

Physics 351: Electricity and Magnetism

Fall 2015

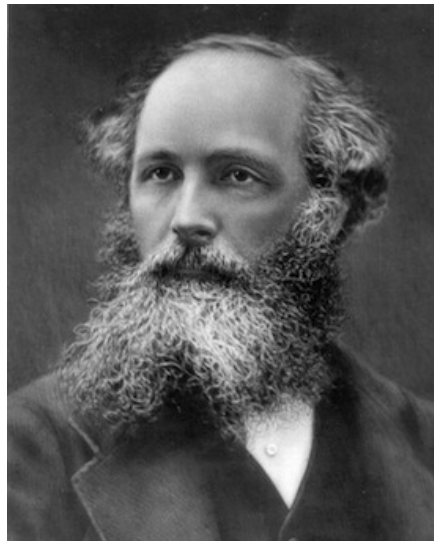
“I have also a paper afloat, with a electromagnetic theory of light which, till I am convinced of the contrary, I hold to be great guns.”

– James Clerk Maxwell

Welcome to Physics 351! In this class we will study charges, currents, electric and magnetic fields, and their interactions. Much of the physics is expressed in a single, remarkable set of equations

$$\begin{aligned}\vec{\nabla} \cdot \vec{\mathbf{E}} &= \frac{1}{\epsilon_0} \rho \\ \vec{\nabla} \times \vec{\mathbf{E}} &= -\frac{\partial \vec{\mathbf{B}}}{\partial t} \\ \vec{\nabla} \cdot \vec{\mathbf{B}} &= 0 \\ \vec{\nabla} \times \vec{\mathbf{B}} &= \mu_0 \vec{\mathbf{J}} + \mu_0 \epsilon_0 \frac{\partial \vec{\mathbf{E}}}{\partial t}\end{aligned}$$

This formulation of electromagnetism is due primarily to the Scottish physicist James Clerk Maxwell. His equations, in one form or another, describe phenomenon ranging from the propagation of light to the deflection of a compass needle by a magnetic field.



James Clerk Maxwell (1831-1879)

The impact of Maxwell’s equations extends well beyond electromagnetism. The Theory of Special Relativity is secreted away inside them, and they are the prototype for a unified description of the basic forces of Nature.

Basic Information

WHO AM I: Dr. Robert McNees. I'm the professor. You can call me "Bob" or "Dr. McNees" – I'm not too picky about that.

EMAIL: rmcnees@luc.edu. You *must* use your "@luc.edu" address when sending me an email. Emails sent from outside accounts sometimes get blocked by Loyola's mail servers!

OFFICE: Cudahy Science 308. "Official" office hours will be announced, but for the most part I have an open-door policy and you can drop by anytime. If you have a busy schedule and want to make sure I'm there, you can email or call my office phone: 508-7570.

LECTURES: Tuesday and Thursday from 1:00-2:15 in Cudahy 313.

DISCUSSION: Thursday from 4:15-5:05 in Cudahy 313.

WEBSITE: <http://jacobi.luc.edu/p351.html>.

Textbook

The main text for the class is *Introduction to Electrodynamics* (4th edition) by Griffiths. Homework assignments are not taken from the book, so you'll probably be fine with the 3rd edition if you can get a copy. The tone of the book is casual and most students find it to be very accessible. When I was an undergraduate I used the books by Wangsness and Purcell. Those texts might be useful if something in Griffiths isn't clear. The book by Purcell has just been released in a new edition, and I expect it will be very good. A more advanced treatment is given in Jackson's *Classical Electrodynamics*, which is the text for practically every graduate E&M course. You can find links to all these books on the [course website](#).

Griffiths' book has a very complete (for our purposes) discussion of vector calculus as it is used to describe electricity and magnetism. If you'd like to see additional discussions of this material, I recommend the book *Mathematical Methods in the Physical Sciences* by Boas, or *Mathematical Methods for Physics and Engineering* by Riley, Hobson, and Bence. For a more advanced treatment refer to *Mathematical Methods for Physicists* by Arfken and Weber.

From time to time I may supplement the material from the book with my own notes. I will post these notes as pdf files on the class website.

Schedule

We will cover most of the first nine chapters of the textbook, with the exception of parts of chapters 8 and 9. The table below is an estimate of how we'll spend our time.

Week	Dates	Chapter
1	August 25, 27	1
2	September 1, 3	1, 2
3	September 8, 10	2
4	September 15, 17	2
5	September 22, 24	2, 3
6	September 29, October 1	3
7	October 6, 8	<i>Mid-Semester Break, 3</i>
8	October 13, 15	3, 4
9	October 20, 22	4, 5
10	October 27, 29	5
11	November 3, 5	5
12	November 10, 12	5, 6
13	November 17, 19	6, 7
14	November 24, 26	<i>7, Thanksgiving Break</i>
15	December 1, 3	9

Please keep in mind that these dates are subject to change. There are two reasons for this. First, I usually teach this course in the spring. The fall calendar is different and it may require some changes. Second, I may decide to switch things around or spend more or less time on a given chapter. I will always notify you about any changes I make to this schedule.

Grades

Grades in the course are primarily determined by homework assignments and exams. The weekly homework grades contribute 35% of your final grade in the class, and two midterm exams (dates TBA) count 15% each. A cumulative final on Friday, December 11 (from 1:00-3:00 PM) is worth 30%. The remaining 5% depends on your attendance and participation. To receive the full 5% you should do two things that show me you are engaging the material and thinking about what we're doing. First, you must regularly attend lectures and discussion sections. Second, you should ask questions. This can happen either in class, discussion, or office hours. There is no minimum number of questions you need to ask, and if you don't like to speak up in class you can ask them during office hours. In any case, you *must* visit me during office hours at least once during the semester, with a question related to something we've done in class. As long as you do these things, you get the 5%.

