Physics 350 Electrodynamics Fall 2015

Instructor:	Daniel Robb	Class Mtgs:	MWF 10:50-11:50 (TREX 272)
Office:	TREX 266B	Office Hrs:	MWF 2-4, Thurs 9-11
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Course Description:

Developed examination of electrostatics, potential theory, dielectric media, magnetostatics, and an introduction to Maxwell's equations.

Textbooks:

• *Introduction to Electrodynamics,* David Griffiths, 3rd edition (1999). ISBN-13 9788120316010

Purpose of the Course:

Electrodynamics is an introductory framework for understanding and appreciating the world of "field theory". Because the **E** and **B** fields are primary examples of a "vector field", they present themselves as the primary place of introduction to this branch of physics. The application of field theory spans all of physics, from the most tangible (fluid mechanics) to the most ethereal (string theory). Specifically, electrodynamics serves as the backbone for the following branches of physics: astrophysics, biophysics, cosmology, electrical engineering, the whole spectrum of materials science, and particle physics. Thus, a thorough understanding of electrodynamics will serve you well whatever your future endeavors in physical science. In doing so, we will try not to miss the beauty of the forest for the trees. The "trees" of partial differentiation, vector notation and non-Cartesian coordinates are towering oaks that will require our focused energy and though. However, having made this effort, you will emerge with a clear vision of one of the most ubiquitous "forests" – the electromagnetic field. I will work to draw attention to the main takeaways of the mathematical treatment without sidestepping the intriguing connection between the mathematics and physical reality.

Specific Goals of the Course:

1. Identify underlying electromagnetic phenomena related to foundational applications in the field.
2. Attach and manipulate units as a viable source of knowledge about the physical world.
3. Construct organized problem solutions that demonstrate logically connected sequences of thought.
4. Synthesize numerical information, physical assumptions, and previous concepts to correctly solve problems in electromagnetism.
5. Analyze the historical application of some aspects of electromagnetism to better understand the process of science.

Feedback and Evaluation:

I will assign numerical grades to all your work. I *may* curve your final grades (upward), but otherwise you can expect to receive an "A" for 90-100, a "B" for 80-89, etc. I will assign +/- to your final grades by examining the distribution of grades. These are the categories and percentages that will be used:

Homework:	20%
Participation:	10 %
Quizzes:	20 %
Tests:	30 % (3 @ 10 % each)
Final exam:	20 %

Homework problems are due **at the start of class** on the due date. You will learn the material best by working and persevering with challenging problems. I encourage you to discuss homework problems with other students, but you must not just borrow a problem solution from another student; you should write up the solution independently. I will grade one homework problem (at random) each week and return it on Monday; the solutions to all of the homework problems from the previous week will be posted on Monday.

Participation will include a variety of in-class activities, including problem-solving at the board and short discussions. The grade in this category will be based on completion of these in-class activities, as well as attendance at and summaries of two MCSP Colloquium Talks.

Quizzes will be given at the start of class on the dates indicated in the class schedule, and will last 10-15 minutes. Generally they will be on Wednesdays, with the exception of the last quiz which is on a Monday. They will be short problems comparable in difficulty to the assigned homework problems.

Tests will involve problems similar to those in the homework. The tests will also include several conceptual questions, in multiple-choice and/or short-answer format.

The final exam will be comprehensive (i.e., cover the entire semester) and will also include conceptual questions in a format similar to the tests.

MCSP Colloquium Series:

The MCSP department offers a series of discussions that appeal to a broad range of interests related to these math, computer science and physics. Members of this class are invited to be involved with all of these meetings; however participation in **at least two** of these sessions is mandatory. Within **one week** of attending a colloquium you must submit (via a link on Inquire) a one-page single-spaced paper reflecting on the discussion. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience.

Attendance Policy:

Attendance is very important. You must notify me in advance if you must miss class for a valid reason (an excused absence). Any student who misses a total of five classes unexcused will be dropped from the course with a grade of DF. A warning email (cc'd to your advisor and the registar) will be sent after the fourth unexcused absence occurs. Note that if a student shows up for class 10 minutes late, walks out in the middle of class, or is caught napping/texting/checking emails/browsing the Internet during class, that student will be given an unexcused absence for the class.

