

Electromagnetic Theory

PHY 355.001 --- Fall 2012 Syllabus
Physics Department --- Mercer University

Text: Introduction to Electrodynamics, 3rd ed. by David J. Griffiths
Class Meetings: MW 3-4:15pm, SEB 140
Instructor: Dr. Jose L. Balduz Jr
email: balduz_jl@mercer.edu
office: Science & Engineering Bldg (SEB) 205, **phone:** 478-301-2229
office hours: MW 12-1, F 12-2, or by appointment (or try email)...

This is an intermediate course in the theory of electric and magnetic phenomena, for junior or senior level students. It is intended primarily for physics majors, but should be of interest also to students in mathematics, chemistry, computer science and engineering. Prerequisites are PHY 161/162 General Physics I&II, MAT 293 Multivariable Calculus, and MAT 330 Introduction to Differential Equations, or their equivalent. Students are therefore assumed to know some basic physics, and to be able to use vector calculus and simple differential equations. Other advanced mathematical tools are introduced in the course.

The bulk of the course material will be selected from chapters 1-7 on vector analysis, static electric and magnetic fields in vacuum and in matter, mathematical techniques, and electrodynamics. Additional topics from chapters 8, 9 and 12 on electromagnetic waves, conservation laws, and the relationship of electrodynamics to special relativity will be covered as time allows. The goal is for students to go beyond conceptual understanding of these topics, becoming able to perform nontrivial analysis and calculations which go beyond the level of an introductory physics course.

Lectures: Much of the class meeting time will be devoted to conventional lectures and discussion. We will go over the text in detail, including derivations and examples, as well as homework and exam problems.

Homework: The instructor will assign sets of homework problems to be worked by the students and handed in for grading. There will be one set for each of chapters 1-7, and one set for the remaining material, for a total of eight homework sets (Please see schedule.). Students are encouraged to collaborate on these; however, each must hand in their own separate papers. After the papers are collected, a solution sheet will be provided. Altogether, the homework will count for 80% of the total grade.

Final Exam: This will be a take-home exam, due on the official final exam day of **Saturday 12/15 at 5pm**. It will cover Chapters 1-7 and will count for 20% of the total grade. For this exam, students may not collaborate. Each student is limited to using only the Griffiths textbook (and other texts as approved by the instructor), their own class notes, and consultation with the instructor.

Grading: The percentage for each activity is shown in the left table below. To convert the total percent to a letter grade, use the scale shown in the right table below.

	#	total %
Homework sets	8	80
Final Exam	1	20
		Total: 100

	GP	%
A	4.0	90-100
B+	3.5	85-89
B	3.0	80-84
C+	2.5	75-79
C	2.0	70-74
D	1.0	60-69
F	0.0	0-59

TEXTBOOK: **Introduction to Electrodynamics**, 3rd edition, by David J. Griffiths, Prentice Hall (1999), ISBN: 0-13-805326-X.

1. **Vector Analysis.** Vector Algebra, Differential Calculus, Integral Calculus, Curvilinear Coordinates, Dirac Delta Function, Theory of Vector Fields.
2. **Electrostatics.** Electric Field, Divergence and Curl of Electrostatic Fields, Electric Potential, Work and Energy in Electrostatics, Conductors.
3. **Special Techniques.** Laplace's Equation, Method of Images, Separation of Variables, Multipole Expansion.
4. **Electric Fields in Matter.** Polarization, Field of a Polarized Object, Electric Displacement, Linear Dielectrics.
5. **Magnetostatics.** Lorentz Force Law, Biot-Savart law, Divergence and Curl of B, Magnetic Vector Potential.
6. **Magnetic Fields in Matter.** Magnetization, Field of a Magnetized Object, Auxiliary Field H, Linear and Nonlinear Media.
7. **Electrodynamics.** Electromotive Force, Electromagnetic Induction, Maxwell's Equations.
8. **Conservation Laws.** Charge and Energy, Momentum.
9. **Electromagnetic Waves.** Waves in One Dimension, Electromagnetic Waves in Vacuum, Electromagnetic Waves in Matter, Absorption and Dispersion, Guided Waves.
10. **Potentials and Fields.** Potential Formulation, Continuous Distributions, Point Charges.
11. **Radiation.** Dipole Radiation, Point Charges.
12. **Electrodynamics and Relativity.** Special Theory of Relativity, Relativistic Mechanics, Relativistic Electrodynamics.

