Physics
Adelphi University

0156-380-001
Electrodynamics
Spring Semester 2021
Professor Matthew Wright
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Office hours: M 10-12, W 9-11, F 11-12
Note: Feel free to come by at other times or make an appointment if necessary. Officially, questions via email will be answered within 24 hours. I will do my best to answer them ASAP.

SYLLABUS

TEXTS:

Introduction to Electrodynamics, 4th ed., Griffiths (Required).

Other resources:

Access to Matlab, or other scientific programming language.
Training will be provided in and after class when necessary. This software can be found in the computer lab in the physics main office.

COURSE DESCRIPTION AND PURPOSE:

In this class, we will discuss the topics of electric and magnetic fields: electrostatics, Gauss' law, LaPlace's and Poissons' equations, multipoles, dielectrics, magnetic induction, Bio-Savart and Ampere's law, magnetic properties of matter, Faraday's law, Maxwell's equations, energy and momentum, electromagnetic waves, and guided waves.

GEN ED LEARNING GOALS/DISTRIBUTION REQUIREMENTS:

N/A

COURSE PREREQUISITES:

0156-211 or 0144-244

COURSE OR MATERIALS FEES:

N/A

SCHEDULE (* subject to change):

Chapter 1 – Week 1 – Review of Math Methods

Chapter 2 – Week 2/3 – Electrostatics

Exam I on Chapter 1 & 2: Due February 24st

Chapter 3 – Week 4-6 – Potentials

Exam II on Chapter 1 - 3: March 5th

Chapter 4 – Week 7-8 – Electric Fields in Matter

Exam III on Chapter 1 - 4: March 31th

Chapter 5 – Week 9-11 – Magnetostatics

Chapter 6 – Week 12 – Magnetic Fields in Matter

Exam IV on Chapter 5: Due April 16th

Chapter 7 – Week 13-14 – Electrodyanmics

Extra Stuff (such as Chapter 9) if time.

Exam V on Chapter 5-7: TBA

The following days there will be no class: March 10, April 16, May 3

COURSE LEARNING GOALS:

- **Math/physics connection:** Students should be able to translate a physical description of a junior-year, electro-magnetism problem to a mathematical equation necessary to solve it. Students should be able to explain the physical meaning of the formal and/or mathematical formulation of and/or solution where appropriate.

- **Organized knowledge:** Students should be able to articulate in their own words the big ideas from each chapter, section, and/or lecture, thus indicating that they have organized their content knowledge. They should be able to filter this knowledge to access the information that they need to apply to a particular physical problem, and make connections/links between different concepts. At the completion of this course, students will be able to discuss in their own words the following ideas:

  Electrostatics, Gauss' law, LaPlace's and Poissons' equations, multipoles, dielectrics, magnetic induction, Bio-Savart and Ampere's law, magnetic properties of matter, Faraday's law, Maxwell's equations, energy and momentum, electromagnetic waves, and guided waves.

- **Visualize the problem:** Students should be able to sketch the physical parameters of a problem (e.g., field lines, charges), as appropriate for a particular problem.

- **Problem-solving techniques:** When faced with an electro-magnetism problem, choose and apply appropriate problem solving techniques. Transfer the techniques learned in class and through homework to novel contexts (i.e., to solve problems which do not map directly to those in the book). Justify selected approach (see "Communication" above). In addition to building on techniques learned in previous courses (e.g., recognizing boundary conditions, setting up and solving differential equations, separation of variables, power-series solutions, operator methods), students are expected to develop specific new techniques as listed in concept-scale learning goals below.

  Approximations: Recognize when approximations are useful, and to use them effectively. Indicate how many terms of a series solution must be retained to obtain a solution of a given order.

  Coordinate Systems: Recognize an appropriate coordinate system to work in for a given problem. Students will need to work be able to work in the three most important coordinate systems cartesian, spherical, and cylindrical.

  Delta (Dirac) Functions: Recognize how and when to use Dirac delta function. Students will need to have a solid feeling for what a delta function is, how to use it, and how it is defined.

  Delta (Kronecker) Functions: Recognize how and when to use delta functions in both 1D and 3D problems. Students will need to have a solid feeling for what a delta function is, how to use it, and how it is defined.

  Differential Equations: Recognize an appropriate method for finding the solution to differential equation and apply it.

  Symmetries: Recognize symmetries and be able to take advantage of them in order to choose the appropriate method for solving a problem (e.g., when parity allows you to eliminate certain solutions).

  Vector Calculus: Students will need to become comfortable with using the tools of vector calculus including but not limited to the curl, divergence, gradient, Green's theorem, and Stoke's theorem.

- **Problem-solving strategy:** Draw upon knowledge and skills to attack a problem even when a process leading to a correct solution is not yet clear. Continue to develop the ability to monitor progress towards a solution by learning how to:

  1. Backtrack and try a new approach when necessary
  2. Recognize when a solution has been reached and be able to articulate why this solution is valid (see "Expecting and Checking Solution" below)
  3. Persist through to the solution of problems requiring many steps

- **Expecting and checking solution:** When appropriate for a given problem, articulate expectations for the solution to a problem, such as:
    1. Dependence on coordinate choice
    2. Behavior at large distances
    3. Problem symmetry

    For all problems, justify the reasonableness of a solution reached, by using methods such as:
    1. Checking solution symmetry
    2. Verifying boundary conditions
    3. Order of magnitude estimates
    4. Dimensional analysis
    5. Limiting or special cases (e.g., checking the solution for correct behavior in limiting or known cases)

- **Communication.** Students should be able to justify and explain their thinking and/or approach to a problem or physical situation, in either written or oral form.

