

PHY- 335 Electromagnetic Theory

Fall 2001

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Lectures: MWF 8:00 – 8:50am, Rm. 0331

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Objectives:

This course will cover the basics of electromagnetism. You were introduced to this subject in the second half of general physics, where you learned about entities called electric and magnetic fields, which determine the forces on electric charges and magnetic dipoles. This semester, you will cover this material in a more sophisticated manner than in the intro class. You should now be more mathematically mature i.e. you've been exposed to enough specialized math such as linear algebra, differential equations, infinite series, etc. to be able to deal with vector calculus, special functions and other techniques without completely panicking.

There are many reasons for learning about electromagnetism. First of all, a significant portion of the phenomena that we see around us involves electromagnetism in one form or another. Because of this, you will see these applications in mechanics, optics, quantum mechanics, and many branches of engineering. Secondly, the mathematical techniques that you learn in this class are amongst the most common that you will encounter in your science career. Vector calculus shows up in quantum mechanics, fluid dynamics, and acoustics to name just a few areas. This course should therefore also be a big help on the GRE subject test, not to mention graduate qualifying exams. And for those of you considering a future in fundamental physics (elementary particles, string theory, etc.), the electromagnetic force is considered one of four fundamental interactions. (Nowadays, it is combined with the weak force as one of the three fundamental forces, but that is another story.)

Text:

Your textbook for this class will be *Introduction to Electrodynamics* (3rd Edition) by David J. Griffiths. The author has written several excellent textbooks for upper division physics courses and this one is probably the most widely used for this course. We will cover most of the topics in the first seven chapters. These chapters focus mainly on electro- and magneto-statics where charges and dipoles are not in motion (so much for the "dynamics" part of the title!). Your waves course next semester will deal with some topics in electromagnetic waves.

Homework:

Homework will be due every Wednesday. I encourage you to pace yourself by attempting the problems as we get to each section. You are encouraged to discuss the assignments with others and with your professor, but only AFTER you have tried them yourself. Your written assignment MUST be in your own words and reflect your own understanding of the material. Furthermore, your homework should include all work, diagrams and discussion and not just the final answers. Solutions will be made available.

Participation:

You will be expected to participate in class in several ways. First of all, if you have questions during class, please ask. Secondly, there will be in class problem sessions where you will work with a small group. Third, you may be called to the board or asked to volunteer to attempt a problem. While your performance will not be graded for any of these activities, non-participation will affect your grade.

Getting help:

There are many resources for getting help in this course. These include discussing problems with your classmates and other physics majors, consulting other textbooks (see below), and meeting with me during office hours or via appointment. You can always drop by my office or e-mail me a question; however, I cannot guarantee that I will always be around or have the time.

Exams: There will be two quizzes, three midterms and a final. The quizzes will count as one midterm. The final will be cumulative. Exams will be closed book; however, some formulas will be provided. Calculators will not be necessary.

Grading:

Your grade for the course will be based on the following points:

- Homework 15 pts
- Participation 10 pts
- Midterms 60pts (Best 3 out of 4, 20 pts each)
- Final Exam 25 pts

For a total of 120 points. Grades will be assigned on a standard scale:

A=90-100%, B=80-90%, etc.

Reference Material:

If you are looking for additional references, there are many books in the library and around the department that cover the same material. The ones listed below are in the library. It is requested that you do not check them out so that everyone can have access to them. These are some books that provide more detailed explanations of most of the mathematics you will be using this semester:

Boas, M., "Mathematical Methods in the Physical Sciences" (highly recommended – check out the copy on my shelf to see how incredibly useful this book has been)

Schey, H. M., "Div, Grad, Curl, and All That: An Informal Text on Vector Calculus" (the name says it all)

Arfken, G., "Mathematical Methods For Physicists" (similar to your text, but more general)

The library has many texts that were candidates for the this semester's text including:

Lorrain, P., Corson, D. R. and Lorrain, F., "Foundations of Electromagnetic Phenomenon"

Reitz, J., Milford, F., and Christy, R., "Foundations of Electromagnetic Theory"

Wangness, R. "Electromagnetic Fields"

And for really advanced or subtle questions:

Jackson, J. D., "Classical Electrodynamics" (for those of you going on to grad school, you might even consider buying your copy now)

Date	Reading
8/31	
9/3	Intro, 1.1.1 – 1.1.4
9/5	1.1.5 – 1.2.6
9/7	1.2.7 – 1.3.1
9/10	1.3.2 – 1.3.4
9/12	1.3.5 – 1.4.2
9/14	1.5.1 – 1.5.3
9/17	1.6.1 – 1.6.2
9/19	2.1.1 – 2.1.3
9/21	Quiz I (Ch 1)
9/24	2.2.1 – 2.2.3
9/26	2.2.4 – 2.3.2
9/28	2.3.3 – 2.3.5
10/1	2.5.1 – 2.5.4
10/3	3.1.1 – 3.1.6
10/5	Exam I (Ch 1 & 2)
10/8	3.2.1 – 3.2.4
10/10	3.3.1
10/12	3.3.2
10/15	3.3.2
10/17	3.4.1 – 3.4.2
10/19	3.4.3 – 3.4.4
10/22 – 10/26	FALL BREAK
10/29	4.1.1 – 4.1.4
10/31	4.2.1 – 4.2.3
11/2	4.3.1 – 4.3.3
11/5	4.4.1 – 4.4.2
11/7	5.1.1 – 5.1.3
11/9	Exam II (Ch 3 & 4)
11/12	5.2.1 – 5.2.2
11/14	5.3.1 – 5.3.2
11/16	5.3.3 – 5.3.4
11/19	5.4.1 – 5.4.2
11/21	5.4.3
11/23	THANKSGIVING
11/26	6.1.1 – 6.2.3
11/28	6.3.1 – 6.3.3
11/30	6.4.1 – 6.4.2
12/3	7.1.1 – 7.1.3
12/5	7.2.1 – 7.2.2
12/7	Exam III (Ch 5 & 6)
12/10	7.2.3
12/12	7.3.1 – 7.3.4
12/14	Quiz II (Ch 7)
12/17-21	----- FINALS -----