

Physics 431
Fall 2013 Semester
Electricity and Magnetism

Logistics

Instructor	Dr. Norman Mannella
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Lecture Time and Location	T-R, 8:10 - 9:25, Nielsen 306
Office Hours	Immediately after class, or by appointment, in my office

Target audience

The course is designed for senior level physics majors; however other engineering and science majors with the correct preparation are very welcome. Nb: this is a course that is mandatory for all Physics Majors. Therefore, this is a course whose audience is composed by students who intend to pursue graduate studies, but also by students who will want to find a job after the BS degree. Topics of choice must take this fact into consideration.

Prerequisites PHYS 232 or PHYS 136 or PHY 138

Expected previous knowledge

- Concepts.** A basic knowledge of electricity and magnetism at the level of physics freshman courses (PHY 232 or PHY 136-138) is expected
- Skills** Familiarity with calculus and calculus concepts (vectors, vector, differential and integral calculus), linear algebra (matrices, determinants etc.), differential equations (ODE, PDE), vector analysis (i.e. Div, Curl, Grad, Div and Stokes' Theorems).

Course Objectives

- **Gain deeper understanding of Electricity and Magnetism.** Consolidate the understanding of fundamental concepts in Electricity and Magnetism more rigorously as needed for further studies in physics, engineering and technology.
- **Advance skills and capability for formulating and solving problems.** Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems.
- **Increase mathematical and computational sophistication.** Learn and apply **advanced mathematical techniques** and methods of use to physicists in solving problems. Develop some capabilities for **numerical/computational methods**, in order to obtain solutions to problems too difficult or impossible to solve analytically.

Textbook

"Introduction to Electrodynamics", by David J. Griffiths, Pearson, or
"Electromagnetism" by Pollack and Stump, Addison Wesley

Minimum Material Covered

Electrostatics: Coulomb's law, Electrostatic field and its computation, Gauss's law and divergence of E, Electrostatic potential, conductors
Electrostatics in matter: Polarization, dipole fields, electric displacement, Gauss's law in dielectrics, linear dielectrics (susceptibility, permittivity, dielectric constant)
Magnetostatics: Lorentz force, Biot-Savart law, divergence and curl of B, magnetic vector potential
Magnetostatics in matter: magnetization, torque and forces on a magnetic dipole, bound currents, the auxiliary field H, Ampere's law in matter and its differential form, magnetic susceptibility and permeability
Electrodynamics: Electromotive force, Ohm's law, motional emf, electromagnetic induction, Faraday-Newmann-Lenz's law, inductance
Maxwell's equations

Contacting the Instructor

I prefer personal contact to e-mail contact, and therefore encourage you to come to office hours. As a general rule, I do NOT address homework problems by e-mail. On the other hand, if you have a personal emergency, e-mail is fine. If you cannot make my office hours, we can schedule an appointment. Anyhow, I strongly encourage you to come and see me.

Grading

Homework	=	40%
Midterms	=	25%
Final Exam	=	35%

Please note: **Ordinarily make-up exams will NOT be given. Missing the Final Exam is very serious and may well result in failure of the course.** However, if there are extremely serious circumstances supported by proper documentation, a make-up for Midterms and/or Final exam may be considered at my discretion.

For students with disabilities

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss specific needs. I will then contact the Office of Disability Services at 865-974-6087 in Hoskins Library to coordinate reasonable accommodations for students with documented disabilities.