Physics 622
Syllabus

1/24/2011

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Office hours: call to make sure I am in, MWF afternoons and TTh all day.

Text: *Classical Electricity and Magnetism,* Panofsky and Phillips, Dover Publications, Mineola, New York (2005) - re-publication of the Second Edition of the text

Suggested references:

Wyld, *Mathematical Methods for Physics,* Perseus books (1999)
Griffiths, *Introduction to Electrodynamics*, Addison Wesley(1999)
Abramowitz and Stegun, *Handbook of Mathematical Functions*, Dover
Jackson, *Classical Electrodynamics,* John Wiley & Sons

Grading:
    3   Tests
    2   Homework and Pop Tests
    2   Final
    7

100-87.5	A
87.5-75	B
75-62.5	C
62.5-50	D
<50	F

Academic Regulations:

Regular attendance is expected. Every class is important. Please do not come late. Homework is to be turned in at the beginning of class.

Goals:

To develop an understanding of Electricity and Magnetism and to develop your math skills as applied to physics.

In this semester we study the interaction of electromagnetic fields with charges. First we develop the electromagnetic wave equation with sources and study multipole radiation. Next, we develop the kinematic relations of special relativity and introduce the idea of covariance to the formulation of relativistic electromagnetics. This idea is used to study the electromagnetic fields of moving and accelerating charges. Then the charges and fields are treated in unison to develop equations of motion for charged particles. The equations of motion are then solved in order to investigate the interaction of radiation with charged particles for the purpose of studying scattering and dispersion.

Expectations:

You are expected to read the text material before class and after class. It is expected that you will be able to reproduce any derivation presented on tests and the exam. I highly recommend that you take notes in class and annotate or recopy these notes after class so that you can use these notes to study. The problems in this course are similar to and often derived from research problems. Solving these will develop your ability to do independent research. Some of the homework problems are difficult. You should start working on the problems early so that if you need to read other texts or go to the library you will have time to do so.

University of Mississippi Creed:

The University of Mississippi is a community of learning dedicated to nurturing excellence in intellectual inquiry and personal character in an open and diverse environment. As a voluntary member of this community:

I believe in respect for the dignity of each person

I believe in fairness and civility

I believe in personal and professional integrity

I believe in academic honesty

I believe in academic freedom

I believe in good stewardship of our resources

I pledge to uphold these values and encourage others to follow my example.

The syllabus below is subject to change to accommodate instruction and/or student needs.

Date	Chapter	Homework Due
Jan 24	Spherical waves 13-8	
Jan 26	Scattering 13-9	
Jan 28	Wave equation, Fourier analysis 14-1,2	
Jan 31	Radiation fields 14-3	Worked exam due
Feb 2	Radiated energy 14-4	
Feb 4	Hertz potential and methods 14-5,6	
Feb 7	Electric dipole radiation, multi-poles 14-7,8	Problem Ch 13
Feb 9	Multipole radiation 14-8	
Feb 11	Energy and angular momentum of radiation 14- 9	
Feb 13	Background, Relativistic kinematics 15-6, 16-1,2,3	
Feb 15	Lorentz transformation, geometric interpretation 16-3,4	
Feb 17	Velocity transformation, Lorentz transform of 4 vector 16-5,17-1	Problem set Ch 14
Feb 21	Tensor relations, conservation of momentum 17-2,3	
Feb 23	Energy and momentum transform, Minkowski force 17-4,5	Test 1.
Feb 25	Collisions, 4 vectors for collisions 17-6,7	
Feb 28	Covarient formulation of electrodynamics 18-1,2	Problem set Ch 16
Mar 2	Electromagnetic field tensor, Lorentz force 18-2,3	
Mar 4	Test 1 and Homework discussion	Last day to drop
Mar 7	Lienerd-Wiechert potentials, uniformly moving charge 19-1,2	Problem set Ch 17
Mar 9	Direct solution of wave equation, convection potential 19-3,4	
Mar 11	Radiation from an accelerated charge 20-1	Problem set Ch 18
Mar 13-20	Spring break	
Mar 21	Radiation at low velocity 20-2	
Mar 23	Radiation for velocity and acceleration parallel 20-3	Problem set Ch 19
Mar 25	Radiation from circular orbits, arbitrary velocity and acc. 20-4,5	
Mar 28	Problem discussion Ch 15-19	
Mar 30	Test 2 Ch 15-18	Test 2
Apr 1	Bremsstrahlung 20-6	
Apr 4	Cerenkov radiation 20-7	
Apr 6	Radiation reaction, transform of free radiation field 21-1,2	
Apr 8	Electromagnetic energy and mass 21-4,5	
Apr 11	Reaction, direct computation from retarded fields 21-6,7	Problem set Ch 20
Apr 13	Covarient description of mechanical properties 21-8,9	
Apr 15	Radiation, scattering and dispersion, Damped SHO 22-1	
Apr 18	Forced vibrations, scattering by free electrons 22-2,3	
Apr 20	Scattering by bound electrons, absorption of radiation 22-4,5	Problem set Ch 21
Apr 22	Good Friday holiday	
Apr 25	Volume distribution of scatterers 22-7	
Apr 27	Problem discussion, review	
Apr 29	Test 3	Test 3
May 2	Rayleigh scattering, dispersion 22-8,9	
May 4	Results form 22-10 general theorem on scattering	Problem set Ch 22
May 6	Questions, discussion	
May 9	Final Exam 8:00am	