Spring 2022 Syllabus

PHYS 407, Electromagnetic Theory

Instructor: Dr. Todd Pittman
Office: Physics 318
e-mail: todd.pittman@umbc.edu
Office Hours: Wed. 2:00 – 3:30 pm

Lectures: MWF 9:00 – 9:50 am
Location: Physics 201

HW Grader: K. Szekerczes

Course Text: *Introduction to Electrodynamics* (4th edition), by David J. Griffiths.

1. Course Overview

Welcome to E&M, one of the most fascinating and important subjects in physics! We are in for an exciting adventure this semester!

Before embarking on this journey, it is comforting to note that the pedagogy for E&M is fairly standardized. As Griffiths states in the Preface of our text, "*Unlike quantum mechanics or thermal physics, there is a fairly general consensus with respect to the teaching of electrodynamics; the subjects to be included, and even their order of presentation, are not particularly controversial, and textbooks differ mainly in style and tone.*" I've certainly found this to be true, and I've certainly found the style and tone of Griffiths' textbook to be outstanding! Consequently, we'll be using Griffiths as the anchor point for our entire course, with a goal of sequentially working through Chapters 1 - 7 by early May.

This will primarily be a lecture format course, with lots of examples and discussion in class. In addition to the material in Griffiths, I'll be incorporating lots of modern applications and experiences from my own research lab. Reading the relevant Griffiths chapters, working the HW problems thoroughly, and participating in the class discussions are the keys to success.

2. Course Grading

- Homework 20%
- Exam 1 (early March) 20%
- Exam 2 (early April) 20%
- Exam 3 (early May) 20%
- Final Exam (mid-May) 20%

3. Homework

We'll have roughly 10 HW assignments throughout the semester. HW will generally be assigned on Fridays, and due the following Friday (with some variation later in the semester).

Understanding the HW problems is a key part of your learning E&M, and significant portions of the Exams will be along the lines of the HW problems. Homework will be turned in at the beginning of the class in which it is due. I cannot accept late HW, since we will discuss solutions in class.

More details on the HW expectations and grading will be provided in the "*PHYS 407 HW Guidelines and Grading Rubric*" document that will be handed out with the first HW assignment.

4. Exams

Exams 1, 2, and 3 will be standard 50-minute closed-book in-class exams. The Final Exam will also be a closed-book in-class exam; it will be a longer comprehensive exam covering material from the entire course.

5. Academic Integrity

As with all courses, Academic Integrity is required in PHYS 407:

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory.

6. Learning outcomes assessment

There are a number of educational objectives for physics students at UMBC. The 7 specific learning objectives for PHYS 407 are summarized below. By the end of this course, students should be able to:

1. Have a working understanding of vector analysis, of the physical meaning of differential operators such as the div and curl, and of related theorems such as the divergence, Gauss's and Stokes' theorems.

2. Solve problems in electrostatics that manifest an understanding of the divergence of electrostatic fields, the electric potential, and work and energy in electrostatics.

3. Demonstrate an ability to solve problems in electrostatics by solving Laplace's equation, and by using the method of images, or of separation of variables.

4. Understand electric fields in matter, through being able to solve problems involving the field of a polarized object, the electric displacement, and dielectrics.

5. Demonstrate an understanding of magnetostatics, through the ability to solve problems involving the Lorentz force and the Biot-Savart Law, as well as the divergence and curl of the magnetic field and vector potential of the magnetic field.

6. Understand magnetic fields in matter, through solving problems involving magnetization, the field of a magnetized object, the auxiliary field H, magnetic susceptibility and permeability and ferromagnetism.

7. Demonstrate an understanding of the electromotive force, the electromagnetic induction, and Maxwell's equations.

These objectives will be assessed by my observations of your participation in class discussions, as well as your performance on homework and written exams.