	15%
Final Exam (TBD)	25%

Please note the Quiz/Exam dates. The course is planned such that Quiz 2 will be graded **so that approximately 40% of your grade will be known before the course withdrawal date of October 29th**. Your final grade will be assigned according to the following scale:

Letter Grade	Final Score
A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
F	0% - 59%

The course will initially not be graded on a curve. The professor, however, reserves the right to adjust the above cutoffs to bring the grade distributions to one that he deems more appropriate.

Exam Details

You will have a **single sheet of 8.5” by 11” of paper** for your notes. Otherwise it is a closed book exam. Calculators are allowed but no smart phones or laptops. **For each exam, you will be allowed one new sheet of paper as well as your sheets from previous exams.**

Exams will be comprehensive, with at least one problem a repeat from a past quiz. In order to succeed on these problems, keep past material fresh, especially the key concepts covered in previous exams.

Homework Resubmissions

We all learn from our mistakes, and I want to encourage you to understand any errors you make on your homework. As such, **I am allowing homework resubmissions to recover up to ½ of your lost points. These submissions are due one week after the graded homework has been returned.**

A preliminary set of due dates for each homework is included in the class schedule but is subject to change based on the grader’s turnaround time. The one-week-from-returned-homework rule trumps the actual dates on the schedule.

Due to the proximity to the final exam, the final homework is not eligible for resubmission.

Course Expectations and Guidelines

Commitment to Learning – Student-Faculty Expectations

I am committed to making you a better scientist and engineer. This commitment covers the objective of teaching you the electromagnetic concepts of this course but also providing the seeds to develop key skills that I wish I had when I was an undergraduate student. I will go the extra mile and try my best to give you a rewarding experience.

I hope that this commitment is mutual. In return, I ask that you:

1. **Help build a supportive, respectful learning environment.** I have been the student of many classes. I found the maintenance of a good learning environment where I felt safe to ask stupid questions and remained engaged with ease. Constructing such an environment

requires everyone to pitch in. Please be respectful and attentive so that, together, we can create an environment conducive to getting your tuition's worth.

- 2. Resolve to put in time to learn the content.** This material is challenging. Keep at it and spend the time. Try not to go through the motions or get too frustrated. Never stop thinking about what you are learning. This is easier said than done but you're likely pretty good at it now and will only get better over time.
- 3. Keep an open mind.** I have learned that engineering is a full-contact sport that requires you to be good at many things beyond knowing Maxwell's equations. I was slower than some to catch on to the urgency of learning these other skills. Your project is an attempt to help you develop other equally important skill sets that I wish I started building sooner.

Extensions, Late Assignments, and Re-scheduled/Missed Exams

Assignments must be submitted at the beginning of class on the day they are due. There are no undocumented exceptions. **If you have an emergency situation or a school sanctioned event, please contact me before the due date and provide some form of documentation.**

Quizzes can only be rescheduled to earlier dates and the need must be communicated more than two weeks in advance.

You will be able to drop **two** of your lowest homework scores.

Attendance and Participation

I believe that you are adults and responsible enough to determine the best use of your time. Therefore, **I will not take attendance as part of your grade and will leave it to your judgment.**

That said, I put a lot of time and work into lecture preparation and I ask that you recognize this effort by doing your best to attend. Time is a scarcity for all of us. **If you choose not to attend, please be mindful of the impact in time caused by your decision on myself, the teaching assistant and your peers if you need help to catch up.**

Collaboration and Group Work

Group work is allowed and encouraged within reason as long as you write up your submission on your own. Each person submits their own homework.

Mobile Devices in the Classroom

Please help me in minimizing screen use in the classroom. There is research evidence showing strong retention linked with handwritten notes. In addition, studies also show detrimental effects of classroom laptops on the students as well as their neighbors. I will not ban screens from the classroom (again, you are adults) but I ask that you only access devices when absolutely necessary.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit: <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will cause immense disappointment to the instructor and be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Individuals with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, **as soon as possible**, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs. Note that this also applies to any legitimate difficulty you may have with the course project.

Course Schedule

I will try my best to stick to this learning schedule but reserve the right to make adjustments based on the progress of the class.

Lecture #	Dates	Topics Covered	Reading
1	8/22	Introduction to transmission lines	TSTL 1
2	8/24	Transmission line equations	TSTL 2
3	8/29	DC signals on resistively loaded lines	TSTL 3
4	8/31	Termination schemas	TSTL 4
	9/5	LABOR DAY	
5	9/7	Cascaded lines and fan-outs	TSTL 5
6	9/12	Initially-charged transmission lines	TSTL 6
7	9/14	Finite duration pulses on transmission lines	TSTL 7
8	9/19	Frequency domain analysis, phasor review (Video Lecture)	TSTL 13
9	9/21	Quiz 1 Review (Instructor Class Eval)	N/A
	9/26	QUIZ 1 (Lectures 1-7)	
10	9/28	Short Circuit and Open Circuit Lines	TSTL 14
11	10/3	Arbitrary Terminations <u>Begin project presentations (3/day)</u>	TSTL 15
12	10/5	Arbitrary Terminations (cont), Vector Math Review	TSTL 15, FW 1,2
	10/10	STUDENT BREAK	
13	10/12	Vector Math Review	FW 1,2
14	10/17	Electric Fields	FW 4
15	10/19	Dielectrics and Conductors	FW 5, 12
16	10/24	Vector Calculus Review, Gauss's Law (Integral form)	FW 3, 6
	10/26	QUIZ 2 (Lectures 8-14)	
17	10/31	Gauss's Law (Differential Form)	FW 7
18	11/2	Scalar Electric Potential and Laplace's Equation	FW 8, 9
19	11/7	Capacitance and Energy	FW 10, 11
20	11/9	Bio-Savart relationship	FW 13
21	11/14	Ampere's law	FW 14
22	11/16	Inductance, Faraday's law	FW 15, 16
	11/21	Quiz 3 (Lectures 15-21)	
	11/23	THANKSGIVING BREAK	
23	11/28	Maxwell's Equations, Plane Waves	FW 17, 18
24	11/30	Plane Waves, Antennas	FW 18, 25
25	12/5	Antennas	FW 25, 26
	12/14	FINAL EXAM (Comprehensive) 3PM-6PM	