

Physics 421
Spring Semester 2013
MWF 11:10 – 12:00, LL 311

Instructor: John Huennekens
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office hours: walk-in anytime or by appointment

Textbook: J. D. Jackson, “Classical Electrodynamics”,
3rd Edition, John Wiley & Sons, 1998

Other books: Jackson 1st edition
Jackson 2nd edition
Griffiths “Intro to Electrodynamics”
Feynman “Lectures on Physics” Vol. 2

Grading: Homework – 20%
Hour Exam I – 20%
Hour Exam II – 20%
Final Exam – 40%

Accommodations for Students with Disabilities: If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

Statement on Academic Integrity/Code of Conduct: This is a graduate class and I assume graduate students are honest and understand what is expected. However, a couple of specific comments might be necessary.

Homework: I consider homework assignments to be more important for learning than for grading. Therefore, I grade the homework mostly on effort rather than simply looking for right answers. I encourage students to work with each other on homework assignments. You are also welcome to come see me if you need help. However, use of solution sets from previous years is considered an act of cheating, both for the current student and for the previous year student who provided the solution sets.

Exams: All exams will be in class (no take home exams). Copying from papers of other students, collaborating on exams, and use of notes or references that are not explicitly permitted, are obvious forms of cheating that will be dealt with by referral to the Discipline Committee. Phones of any kind are not permitted in the exam room and anyone found with a phone during the exam period (either within or outside the exam room) will be given a grade of zero on the exam. Any student found at any location outside the exam room during the exam (except the restroom), without explicit permission, will also receive a grade of zero for that exam.

Topics Covered:

- 1) Introduction
 - Dimensions and units
 - Vector calculus, Dirac delta function
- 2) Introduction to Electrostatics (Jackson chapter 1)
 - Coulomb's Law
 - Electric field
 - Gauss's Law
 - Curl of \vec{E}
 - The Electric Potential
 - Poisson's Eq. and Laplace's Eq.
 - Boundary conditions on \vec{E} and Φ
 - Uniqueness Theorem
 - Method of Green's functions
 - Electrostatic Energy
- 3) Boundary Value Problems in Electrostatics I (ch. 2)
 - Method of Images
 - Relation of method of images to method of Green's functions
 - Expansions in Orthonormal functions
 - Laplace's Eq. in Rectangular Coordinates
- 4) Boundary Value Problems in Electrostatics II (ch. 3)
 - Laplace's Eq. in Spherical Coordinates
 - Expansion of Green's functions in Spherical Harmonics
 - Laplace's Eq. in Cylindrical Coordinates
- 5) Multipoles, Electrostatics of Macroscopic Media, Dielectrics (ch. 4)
 - Multipole Expansion
 - Macroscopic Electrostatics in Media
 - Boundary value problems with Dielectrics
 - Models for Molecular Polarizability
 - Energy in Dielectrics
- 6) Magnetostatics (ch. 5)
 - Currents and Current Densities
 - Biot-Savart Law
 - Vector Potential
 - Magnetic Dipole Moment
 - Macroscopic Equations of Magnetostatics in Media
 - The \vec{H} field
 - Boundary value problems in Magnetostatics
- 7) Maxwell's Eqs. (end of ch. 5 and beginning of ch. 6)
 - Faraday's Law
 - Maxwell's Displacement Current
 - Potentials and Gauge Transformations
 - Green's Functions for the Wave Equation
 - Macroscopic Equations in Media