FALL 2017

Physics 406: Electricity and Magnetism II

Tu Th 12:30-1:45 pm, Rm. 184

Instructor: S. PRASAD, Rm 1119, 277-5876, sprasad@unm.edu

As the second course of the two-course sequence on electromagnetism (E&M) at the advanced undergraduate level, Physics 406 will focus on physical phenomena involving the propagation, interaction, and sources of time-dependent electromagnetic fields. The concepts and mathematical methods you learned in Physics 405 will be vital to your understanding of the time-dependent phenomena that we plan to cover this semester. The material will continue to be rigorous, at roughly the same level as the first course, both conceptually and mathematically, but you should not need any additional mathematical background to master it.

I will continue to use D. Griffiths' "Introduction to Electrodynamics," 4th edition, as the main text for the course for the same reasons for which I chose it for the first course and for the sake of continuity. The text provides not only the best introduction to electrodynamics at the advanced undergraduate level of all the texts with which I am familiar, but it also contains a vast collection of useful problems that clarify and illustrate the subject at multiple levels from multiple viewpoints and a wealth of references to more contemporary didactic material, typically published in the American J. of Physics. Occasionally I shall supplement my presentation with discussions drawn from other texts, most notably R. Feynman's "Lectures in Physics," vol. II; and Reitz, Milford, and Christy's "Foundations of Electromagnetic Theory." This class will cover the rest of Griffiths' text, essentially Chapters 7 through 12, more or less completely. You can expect to gain an excellent working knowledge of advanced electromagnetism that will serve you well in many of your classes at the graduate level in physics and astrophysics.

Problems Class - Listed officially as Phyc 416.001 (CRN: 35469; W 3:00-3:50 pm, Rm 184), this is an important adjunct to the main lecture class. I cannot emphasize enough the importance of the problems class, and I strongly encourage you to enroll in it as well since it will provide you additional practice with solving problems beyond your homework assignments and self study. I will send you a list of problems that we will work on at least a day or two in advance of each problem session. The class will also give you a valuable opportunity to bring to my attention your difficulties with any concepts covered in the lecture class so I can address them in a group setting. Most of you know about these benefits well from your previous semester.

Web-Based Course Materials - All course materials, including lecture notes, HW assignments, solutions, problem session notes, and supplements, if any, will be posted electronically on the course web page at physics.unm.edu/Courses/Prasad/Fa17/P406/. The passwd for the page is lobo406.

Grading - The grading in the course will be based on your performance in homework (HW) assignments (25%), two mid-term (MT) exam scores (20% each), and a final exam (35%). There will be 9-10 assigments in all with about 4-6 problems each. The exams will be all closed-book, but you will be allowed the use of a single sheet of personal notes for each MT exam and three sheets for the final exam. The MT exams are tentatively scheduled for two Thursdays, Sep 21st and Nov 2nd, during (slightly extended) class time, and the final exam will be held on Thursday, Dec 14th, at 10 am - 1 pm.

Travel - As of now, I will be on travel on two different occasions during the semester, which will mean missed lectures and problem sessions that I will attempt to make up over the semester. My scheduled dates of absence are Sep 19 and 20; and Nov 21 and 22.

Required Text - *Introduction to Electrodynamics* by David Griffiths, 4th ed.

TA - Vahid Karimi (contact email: vkarimi@unm.edu)

Office Hrs: *Instructor's* – Tu Th 2:30 - 3:30 pm or by appointment;
TA's – to be determined

Schedule of Topics

- *Electrodynamics* (6 lectures)
  Electromotive force
  Electromagnetic induction
  Maxwell's equations
- *Conservation Laws* (2 lectures)
  Charge and energy
  Linear and angular momentum
- *Electromagnetic Waves* (6 lectures)
  Waves in one dimension
  EM waves in vacuum
  EM waves in matter and at boundaries
  Absorption and dispersion
  Waveguides
- *Potenials and Fields* (5 lectures)
  Scalar and vector potentials
  Continuous distributions and retarded potentials
  Moving point charges, Liénard-Wiechert potentials, and EM fields
- *EM Radiation* (6 lectures)
  Electric and magnetic dipole radiation
  Radiation from an arbitrary source
  Power radiated by an accelerated point charge
  Radiation reaction and damping
- *Electrodynamics and Special Relativity* (3 lectures)
  Special theory of relativity
  Relativistic electrodynamics