Expected Hours of Work

As a one credit course, this course expects you to spend at least 12 hours per week inside and outside of class.

Policy on Late Work:

I will grade an assignment with a 10% lateness deduction if turned in by 5:00PM on the due date. Following that, assignments will receive a further 10% lateness deduction for each successive school day late (with days considered to end at 5:00 PM). Assignments more than two weeks late will receive no credit.

Make-up Tests:

Make-up tests may be given only under unusual circumstances. If you miss a test, and have an official college excuse for that absence, then I may be willing to arrange for a make-up test, but I reserve the right to have your final exam grade count for the missed test.

Academic Integrity:

The College academic integrity policies are vigorously enforced. Although you are encouraged to work in groups on your homework assignments, all work turned in for a grade must be your own. Please familiarize yourself with the College's academic integrity policies.

Disability Support Services:

If you are on record with the College's Office of Disability Support Services as having academic or physical needs requiring accommodations, please meet with me during my regular office hours or schedule an appointment as soon as possible. We need to discuss your accommodations before they can be implemented. Also, please note that arrangements for extended time on exams and testing in a semi-private setting must be made at least one week ***before every exam***. If you believe you are eligible for accommodations but have not yet formally contacted Disability Support Services, please contact the Coordinator for Disability Support Services at 375-2247 or drop by the Center for Learning & Teaching in Fintel Library.

#	Date	Topic	Reading	Problem(s)
1	Sept. 2	Intro; Brief review of E & M	--	
2	4	Vector algebra roundup	Section 1.1	1.7
3	7	Differential vector calculus	1.2	1.11b, 1.15b, 1.18b
4	9	**Quiz 1**/ Integral vector calculus in 1D and	1.3	1.29
5	11	Integral vector calculus in 3D	1.3	1.32
6	14	Curvilinear coordinates	1.4	1.39
7	16	**Quiz 2/** Dirac δ, Vector field theory	1.5-1.6	
8	18	The electric field	2.1	2.3
9	21	Divergence of electrostatic fields	2.2	2.9
10	23	**Quiz 3**/ Curl of electrostatic fields	2.2	2.14
11	25	Electric potential	2.3	2.21
12	28	Work and Energy in Electrostatics	2.4	2.31
13	30	**Quiz 4/** Conductors	2.5	2.35
14	Oct. 2	Laplace's Equation	3.1-3.2	
15	5	**Midterm Exam I (Ch. 1-2)**		
16	7	Separation of variables	3.2-3.3	
17	9	Multipole expansion and dipole moment	3.4	3.27
18	12	Polarization	4.1	3.31
19	14	**Quiz 5/** Bound charges	4.2	4.2
20	16	Field of polarized objects	4.2	
		FALL BREAK		
21	26	Electric displacement	4.3	4.5
22	28	**Quiz 6/** Electric displacement	4.3	4.10
23	30	Linear dielectrics	4.4	4.15
24	Nov. 2	Dielectric materials	4.4	4.18
25	4	**Quiz 7/** Lorentz force law	5.1	4.26
26	6	Biot-Savart law	5.2	
27	9	**Midterm Exam II (Ch. 3-4)**		
28	11	Biot-Savart Law	5.2	5.3
29	13	Divergence and Curl of B	5.3	5.8
30	16	Magnetic Vector Potential	5.4	5.13
31	18	**Quiz 8/** Magnetization	6.1	5.34
32	20	Field of magnetized objects	6.2	
33	23	Magnetized fields	6.2	6.1
34	30	**Quiz 9**/ Ohm's Law and EMF	7.1	6.25, 7.2
35	Dec. 2	Motional EMF	7.1	
36	4	**Midterm Exam III (Ch. 5-6)**		
37	7	Electromagnetic induction	7.2	
38	9	Maxwell's equations	7.3	7.7
39	11	Maxwell's equations in matter	7.3	
		FINAL: Tuesday, December 15, 8:30-11:30		

Note: You should expect to spend a minimum of 12 hours per week on lectures, homework, reading and studying for PHYS 350.