PHYS 345: Electricity and Magnetism I
Fall 2006

Teacher: Dr. Kelly Krieble Office: Room 109, Collier Hall of Science Phone: ext. 1437 e-mail: krieblek@moravian.edu	Classroom: CHS 123 M,W,F 9:10-10 Lab: CHS 107 W 12:45-3:45 Office Hours: By appointment

Goals of the course:

The primary aim of this course (and its second semester counterpart PHYS346) is to provide students with a working knowledge of the concepts of electromagnetism and to prepare them for graduate school or industry. This first semester course will concentrate on electrostatics and the fields of stationary charge distributions and steady currents. Since electromagnetic theory uses the idea of the vector field, students will learn the mathematics of vectors and vector operators. Students will be able to determine the electric field for a variety of charge/conductor/insulator distributions using a number of different techniques: Coulomb's and Gauss's Law, Laplace's and Poisson's equations, the method of images, energy concepts, and numerical techniques. In the laboratory portion of the course, the students will learn a variety of experimental techniques that will complement the theoretical ideas introduced throughout the course.

Course Text: Introduction to Electrodynamics, 3rd ed., Griffiths

Course Content and Schedule of Topics:

Topic	*Approximate Time Span*	*Readings*
Course introduction and review of Physics 111-112	1 day	PHYS112 notes
1. Vectors a. Vector operations b. Div, Curl, Grad, Laplacian c. Divergence Theorem, Stokes Theorem d. Coordinate systems	1 week	1.1-1.4
2. Electrostatics a. Coulomb's law b. Electric field, potential c. Gauss' Law	1 week	2.1-2.2
3. Laplace and Poisson equations a. Charge distributions b. Conductors	1 week	3.1, 2.5
4. The electric dipole and multipoles	1 week	3.4
5. Electric potential a. Energy density b. Forces on conductors c. Capacitors	1 week	2.3
6. Electric polarization a. Electric Susceptibility b. Electric Displacement c. Interior and exterior fields	1 week	4.1
7. Charge distributions and dielectrics a. Potential energy b. Forces c. Boundary conditions	4 weeks	4.2-4.4
8. Method of Images a. Uniqueness theorem b. Complex variables c. Solutions to Laplace's equation	3 weeks	3.2
9. Coordinate Systems and Boundary Conditions	1 week	3.3

Grading Policy:

A = 90%-100%
B = 80%-89%
C = 70%-79%
D = 60%-69%
F = below 60%

Assessment:	% Weight
Homework Problems	30
Labs	20
Project	10
Quizzes	20
Final Exam	20

Homework Problems:

As illustrated above, the problem sets constitute a major portion of your grade. Your work on these problem sets will be bound by the Moravian College Policy on Academic Honesty in the Student Handbook. The due dates for each assignment will be stated when the assignment is handed out. There will be a 50% deduction for tardy work up until solutions to the homework are posted in the periodical room (CHS 117). Work submitted after that time will receive a zero.

Projects:

To augment your overall learning experience and provide an experimental (and presentation) aspect to the course, you will be required to complete one project during the term. The project may be selected from several options, giving you an opportunity to work on a project of your choice. All projects MUST be discussed with your instructor and given an OK before they are started. Your options:

1. A theoretical examination of a non-trivial distribution of charges, with the calculation of equipotential lines (surfaces) and electric field lines created by such a distribution. Can be done analytically or numerically using a computer.
2. Write a review paper (at least 5 pages in length) on a current topic in E&M.
3. Review and present an appropriate AJP article to the class.
4. Develop, construct, and run an experiment to be used in future years.

Labs:

We will meet every week for lab, although we will probably not do a lab every week. Expect to perform and write up a lab every two weeks. I will brief the entire class on the weekly lab that you may perform as a group or individually at your leisure. In addition, I will also utilize the lab period to review problem sets and give quizzes.

Quizzes:

Approximately every two weeks a quiz of one or two problems will be given at the beginning of the laboratory period.

Final comprehensive exam:

An exam on all material covered during the semester.

Attendance Policy:

Students are expected to come to class. To that end, I WILL take attendance, and reserve the right to raise/lower your grade based on your attendance.

Good luck in the coming year. Should you have any comments about the class during the semester, please feel free to discuss them. I will welcome any suggestions for improving the course. Since I am looking for you to do your best work, you should demand excellence from me as well.

Subject to revision