Physics 422
Fall Semester 2016
MWF 11:10 – 12:00, LL 311

Instructor: John Huennekens
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Lab LL 256
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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
Zangwill "Modern Electrodynamics"
Griffiths "Intro to Electrodynamics"
Marion "Classical Electromagnetic Radiation"

Grading: Homework – 25%
Midterm – 25%
Final Exam – 50%

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, Williams Hall, Suite 301 (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.

The Principles of Our Equitable Community: Lehigh University endorses The Principles of Our Equitable Community (http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

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) Review
   quick review of statics – chapters 1-5
2) Review of Maxwell's Eqs., wave equation, and gauge transformations (ch. 6)
3) Macroscopic fields in materials, Energy and momentum in electrodynamics (ch. 6)
4) Reflection and Refraction, classical model for ε, MHD and plasmas (ch. 7)
5) Wave Guides & Resonant Cavities (ch. 8)
6) Radiating Systems, Antennas (ch. 9)
7) Scattering & Diffraction (ch. 10)
8) Relativity (chs. 11 & 12, but mostly class notes)
9) Collisions Between Charged Particles (ch. 13)
10) Radiation By Moving Charges (ch. 14)

Required Initial Competencies

Students are expected to enter the class with graduate level understanding of Electrostatics and Magnetostatics and with a junior/senior undergraduate level understanding of Electrodynamics. A solid understanding of vector calculus and methods of solution of ordinary and partial differential equations is also expected.

Final Competencies

1) Students should understand how electromagnetic radiation carries energy and momentum.
2) Students should be able to solve Maxwell's equations and understand conceptually and mathematically how electromagnetic radiation propagates in vacuum, in dielectric materials, in conducting materials, and in wave guides.
3) Students should understand conceptually and mathematically how electromagnetic radiation is produced by accelerating charges.
4) Students should understand scalar diffraction theory and the scattering of electromagnetic radiation including the polarization properties of scattered light.
5) Students should have a solid understanding of special relativity using a four-vector notation. They should be able to write the Lorentz force and Maxwell's equations in a manifestly covariant form and be able to use mathematics to show how electric and magnetic fields transform under Lorentz transformations.
6) Students should be able to solve problems involving collisions or decay of relativisitic particles using conservation of 4-momentum.
7) Students should understand the emission of electromagnetic radiation from charged particles in arbitrary motion with relativistic or non-relativistic velocities.