Advanced Electromagnetic Theory

PHYS 5333, Spring 2009

Instructor: Reeta Vyas (Office: Physics 210; rvyas@uark.edu; Ph: 575-6569)
http://physics.uark.edu/em/

Place & Time: PHYS 132, Tues., Thurs., 12:30 pm- 1:50 pm.
Office Hours: Tues. Thurs. 9:30-10:30 am, Walk-in or by appointments

MATH BACKGROUND: Theorems of vector calculus, ordinary linear differential equations, special functions (Legendre, Laguerre, Hermite, Bessel functions, etc.), asymptotic forms, completeness and orthogonality, partial differential equations, boundary value problems, Green's function, summation of series, Fourier series, use of Mathematica /Maple

HOMEWORK: Problem solving is a central part of physics. By solving problems we gradually come to a real understanding of the subject. Physics is a subject for "understanding" and this understanding comes by asking puzzling questions about what is going on out there, and working out how to answer them. Sometimes struggling with problems is a way to develop an understanding of a concept. It is very important that you learn the technique and the method to analyze situations. By analyzing and solving many problems we begin to develop and intuitive feel for physics. I can assure you that you are in for a pleasant surprise for you will begin to make sense out of this world based upon the concepts that you learn in this course.

You will be assigned homework problems selected from various books. The homework problems are designed to stimulate this process of inquiry. If you have any difficulty, feel free to discuss with me. Solutions to the difficult problems will be available for you to consult in the physics library.

GRADING: Your final grade will be computed from **homework** problems, **two midterm** and **one comprehensive final** exams. It will be computed from points weighted as follows:

Homework	20 %		
Two midterm exams	50 %	Exam I: Feb. 26,	Thurs. 12:30 pm-1:50 pm
Final	30 %	Exam II: April 9,	Thurs. 12:30 pm-1:50 pm
		Final: May 4,	Mon. 10:00 am-12:00 noon

Grading Scale: 85-100 A, 70-84 B, 55-69 C, 40-54 D, 0-39 F
Help Session (6:00-7:00 pm): Feb. 25, April. 8

REFERENCES: **(Textbook) Classical Electrodynamics,** by J. D. Jackson (John Wiley, New York, NY 1998).
Introduction to Electrodynamics, by David J. Griffiths (Prentice Hall, NJ 1999).
Modern Problems in Classical Electrodynamics, C.A. Brau (Oxford Univ. Press, NY 2004).
Electrodynamics of Continuous Media, by L. D. Landau and E. M. Lifshitz (Pegamon, New York 1960).
Classical Electricity and Magnetism, by W. K. H. Panofsky and M. Phillips (Addison-Wesley, Cambridge, MA 1962).
Electromagnetism, Principles and Applications, by Paul Lorrain and Dale R Corson (Plenum Press, 1998).
Foundation of Electromagnetic Theory, John R. Reitz, Frederick J. Milford, and Robert W. Christy (Addision-Wesley, Reading, MA 1979).
Electricity and Magnetism, Berkley Physics Course Vol-2, Edward M. Purcell; **Mathematical methods for Physicists,** by George Arfken (Academic Press, San Diego CA 1985); **Tables of Integrals, Series, and Products,** by I. S. Gradshteyn and I. M. Ryzhik (Academic Press, NY 1965); **Handbook of Mathematical Functions**, by M. Abramowitz and I. A. Stegun.

TOPICS TO BE COVERED

Magnetostatic (From PHYS 5073), Time dependent fields, energy in electromagnetic fields, Maxwell's equations, Poynting's Theorem, electromagnetic waves in free space (plane waves, beams, anisotropic media, polarization), wave propagation in bounded regions, reflection and refraction, guided wave propagation (RF waveguides, resonators, and fibers); nonrelativistic radiation (electric dipole, magnetic dipole, and electric quadrupole radiation), diffraction and scattering of electromagnetic waves; special relativity.

HOW TO SUCCEED IN ADVANCED ELECTROMAGNETIC THEORY

(a) **Before coming to the class** read all the materials that are likely to be discussed in the class. Some topics will be confusing on first reading, but don't worry about it. Just note the areas that you have trouble with and ask me.

(b) Studies show that students who attend the lectures perform better in the course. Good students (with grade point average > 3.2) generally miss at most one or two lectures during the semester. This recommends that **attend your classes**. **Stay alert and focused in the class**. Participate in the class discussion and actively involve yourselves in thinking. Take brief notes in the class. In the class you may be able to resolve the confusion you had earlier. If things are still confusing feel free to discuss with me in the class or during my Office Hours.

(c) **After the class** re-read the materials covered in the class and make sure that you understand them. Also prepare for the next class. One way to improve your understanding is to make your own notes. All these will take time and so study regularly not just before exams.

(d) Solve all the assigned **homework problems**. Problem solving is a central part of physics by solving problems you will gradually come to a real understanding of the subject. Physics is a subject for "understanding" and this understanding comes by asking yourself puzzling questions about what is going on out there, and working out how to answer them. The homework problems are designed to stimulate this process of inquiry. Struggling (sometimes) with problems is the way to develop this "understanding."

You will be assigned homework problems selected from the textbook. If you have any difficulty help may be obtained from your lab instructor or me. Please note that some of the problems will appear in your exams.

(e) Few days before each exam a special review session will be organized. If there is sufficient demand, we will also have another review session. In the exam read questions carefully, relax, and do your best.

INCLEMENT WEATHER POLICY

I will follow University's Weather Inclement Policy. However, if weather is bad (Fayetteville Public Schools are closed) and exam is scheduled on that day, I will postpone the exam.