- **Intellectual maturity:** Students should accept full responsibility for their own learning. They should be aware of what they do and do not understand about physical phenomena and classes of problem. They should learn to ask sophisticated, specific questions. Students should learn to identify and articulate where in a problem they experienced difficulty and to take appropriate action to move beyond that difficulty. Finally, they should regularly check their understanding against these learning goals and seek out appropriate help to fill in any gaps.

- **Build on Earlier Material:** students should recognize and make use of connections to prior work, especially concerning mathematically tools developed in Math Methods I & II.

[*Some of these learning goals were taken from Steven Pollock's Notes.]

STUDENTS WITH DISABILITIES:

If you have a disability that may significantly impact your ability to carry out assigned coursework, please contact the Student Access Office, (formerly the Office of Disability Support Services) located in Post Hall, First Floor, 516-877-3145, sao@adelphi.edu. The staff will review your concerns and determine, with you, appropriate and necessary accommodations. When possible, please allow for a reasonable time frame for requesting ASL Interpreters or Transcription Services; a minimum of four (4) weeks prior to the start of the semester is required.*

HONOR CODE STATEMENT:

Students enrolled in this course are expected to abide by the Adelphi University Honor Code. The purpose of the Honor Code is to protect the academic integrity of the University by encouraging consistent ethical behavior in assigned coursework by students. Following is excerpted from the Student Honor Code:

The Code of Academic Honesty
The code of academic honesty prohibits behavior, which can broadly be described as lying, cheating, or stealing. Violations of the code of academic honesty will include, but are not limited to, the following:

1. Fabricating data or citations
2. Collaborating in areas prohibited by the professor
3. Unauthorized multiple submission of work
4. Sabotage of others' work, including library vandalism or manipulation
5. Plagiarism: presenting any work as one's own that is not one's own
6. The creation of unfair advantage
7. The facilitation of dishonesty
8. Tampering with or falsifying records
9. Cheating on examinations through the use of written materials or giving or receiving help in any form during the exam, including talking, signals, electronic devices, etc.

TURNITIN:

N/A

STUDENT COURSE EVALUATIONS:

During the last two weeks of the class, you will receive notification, via email and eCampus, that the course evaluation is available for your input electronically.

Availability will end at the start of the final examination period. Your feedback is valuable and I encourage you to respond. Please be assured that your responses are anonymous and the results will not be available to the instructor until after the end of the semester and therefore after course grades have been submitted. *****

Additionally, feel free to provide feedback to the instructor on the one minute paper that will be handed out during most classes. Please do not include your name on this feedback.

MOODLE:

While Moodle will be used to display sensitive material, most of the course work can be found here: https://wrightresearchlab.wordpress.com/junior-level-introduction-to-electrodynamics/

ASSIGNMENTS/COURSEWORK:

Homework:

Homework sets will be provided online Friday of each week by 4:00 pm. These homework sets will be due exactly one week later on Friday's at 4:00 pm. The day and time may change where appropriate. You may skip

one homework set without affecting your grade. Students are encouraged to work in groups and to seek outside help where appropriate; however, they must write (or type) their homework sets individually in a neat concise manner.

Each homework set will be graded for effort only not for correctness. Each problem will count as 2 points. A reasonable effort will give you 2 points. Some kind of attempt will give you 1 point. If no attempt is made, you will not receive any points for the question. Those who work through and understand their homework are most likely to succeed on the exams.

Homework is important part of you developing into a problem solver and physicist. These will require extreme work.

Here is what my peer (Steven Pollock) wrote about collaboration on assignments:

> **I strongly encourage collaboration**, an essential skill in science and engineering (and highly valued by employers!) Social interactions are critical to scientists' success - most good ideas grow out of discussions with colleagues, and essentially all physicists work as part of a group. Find partners and work on homework together. However, it is also important that you OWN the material. I strongly suggest you start homework by yourself (and that means really making an extended effort on every problem) Then work with a group, and finally, finish up on your own - write up your own work, in your own way. There will also be time for peer discussion during classes - as you work together, try to help your partners get over confusions, listen to them, ask each other questions, critique, teach each other. You will learn a lot this way!

Exams:

Exam I & Exam IV will be a group an exam and will take place outside of the classroom. Exam II, Exam III, and Exam V will take the entire class period.

Group Teaching Project:

The group teaching project is an opportunity for students to improve their communication skills, information literacy, and to have fun. Students will be asked to work in groups of two or three to create a 10-20 minute video taped lesson on a topic in the text book. The group project will be conducted at the beginning of the semester.

Concept Question:

During most classes, we will have a short quiz that is relevant to the material we are covering on that day. No preparation is required. Students can miss up to two concept questions for whatever reason. This is defacto way of keeping track of attendance. Not all classes will have a concept question.

GRADING/EVALUATION:

Grades:	In class exam #1	8%
	In class exam #2	16%
	In class exam #3	16%
	In class exam #4	8%
	Homework	16%
	Group project	12%
	In class quizzes (concept)	4%
	Final exam (exam #5)	20%

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Percentage	91	85	80	77	74	70	67	64	60	55	50	

ATTENDANCE POLICY:

You are strongly encouraged to come to each class. There numerous reasons you may miss class (e.g., illness, conferences), therefore you can miss up to two without it counting negatively toward your grade. If you expect to miss a large number of classes, please contact the instructor as soon as possible.