

Cornell University

Department of Physics

Physics 3327

August 16, 2012

Fall 2012
Phys3327: Advanced Electricity and Magnetism
Course Information

Prerequisites: Physics 1112/1116, 2213/2217, and 2214/2218. Math 1920/2220, 2930, and 2940/2210. Co-enrollment in AEP 4210 is recommended.

Lecturer: Prof. Maxim Perelstein, Physical Sciences Building 436, x5-4118

Email: mp325@cornell.edu

Office hours: Monday 2-3 pm, or by appointment (use email)

TA: Flip Tanedo (pt267@cornell.edu)

Office hours (a.k.a. “problem-solving parties”): Monday 5:15-7:15 pm, PSB 470

Grader: Shivam Ghosh (sg654@cornell.edu)

Class Times and Locations: Lectures: MWF 11:15 am - 12:05 pm, Rock 231

. Section: F 2:30-3:20 pm, Rock 231

Web Page: <http://blackboard.cornell.edu>

Primary (Required) Text: Heald and Marion, *Classical Electromagnetic Radiation*. **NOTE:** The text is currently out of print, and will not be available through the campus bookstore. I will distribute copies of individual chapters as we cover them in class. If desired, used copies can be obtained at Amazon and other online booksellers. The new paperback edition will be published in December 2012 by Dover, and can be pre-ordered at Amazon. Students are encouraged to purchase the book once it becomes available.

Secondary (Optional) Text: Griffiths, *Introduction to Electrodynamics* (3rd ed.)

Homework: There will be one problem set per week. The problem sets will be posted on Blackboard, and will be due in class on Wednesdays. The homeworks will

be graded by the TA and the grader, and returned to students in section. Solution sets will be posted on Blackboard. One (lowest) homework score will be dropped from the calculation of the final grade.

In addition to traditional pencil-and-paper problems, some problems will require use of computer software, *Mathematica*. I highly recommend that you purchase a copy of *Mathematica 8 for Students* from Wolfram Inc., and install it on your personal computer. There are some public computers with *Mathematica* available for students' use; contact me for details if interested.

Problem sets and reading assignments are an essential part of the course and should be taken very seriously. Each student in the course is expected to abide by the Cornell University Code of Academic Integrity.

Exams: There will be two evening preliminary exams, on **Thursday September 27, 7:30-9:00 pm**, and **Thursday, November 1, 7:30-9:00 pm**. The final exam is on **Friday, December 7, 2:00-4:30 pm**. If you have time conflicts or other legitimate reasons to require alternative arrangements, please let the professor know as soon as possible.

Course Grades: Letter, S/U, and Audit options are available. The credit will be assigned as follows: 25% homework/participation, 25% each prelim, 25% final exam. The S grade requires credit equivalent to C- or higher.

Tentative Syllabus

- Math Review: Grad, div, curl; Line, surface, volume integrals; Gauss's and Stokes' theorems; Spherical and cylindrical coordinates; Dirac delta function in 1D and 3D.
- Electrostatics: Multipole Expansion; Dipole, Quadrupole fields.
- Poisson's and Laplace's Equations in rectangular, spherical and cylindrical coordinates. Spherical harmonics and Bessel functions.
- Magnetostatics and Magnetic Multipoles.
- Electromagnetic Induction and Maxwell's Equations.
- Vector potential and Gauge transformations.
- Energy of electromagnetic field; Maxwell stress tensor.
- Electromagnetic waves; Complex fields.
- Electromagnetic fields in a medium: Dielectrics, Dia/Para/Ferro-magnetism.

- Reflection and refraction of electromagnetic waves.
- Transmission lines and waveguides.
- Retarded potentials and Lienard-Wichert fields.
- Radiation by moving charged particles.
- Electrodynamics and Special Relativity.