

Physics 230: Electricity and Magnetism

Spring, 2010

Contact Information:

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Meeting Times:

Lecture: 9:50-11:00 am MWF YC 115

Office Hours: 1:30-3:00 pm T, Th, and by appt.

Web: Moodle (Physics 230, key: *maxwell*)

Course Outline and Goals:

This course will focus on electrostatics and magnetostatics, ultimately arriving at Maxwell's integration of these two ideas into *electromagnetism*.

Required Text:

D. Griffiths, *Introduction to Electrodynamics*, 3rd ed. Prentice Hall (1999), ISBN: 0-13-805326

Other Texts:

Several other texts may help you in this course. The absolutely critical text is your first year calculus book. It will be an invaluable reference for derivatives and integrals in multiple dimensions, the mathematical core of this course. David Cook's *The Theory of the Electromagnetic Field* and Edward Purcell's *Electricity and Magnetism* take somewhat different approaches to the material, and can therefore be useful references as well.

Course Philosophy:

The lectures in this course will be devoted to covering important topics and concepts in the daily assignments, and to discuss particularly difficult derivations, implications and applications. This requires commitments from you: you must *thoroughly read* the assigned reading before coming to class, and you should be ready to participate in class. Indeed, you will be called on in nearly every class to help with derivations, implications and applications.

Please note that the reading assignments are long. Be prepared to spend an hour or more on each day's reading. As an incentive, reading quizzes (see below) will be assigned on Moodle.

Assignments:

Reading Quizzes will be posted on Moodle for each day's reading. Each quiz will consist of 2-3 primarily conceptual problems to help you focus your reading. The reading quizzes will close automatically 15 minutes before the start of class to allow me to glance through the answers. No collaboration is permitted on the reading quizzes.

Homework will be assigned via Moodle and collected at the **beginning of class** each Friday. Solutions should be recopied in a neat and readable form, and provide complete explanations

(with a figure, where appropriate) to receive full credit. In particular, any step that involves physical reasoning needs to be explained. I am happy to accept typed (LaTeXed) homework; however, I will not accept formula printouts from Maple/Mathematica/IDL/etc. An integral part of this class (as it were) is learning to solve differential and integral problems by hand. I will drop your lowest *nonzero* homework score - if you do not turn in an assignment, the zero stands! I will post homework solutions to Moodle after class on Friday; once solutions have been posted, late homework cannot be accepted.

Two 70 minute exams will be scheduled during the term. I will count the exam with your lower individual score 15%, the exam with your higher individual score 20%.

Finally, to get a feel for the types of problems I consider important (and therefore will ask), four short in class quizzes will be assigned.

Grading Formula:

Weekly homework:	20%
Reading quizzes:	5%
In class quizzes:	10%
Exams:	35%
Comprehensive final:	30%

I expect to base grades on a straight curve, **A**: 90% and above, **B**: 80-89%, etc. With hard work, it is possible for everyone in the course to get an **A**; this is my goal. In other words, the curve will not be raised; it may be lowered at my discretion.

Honor Code:

No Lawrence student will unfairly advance his or her own academic performance or in any way limit or impede the academic pursuits of other students of the Lawrence community. Honor the honor code. Collaboration on the homework is encouraged; however, solutions must be written up individually. Explicitly acknowledge any collaborators. Every assignment must include a signed reaffirmation of the LUHC.

Tentative lecture plan

Week beginning:	Monday	Wednesday	Friday
Mar. 29	Introduction; Vector Review. Advertisement (xi-xv) & Ch. 1 (p1-19)	Differential and Integral Calculus Ch 1 (p17-38)	Coordinate transforms, Delta functions Ch 1 (p38-52) HW 1 due
Apr. 5	Electric field and Gauss' Law Ch. 2 (p58-71) Quiz 1	Gauss' Law & Electric Potential Ch. 2 (p72-83)	Work and Energy Ch. 2 (p83-96) HW 2 due
Apr. 12	Conductors Ch. 2 (p96-106)	Electrostatics: Laplace's Equation Ch. 3 (p110-121)	Tricks: Images & Separation of Variables Ch. 3 (p121-134) HW 3 due
Apr. 19	Tricks: Separation of Variables Ch. 3 (p134-144) Quiz 2	Tricks: Multipole Expansion Ch. 3 (p146-155)	Polarization Ch. 4 (p161-175) HW 4 due
Apr. 26	Exam 1 Ch 1-3	Displacement & Dielectrics Ch. 4 (p175-185)	Force in Dielectrics, Lorentz's Law Ch. 4 & 5 (p191-196, 202-210)
May 3	Current & Biot-Savart Ch. 5 (p211-221)	Div B , Ampere's Law Ch. 5 (p221-230) HW 5 due	NO CLASS: Reading period
May 10	Vector Potential & Magnetic Dipole Ch. 5 (p 232-242) Quiz 3	Magnetic Dipoles, Magnets Ch. 5 (p242-246) Ch. 6 (p255-261)	Magnetized Fields & H Ch. 6 (p262-277) HW 6 due
May 17	Ferromagnetism, EMF Ch. 6 & 7 (p278-282, 285-293)	Exam 2 Ch 4-6	EMF and Induction Ch. 7 (p294-301) HW 7 due
May 24	Induced Field and Inductance Ch. 7 (p301-316)	Maxwell's Equations Ch. 7 (p317-333)	Problems, Applications of Maxwell's Laws
May 31	NO CLASS: Memorial Day	Electromagnetic Waves Ch. 9 (p364-370, 375-380)	Quiz 4 , Review & Celebration HW 8 due

Final Exam: Monday, June 7, 6:30 pm. This is not a typo.