MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Physics

Physics II (8.022) — Electricity and Magnetism — Fall 2011

GENERAL INFORMATION

Welcome to 8.022!

This course is about electricity and magnetism. Mastering this subject will allow you to understand a broad range of technologies and natural phenomena, from the everyday (static cling, lightning, refrigerator magnets, motors and generators, the color of a sunrise) to the profound (the structure of matter, the nature of time and space). Electromagnetism is the greatest success story of physics: a theory in which many seemingly unrelated phenomena are shown to be the non-obvious consequences of a simple and elegant set of rules.

People

Lecturer	Prof. Josh Winn	37-664b, `jwinn@mit.edu`
Recitation Instructors	Prof. Robert Jaffe	6-411, `jaffe@mit.edu`
	Dr. Alan Levine	37-575, `amlevine@mit.edu`
Graduate Teaching Assistant	Mr. Asher Kaboth	6-415, `akaboth@mit.edu`
Undergraduate Tutor	Mr. Max Ockner	`mockner@mit.edu`
Course Manager	Ms. Nancy Boyce	4-315, `nboyce@mit.edu`

Goals

The immediate goals of this course are for you to learn about: electric charge, forces, and fields; electrostatic energy; Gauss's Law; perfect conductors; capacitors; dipoles; insulators; electric current; circuits and Kirchoff's Laws; magnetic forces and fields; the Biot-Savart Law; Ampère's Law; Faraday's Law; inductance; magnetic properties of materials; electromagnetic oscillations and resonance; impedance; electromagnetic waves, momentum, and radiation; the relation of electromagnetism to relativity.

The broader goals are for you to learn to find creative solutions to physics problems; to use symmetry principles and other insights to avoid laborious calculations; to become adept with approximations; to understand the utility and the limitations of common idealizations in physics (such as perfect conductors and point charges); and to appreciate the importance and aesthetic achievement of Maxwell's Equations.

Prerequisites

We will assume you have already mastered single-variable calculus (e.g., differentiation, integration, Taylor expansions) at the level of 18.01, and Newtonian mechanics (e.g., vectors, force and momentum, torque and angular momentum) at the level of 8.01. Also required is prior knowledge of vector calculus, or concurrent enrollment in 18.02 (or equivalent).

Textbook

Required: *Electricity and Magnetism* by E. Purcell and D. Morin, 3rd ed. (Cambridge University Press, 2012). This will soon be available to purchase from Copytech in 11-004.

Possibly useful: The set of 8.022 lecture notes written by Prof. Hughes (although this course will not be exactly the same): `http://web.mit.edu/sahughes/www/8.022`

Should I take 8.022, or 8.02?

This course is more theoretical and mathematical than 8.02. The problem sets and exams are more challenging. Despite the extra difficulty, you will receive exactly the same academic credit as you would receive in 8.02. Why, then, should you take this course instead of 8.02?

Good reasons include: You love physics. You are thinking of majoring in physics or electrical engineering. You like to be challenged. You are good at math and enjoy learning about its physical applications. You want to work hard and achieve a deep understanding.

Bad reasons include: You feel obligated to take the hardest course that is offered, even though you do not really want to. A friend of yours is taking this course. You do not like the TEAL format. This course fits better into your schedule.

Please think carefully about your reasons for taking this class. In our experience, students who take this course for bad reasons do not learn much and have a high probability of failing the course. We do not want anybody to fail. We want you to succeed!

How to Succeed in 8.022

- Attend all of the lectures and all of your recitations. Lectures are mainly for *understanding concepts*, and recitations are mainly for *solving example problems and asking questions.* However, new material will occasionally be presented in recitations, and you will be responsible for learning that material.
- Visit your professors, TA, and tutor during their office hours if you have additional questions, if you need individualized help, or if you just want to talk about physics.
- Work hard on the problem sets. After you turn them in, consult the solutions for the problems that you did not know how to solve. **Each exam will each have at least one problem that is closely related to a homework problem.**
- Read the assigned sections of Purcell before each lecture, or shortly afterwards. Do not fall behind in the reading, because there will be no time to make it up later.
- Do the optional laboratory experiments. You'll have fun, gain some hands-on experience, and earn some extra credit.

Grades

Because we want to give you every incentive to work together, we will not grade "on a curve." Your final numerical grade will be the weighted sum of your scores on the problem sets, quizzes, and final exam:

Problem Sets (10)	20% (2% each)
Quiz 1	20%
Quiz 2	20%
Final Exam	40%

Your letter grade is determined from your numerical grade G as follows:

A	$G \geq 85$
B	$85 > G \geq 70$
C	$70 > G \geq 55$
D	$55 > G \geq 40$
F	$G < 40$

The "+/−" boundaries have not yet been determined. For first year students, a C or better is needed to pass.

There will be 3 opportunities to earn extra credit by completing a laboratory experiment. Each experiment is worth 2 extra points on your final numerical grade.

Other Policies

- We encourage you to work together on problem sets. You should wrestle with a problem yourself, then discuss it with your friends, and then write up the solution by yourself. You may *not* consult solution sets from previous years.
- Late problem sets will not be accepted.
- Problem sets will generally be due on Mondays at 5:00 p.m. in your section's lockbox. The lockboxes are located on the 3rd floor of Bldg. 8, at the junction with Bldg. 16.
- All exams will be closed-book. No calculators, books, or memory aids of any kind are allowed.
- Requests for grade corrections must take the form of a specific and clearly written note. For homework, staple the note to your graded paper and put it in your section's lockbox. For quizzes, give it to your recitation instructor.
- Please do not arrive late to lectures or recitations.
- The course web site provides a calendar with lecture topics and quiz dates, a staff list including office hours, problem sets and solution sets, and other materials:

  `http://stellar.mit.edu/S/course/8/fa11/8.022/`

- You may change your recitation section using the "Membership" section of the course web site.