

Physics 446/546-1B Electromagnetic Theory II Spring, 2005

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| Lecture: | MWF 9:00 - 9:50 am | Instructor: | Harrison |
| Room: | 396 Campbell Hall | Office: | 308 CH |
| Textbook: | <u>Introduction to Electrodynamics</u> (3 rd edition) by David J. Griffiths | Hours: | MF 1:30 - 2:30 |
| | | e-mail: | jgharrison@uab.edu |
| Grading: | Exam I (15%) | Exam II (20%) | Exam III (20%) |
| | Homework (15%) | Project (10%) | |
| | Final Exam (20%) | Mon., May 2, 8:00 am - 10:30 am | <u>comprehensive</u> |

Graduate students enrolled in PH546 are assumed to have had more exposure to introductory physics concepts and are expected to utilize this in answering homework and exam questions. This expectation is reflected in the assignment of partial credit on exams and homework. When comparing scores on exams and homework with undergraduates enrolled in PH446, keep that difference in mind.

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|---------------------|------------|-----------|-----------|-----------|--------|-----------------------|
| Grade Scale: | 100 – 90 A | 89 – 80 B | 79 – 70 C | 69 – 60 D | < 60 F | undergraduate student |
| | 100 – 90 A | 89 – 80 B | 79 – 70 C | | < 70 F | graduate student |

You may bring one (1) 5” x 8” notecard with formulas, equations, examples, etc for reference during each exam. Notecard **MUST** be turned in with the exam.

Course Web page: <http://homework.phy.uab.edu/~harrison/phys446>

Withdrawing From This Course

Undergraduates may withdraw from a course with a grade of “W” up to and including March 8, 2005. After that date you may not withdraw. See the 2004-2006 Undergraduate Catalog (<http://www.catalog.uab.edu/show.asp?durki=58266>) for the full text of this policy.

Topics / Objectives:

Electromagnetic induction, electrodynamics, conservation laws, electromagnetic waves, wave-guides and propagation, radiation, special relativity, computational electromagnetics.

The objectives of the course are (i) to study electrodynamics at an intermediate level; (ii) to develop the ability to employ mathematical techniques for solving problems in E&M as well as other areas of physics; (iii) to develop problem solving skills; (iv) to provide remedial instruction in E&M for graduate students.

Project:

You will work as teams on a problem of your own design addressing one of four topic areas listed below. You may use any computational tool including one of your own design. Two methods in particular (finite element and finite-difference time-domain) can be used to study problems of wave propagation and radiation, as well as magnetic induction. A variety of codes are available at <http://emlib.jpl.nasa.gov/EMLIB/files.html>. You may wish to use *Maxwell-SV* (Ansoft Corp.), *Student Quickfield* (Terra Analysis Corp), or the suite of programs, *TriComp Educational (TCE)* (Field Precision) which are software available at no cost on the internet, (www.ansoft.com, www.quickfield.com, and www.fieldp.com). Note that while TCE and Quickfield have some capabilities in regard to EM induction, they have limited or no capability for radiation problems. Maxwell SV (Ansoft) offers greater flexibility for ac problems. One member will make an oral report (15min) on the last day of class in lieu of a written report; other members will submit a written report. The team must submit a working title and abstract by 5pm, March 23.

Topic Areas:

- 1) Electromagnetic Induction : Mutual induction / self induction
- 2) Radiation from a dipole antenna or antenna arrays
- 3) EM energy absorption / scattering by an object
- 4) Wave propagation in a waveguide

Syllabus:

The following syllabus is tentative. You are responsible for any changes which may be announced during the lecture period, such as changes in exam dates or chapters to be included on an exam

Syllabus

| Week | Mon. | Wed. | Fri. | Assignments | CH | Due |
|---------|-------------------------------|-----------------|-----------------------------|---------------------------|----|----------|
| Jan. 2 | No Class | 7.1 | 7.1 - 7.2 | | | |
| Jan. 9 | 7.2 | 7.2 | 7.3 | 1, 2*, 5*, 7*, 8, 12*, 18 | 7 | Jan. 14 |
| Jan. 16 | No Class | 7.3 | 7.3 | | | |
| Jan. 23 | 8.1 | 8.1 | Exam I (Ch 7) | 22, 24*, 25, 29*, 50*, 53 | 7 | Jan. 24 |
| Jan. 30 | 8.2 | 8.2 | 9.1 | 2*, 4*, 5* | 8 | Feb. 4 |
| Feb. 6 | 9.1 | 9.1 – 9.2 | 9.2 | | | |
| Feb. 13 | 9.2 – 9.3 | 9.3 | 9.3 | 2*, 3, 6, 9*, 12* | 9 | Feb. 18 |
| Feb. 20 | 9.3 | 9.3 – 9.4 | 9.4 | | | |
| Feb. 27 | 9.4 | 9.4 – 9.5 | 9.5 | 13, 15*, 17, 19, 20* | 9 | Feb. 28 |
| Mar. 6 | 9.5 | 9.5 | 9.5; 10.1 | | | |
| Mar. 13 | 10.1- 10.2 | 10.2 | Exam II (Ch. 8,9) | 23, 24*, 25*, 27, 30*, 37 | 9 | Mar. 14 |
| Mar. 20 | 10.3 | 10.3; 11.1 ‡ | 11.1 | 2*, 3, 5*, 7* | 10 | Mar. 21 |
| Mar. 27 | Spring Break | | | | | |
| Apr. 3 | 11.1 (skip 11.2) | 12.1 | 12.1 | 11*, 12, 13*, 18, 25* | 10 | Apr. 4 |
| Apr. 10 | 12.2 | 12.2 | Exam III (Ch. 10,11) | 3*, 4, 6*, 10* | 11 | Apr. 11# |
| Apr. 17 | 12.3 | 12.3 | 12.3 | 4*, 7*, 12, 20, 29* | 12 | Apr. 20 |
| Apr. 24 | Proj. Reports; 12.3 | No Class | | 46, 51, 62, 66, 67 | 12 | Apr. 25 |
| May 1 | Final Ex. 8 – 10:30 am | | | | | |

* problems to be graded # no extension

Homework: due by 12noon sharp on due date. Late penalty as follows:

before noon on due date + 1 25% deduction (score * 0.75)

before noon on due date + 2 75% deduction (score * 0.25)

after noon on due date + 2 no credit

(**EXCEPTION:** Last Problem Set : not graded)

‡ **Project title and abstract due**