

1. INTRODUCTION TO PHYS 295:

Ah, the elegant world of electric and magnetic fields! (We'll see that they are really two aspects of one electromagnetic field.) This is a rich subject that has driven developments in both in technology (electrical grid, radio, cell phones, GPS, windmills, ...) as well as theory; electromagnetism is in some sense the 'ideal' theory that unified the apparently unrelated fields of electricity, optics, galvanism (study of currents), and magnetism.

So much for lofty heights. The subject is also full of new concepts, handy gadgets, and mathematical techniques. It is a field theory so questions we will address over and over are "What is the field of the following configuration?" and, "Given these charges, what happens to those charges?"

We will follow the development of the subject in our wonderful text Purcell and Morin.

2. TEXT:

Edward Purcell and David Morin, *Electricity and Magnetism* 3rd edition. Purcell's text is a classic - one of the best in physics - and Morin has updated it. It starts with statics (no moving charges) for electrical fields outside and inside materials and then proceeds with magnetic fields. Dynamics towards the end, and with it light!

3. INSTRUCTOR:

Seth Major – if you are comfortable doing so, please call me "Seth."

pronouns : he/him

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web : academics.hamilton.edu/physics/smajor/

phone : x4919

office : Sci G052

Class: MWF 10 - 10:50 AM in Science Center G047

Office Hours: My official hours are after every class and Thursday afternoons 1 - 4 or 5, depending of whether I have meetings.

Pro-tip: "Office hours are the most important part of the class. That's where I learn the most."

4. COURSE INFO:

All materials syllabus, problem sets, extra links, etc. will be available online. You can find them through the Courses tab on the course web page. Current versions will be labeled by a version number in the top right of the first page.

5. ASSIGNMENTS

5.1. Problem sets. We will have roughly weekly problem sets, likely 12 in total. Please write up your complete solutions with care. For hints on how to accomplish this see section 8. Solutions will normally be due at the beginning of class on Friday.

You have 3 automatic extension tokens during the semester. The policy is as follows: To opt in for one of these, write me an email before the beginning of class on Friday. The request can be for any reason, illness, busy, travel, etc. You then have 2 more days to complete your solutions. Otherwise (and after this extension) the score decreases by 20% per day (24 hours): the set is graded then a

reduction is computed based on the number of days the work is late. Of course, if you turn on your work within the 2 days of the extension then your solutions have no reduction.

5.2. Reaction Questions. These will be moments for feedback. At suitable moments I will distribute papers asking for a sentence or two reacting to the state of your knowledge concerning electromagnetism. I will use these reactions to help plan upcoming classes and the path of the course. A useful reaction course be a specific question: for example, “How is it that electromagnetic fields carry momentum?” Other possible reactions include indications of general interest, “I’d like to learn more about solving Gauss’ law,” or general questions about course material. For full credit you will need to submit questions for 80% of the reaction moments. (Thanks to Dan Styer for this aspect of the course.)

6. GRADES:

There are 5 parts to the grade:

- (1) Participation 10%
- (2) Reaction questions 10%
- (3) Problem sets (45%).
- (4) Mid-term: (15%) We will have one mid-term in “week 7” of the semester, which will be the week of March 1.
- (5) Final (20%): This closed-book final will be scheduled during finals week.

7. ON WRITING UP YOUR WORK FOR OTHERS I.E. PROBLEM SETS!

For full credit for your solutions you must find the correct answer **and** present your result clearly. You can receive full credit only when you show clearly what you did. If a problem on the homework is not written up properly, you may lose up to 50%, even if the answers appear to be correct. If your solutions are illegible or otherwise unacceptable, it will be returned without grading.

Some Advice for Problem Sets: Before attempting a problem, review your lecture notes and do the reading. This may seem obvious, but often this is done only when a difficulty is encountered.

- (1) Start the problem set early! Start the problem set early! Start the problem set early!
- (2) Make a clear sketch. A well drawn figure can save a tremendous amount of time.
- (3) Work slowly, carefully, and thoughtfully through the problem. It is better to work slowly but get the right answer than to work faster and make unnecessary mistakes.
- (4) Start your work on white board, blackboard, or scrap paper so you don’t freeze trying to get every step the correct.
- (5) Work with friends. It is more fun!
- (6) To avoid a round-off error, do not round numbers early in the calculations.
- (7) Make use of spreadsheets - it will save time, prevent round off error and make it easy to adjust parameters. Start off with building a template with all relevant constants, c , e , etc.
- (8) Use a reasonable number of significant digits in your answer, usually no more than 3. More digits do not make a result more accurate. Way too many sig figs will result in up to 10% reduction.
- (9) In setting up longer problems express physical quantities in terms of dimensionless variables.
- (10) Attend office hours! Attend office hours! Attend office hours!
- (11) Collaborate but write up your own solutions *this includes mathematica code*
- (12) Celebrate your final answers with a box.
- (13) Check your final answers: Do they make sense? A simple dimensional analysis can catch a big mistake. Question numeric answers.

- (14) Write out final copy from your solution notes. If you make a mistake at the end of a problem, don't erase what you did before or rewrite everything. Just cross out or mark what you found to be wrong and continue with a correct solution. (This shows the grader that you checked what you have completed.)
- (15) Present the answer in the form asked for. For example, if an electric field (which as you know is a vector quantity) is asked for, do not just give the magnitude.
- (16) Write down clearly and unambiguously with whom you worked on the problem and any resources you consulted.
- (17) Build a top notch, easy to access set of records for the course - notes, problem sets, and corrected solutions. They may turn out to be an invaluable resource for you in the future...

8. STAYING HEALTHY

We should all be mindful about the stresses of life on the Hill. There are times that we may feel overwhelmed, anxious, or depressed. The Dean of Students Office and Counseling Center have resources available on campus to help and support:

- Counseling Center (www.hamilton.edu/offices/counselingcenter, 315-859-4340) offers individual and group therapy, peer counselors and psychiatric treatment. If you need immediate assistance, phoning the Counseling Center and selecting option 2 will connect you with a counselor, 24 hours a day, 7 days a week. Campus Safety is available 24/7 for urgent concerns at 315-859-4000.
- Associate Dean of Students for Student Support, Sarah Solomon (315-859-4600; ssolomon@hamilton.edu)
- Associate Dean of Students for Academics, Adam Van Wynsberghe (315-859-4600; avanwyns@hamilton.edu)
- Your faculty advisor, RA and Area Director in your residence hall

9. AN APPROXIMATION TO THE WEEKLY SCHEDULE

What follows is preliminary!

Week	Date	Topic	Reading
1	18 January	Electrostatics	Ch 1
2	25 January	Electric Potential	Ch 2
3	1 February	Div, Grad, & Curl	Ch 2
4	8 February	Conductors	Ch 3
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5	15 February	Currents	Ch 4
6	22 February	Special Relativity	extra to come
7	1 March	Fields of moving charges	Exam Ch 5
8	8 March	Magnetic fields	Ch 6
15 & 22 MARCH, SPRING BREAK			
9	29 March	Induction	Ch 7
10	5 April	Maxwell's equations	Ch 9
11	12 April	AC circuits	Ch 8
12	19 April	Electric fields in matter	Ch 10
13	26 April	Magnetic fields in matter	Ch 11
14	4 May	Review	...
FINAL MAY 14 7 PM			

Enjoy!

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