Once your grades have been added up and converted to a percentage, your final grade will be assigned according to the following table:

Percentage	Letter Grade
100 – 92	A
91 – 90	A–
89 – 88	B+
87 – 82	B
81 – 80	B–
79 – 78	C+
77 – 72	C
71 – 70	C–
69 – 68	D+
67 – 62	D
61 – 0	F

So, suppose you finish the class with a 91% average on the homeworks, grades of 85% and 82% on the two exams, and an 89% on the final. You attended the lectures, came to office hours a few times, and asked questions, so you get the full 5% for participating. Then your final grade would be

$$91\% \times 0.35 + 85\% \times 0.15 + 82\% \times 0.15 + 89\% \times 0.30 + 5\% = 88.6\% , \quad (1)$$

which earns you a B+.

Homework Assignments

Homework is assigned each week and collected the following week. Current and past assignments can be downloaded from the course website – I will not hand out printed copies in class. Only some of the problems from each assignment will be graded. I won't tell you which ones, so you need to complete all the problems. Homework is the single largest component of your grade, so take it seriously! It usually takes a good amount of time, which means you need to plan accordingly. Don't put it off until the last minute.

Working with your classmates is encouraged, but you should only hand in work that you've completed on your own. If your solutions look like they were copied from someone else's work then you need to go back and redo it from scratch. If you can't explain each step of your solution then you haven't completed the problem on your own. Remember: the only way to be ready for the exams is to do the homework yourself. Come speak with me if you aren't sure what is or is not allowed.

A Warning

Never, ever hand in an assignment that you copied from a solutions manual or found online. You won't learn anything that way, and it will earn you a grade of zero for that assignment. If it happens more than once it will be reported to the Department Chair and the Dean. Consider yourself warned.

College of Arts & Sciences Statement on Academic Integrity

[Read the statement on the CAS website](#)

A basic mission of a university is to search for and to communicate the truth as it is honestly perceived. A genuine learning community cannot exist unless this demanding standard is a fundamental tenet of the intellectual life of the community. Students of Loyola University Chicago are expected to know, to respect, and to practice this standard of personal honesty.

Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another students work, and submitting false documents.

Academic cheating is a serious act that violates academic integrity. Cheating includes, but is not limited to, such acts as

- Obtaining, distributing, or communicating examination materials prior to the scheduled examination without the consent of the teacher
- Providing information to another student during an examination
- Obtaining information from another student or any other person during an examination
- Using any material or equipment during an examination without consent of the instructor, or in a manner which is not authorized by the instructor
- Attempting to change answers after the examination has been submitted
- Unauthorized collaboration, or the use in whole or part of another students work, on homework, lab reports, programming assignments, and any other course work which is completed outside of the classroom
- Falsifying medical or other documents to petition for excused absences or extensions of deadlines
- Any other action that, by omission or commission, compromises the integrity of the academic evaluation process

Plagiarism is a serious form of violation of the standards of academic dishonesty. Plagiarism is the appropriation of ideas, language, work, or intellectual property of another, either by intent or by negligence, without sufficient public acknowledgement and appropriate citation that the material is not one's own. It is true that every thought probably has been influenced to some degree by the thoughts and actions of others. Such influences can be thought of as affecting the ways we see things and express all thoughts. Plagiarism, however, involves the taking and use of specific words and ideas of others without proper acknowledgement of the sources, and includes the following

- Submitting as one's own material copied from a published source, such as print, internet, CD-ROM, audio, video, etc.
- Submitting as one's own another person's unpublished work or examination material
- Allowing another or paying another to write or research a paper for one's own benefit

- Purchasing, acquiring, and using for course credit a pre-written paper

The above list is in no way intended to be exhaustive. Students should be guided by the principle that it is of utmost importance to give proper recognition to all sources. To do so is both an act of personal, professional courtesy and of intellectual honesty. Any failure to do so, whether by intent or by neglect, whether by omission or commission, is an act of plagiarism. A more detailed description of this issue can be found [here](#).

In addition, a student may not submit the same paper or other work for credit in two or more classes without the expressed prior permission of all instructors. A student who submits the same work for credit in two or more classes without the expressed prior permission of all instructors will be judged guilty of academic dishonesty, and will be subject to sanctions described below. This applies even if the student is enrolled in the classes during different semesters. If a student plans to submit work with similar or overlapping content for credit in two or more classes, the student should consult with all instructors prior to submission of the work to make certain that such submission will not violate this standard.

Plagiarism or any other act of academic dishonesty will result minimally in the instructors assigning the grade of “F” for the assignment or examination. The instructor may impose a more severe sanction, including a grade of “F” in the course. All instances of academic dishonesty must be reported by the instructor to the chairperson of the department involved, and to the Dean of the College of Arts and Sciences.

The chairperson may constitute a hearing board to consider the imposition of sanctions in addition to those imposed by the instructor, including a recommendation of expulsion, depending on the seriousness of the misconduct. In the case of multiple instances of academic dishonesty, the academic dean of the student’s college may convene a hearing board. Students have the right to appeal the decision of the hearing board to the academic dean of the college in which they are registered. The decision of the dean is final in all cases except expulsion. The sanction of expulsion for academic dishonesty may be imposed only by the Provost upon recommendation of a dean. Students have a right to appeal any finding of academic dishonesty against them. The procedure for such an appeal can be found [here](#).

The College of Arts and Sciences maintains a permanent record of all instances of academic dishonesty. The information in that record is confidential. However, students may be asked to sign a waiver which releases that students record of dishonesty as a part of the students application to a graduate or professional school, to a potential employer, to a bar association, or to similar organizations.