

Physics 361 - Electromagnetic Theory (3 cr)

Session: Spring 2019

Instructor: Prof. John B. Buncher

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Office Hours: MW 10 AM – Noon, TTh 11 AM – Noon, or by appointment

Class Meetings: TTh 9:30 AM – 10:45 AM

Location: South Engineering 221

Final: Friday, May 10, 2019, 8:00 AM – 10:00 AM

Prerequisites: Phys 252, Math 266

Course Materials

- The primary text for the course will be “Introduction to Electrodynamics”, by David J. Griffiths, published by Cambridge University Press. Either the 4th Edition or 3rd Edition of the text will work.

Course Description

From the NDSU Catalog Course Description: Electrostatics, magnetostatics, dielectrics, electric circuits, time varying electric and magnetic fields, electromagnetic induction, and application of Maxwell’s equations.

I will assume that you have taken the introductory physics sequence and are familiar with the topics covered there, along with a basic understanding of differential and integral calculus. Additionally, you should have a basic knowledge of vectors and vector algebra. Any mathematical topics needed beyond these will be introduced/reviewed as necessary.

Course Objectives

The primary goal of this course is to provide the students with an more sophisticated understanding of electromagnetism and the associated mathematical tools that will aid them in their careers in any technical field. The students will further refine their conceptual understanding and problem-solving ability such that they can readily apply their knowledge to novel problems and situations. Specifically, students shall be able to:

- Translate between the physical description of a junior-level electromagnetism problem and the mathematical equation needed to solve it.
- Visualize the physical parameters of a problem, through plots and sketches.
- Justify and explain their thinking and/or approach to a problem or physical situation, in either written or oral form.
- Choose and apply the appropriate problem-solving technique for a given problem, including but not limited to: effective use of approximations, series expansions, exploiting symmetries, integration, and superposition.

- Check the validity and plausibility of a solution by examining limiting cases.

Feedback

If you have any concerns about the course or suggestions on how it may improve, please let me know! I am happy to consider and implement student suggestions, and I have had success implementing such suggestions in previous courses.

Course Policies

Attendance & Participation

Attendance and participation in lecture is required. You are expected to come prepared each day and to participate in the discussion and problem-solving. If you miss a class, it is your responsibility to get the missed notes (from a classmate) and any assignments given. If you are absent on a day that homework is due, you will not have the opportunity to make up the assignment unless you discuss the absence with me and provide documentation of a University excused absence (in advance, if at all possible).

According to [NDSU Policy 333 www.ndsu.edu/fileadmin/policy/333.pdf](http://www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

Grades

Your final grade will be determined according to the following weights and cutoffs:

Participation & Preparation	5%	A	90 %
Homework	35%	B	80 %
Exams	40% (each exam given equal weight)	C	70 %
Final	20%	D	60 %
		F	< 60 %

Note that exams make up 60% of your final score! It is crucial that you prepare and study accordingly.

NOTE: You must satisfactorily complete 80% of the homework assignments in order to receive a passing grade in the course.

Homework

Homework will be given roughly once per week throughout the semester. Unless prior arrangements have been made, all homework is due at the **beginning** of class on the due date. If you are late to class on the due date your homework will **not** be accepted.

All of your assignments that you turn in must meet the following “formatting” requirements:

1. It should be neat and presentable.
2. It is to be written on loose-leaf, perforated, or plain paper (no notebook “frillies”).
3. Each problem should be started on a separate page.
4. It should be written in pen (no pencil)!
5. The pages must be stapled. The staple **must** be positioned vertically in the upper-left corner of the page, less than half an inch from the left side of the page.
6. All pages must be numbered in the upper-right hand corner, and put in order.
7. You must re-state the problem which you are attempting to solve, at least briefly.
8. Answers should be clearly labeled (boxed, highlighted, bold, etc.).
9. If you worked with anyone else on your assignment (which you are encouraged to do!), you must indicated key contributions that your other group members made.
10. You may also typeset your assignments using any program that you prefer (\LaTeX , *Mathematica*, LibreOffice, Word, etc.), if you wish.

Exams

Exams will be timed, either in-class or in the evening if schedules permit. You are not allowed to work with other students on the exams.

Office Hours

See the front page for office hours. If you need to meet outside of those times, email me and we should be able to work something out. During office hours, we can discuss anything that you wish (homework, grading, concepts, exams, topics of interest, etc.) If there is something of a personal nature, it would be best to make a separate appointment.

Accommodations

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the [Disability Services Office](http://www.ndsu.edu/disabilityservices/) <http://www.ndsu.edu/disabilityservices/> as soon as possible.

On Academic Dishonesty

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct

records are maintained by the **Office of Registration and Records**. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

You are highly encouraged to work with your fellow students, and to seek out their assistance or the assistance of the instructor, in all of your studies. Working with another person is highly beneficial for both people when there is a healthy working relationship. However, whatever you turn in must be your own work and words. Copying someone else's work and turning it in as your own is a case of academic dishonesty. You are not permitted to collaborate with anyone else on exams.

If you have any questions about what constitutes academic dishonesty it is your responsibility to ask before the assignment is due.

Course Schedule

I intend to cover Chapters 1–7, roughly as follows

	Week	Topic
1/07	1	Introduction, Coulomb's Law, & \vec{z}
1/14	2	Continuous Charge Distributions
1/21	3	Gauss's Law, $\nabla \cdot \vec{E}$, and $\nabla \times \vec{E}$
1/28	4	Electric Potential & Energy
2/04	5	Conductors in Electrostatics
2/11	6	Laplace's Equation, Earnshaw's Theorem, & Method of Images
2/18	7	Separation of Variables & EXAM 1
2/25	8	Multipoles & Legendre Expansions
3/04	9	Polarization
3/11	10	No Class - Spring Break
3/18	11	\vec{D} -field & Linear Dielectrics
3/25	12	Magnetic Forces & Current & EXAM 2
4/01	13	Ampere's Law
4/08	14	Vector Potential
4/22	16	Magnetization
4/29	17	Leftovers & Wrapping Up
5/10	18	FINAL EXAM - Friday 8AM

Advice

Here are some helpful tips for success in the course, from my own personal experience and suggestions of other professors.

1. If you are having trouble, ask for help! Help is available through me via my office hours (or other appointment), other faculty in the department, and your fellow students.
2. When reading the text, be sure to read *critically*. That is, ask questions and take notes! If something is not clear, make a note of it so you can ask in class. You should also be working through steps done (or omitted) in class and the text. As a friend of mine once said "The exam will NOT ask if you agree with our solution, but will asked you to come up with your OWN solution."

3. This course will likely take a significantly greater amount of time than your previous courses, both in completing the homework and understanding the concepts. It is critical that you start your homework assignments as early as possible, as you may need a few days to solve the problem sets.
4. Don't work for more than a few hours on a problem if you're stuck! Switch to another problem (which may cause you to think about the troublesome one in a different way), and find assistance. That being said, do not despair if it is not obvious what to do after 5 minutes of thinking. These problems will require some extra thought.
5. Don't panic. Physics is hard. Like anything else worthwhile, it will take practice and perseverance to succeed, but the rewards are well worth it.