Miscellaneous policies:

If changes to this syllabus are necessary, they will be implemented after discussion and negotiation with the students. Note that the accompanying course schedule is not a part of the syllabus: it is tentative and subject to revision, including all due dates.

Homework assignments are always due on the stated due date: However, they will not be considered late as long as they are turned in before the next sunrise. Beyond that, any late homework sets will suffer a 5% penalty per day (excluding weekends and holidays) until they are handed in: i.e., 5% on the first day, 10% on the second day...

If a student does not turn in the Final Exam by Sa 12/15 at 5pm, that student will have a grade of zero for the exam.

There will be no dropped grades. All work done in the course will be counted. There will be no extra-credit work.

The College of Liberal Arts' academic misconduct policy will be followed. In addition, all students are bound by the Mercer University Honor Code.

Students are *strongly encouraged* to discuss with the instructors all their work during the course, *regardless of their grades*. Questions about point awards should be brought up as soon as possible, as all grades will be final *one week* after the materials are graded and returned to the students.

Students requiring accommodations for a disability should inform the instructor at the close of the first class meeting or as soon as possible. The instructor will refer you to the Disability Support Services Coordinator to document your disability, determine eligibility for accommodations under the ADA/AA/Section 504 and to request a Faculty Accommodation Form. Disability accommodations or status will not be indicated on academic transcripts. In order to receive accommodations in a class, students with sensory, learning, psychological, physical or medical disabilities must provide their instructor with a Faculty Accommodation Form to sign. Students must return the signed form to the Disability Services Coordinator. A new form must be requested each semester. Students with a history of a disability, perceived as having a disability or with a current disability who do not wish to use academic accommodations are also strongly encouraged to register with the Disability Services Coordinator and request a Faculty Accommodation Form each semester. For further information, please contact Carole Burrowbridge, Disability Services Coordinator, at 301-2778 or visit the Disability Support Services website at <http://www.mercer.edu/studentaffairs/disabilityservices>

All requests for reasonable accommodation are welcome also in regard to absence from class for school representation (i.e., athletic or other events) or personal/family problems. *Let's talk about it...*

PHY 355 --- Fall 2012 --- Professor Balduz --- SEB 205

Day			Topic	Assignments
1	W	Aug 22	Vector Analysis 1.1-1.6 (54p, 4d)	
2	M	27		
3	W	29		
<i>Sep 3 Labor Day Holiday</i>				
4	W	5		Hw Ch. 1 due F 9/7
5	M	10	Electrostatics 2.1-2.5 (49p, 4d)	
6	W	12		
7	M	17		
8	W	19		Hw Ch. 2 due F 9/21
9	M	24	Special Techniques 3.1-3.4 (45p, 4d)	
10	W	26		
11	M	Oct 1		
12	W	3		Hw Ch. 3 due F 10/5
13	M	8	Electric Fields in Matter 4.1-4.4 (37p, 3d)	
14	W	10	<i>(mid-term)</i>	
<i>Oct 11-12 Fall Break</i>				
15	M	15		
16	W	17	Magnetostatics 5.1-5.4 (45p, 4d)	Hw Ch. 4 due T 10/16
17	M	22		
18	W	24	<i>(last day to withdraw F 10/26)</i>	
19	M	29		
20	W	31	Magnetic Fields in Matter 6.1-6.4 (27p, 2d)	Hw Ch. 5 due T 10/30
21	M	Nov 5		
22	W	7	Electrodynamics 7.1-7.3 (48p, 4d)	Hw Ch. 6 due T 11/6
23	M	12		
24	W	14		
25	M	19		Hw Ch. 7 due T 11/20
<i>Nov 21-23 Thanksgiving Holiday</i>				
26	M	26	Conservation Laws 8.1 (5p, 0.5d)	FINAL EXAM handout M 11/26
27	W	28	Electromagnetic Waves 9.1-9.2 (18p, 1.5d)	
28	M	Dec 3	Electrodynamics and Relativity 12.3 (21p, 2d)	
29	W	5		Hw Ch. 8/9/12 due F 12/7
Saturday, December 15, 5pm: Final Exam Due, Ch. 1-7				