Syllabus for PHYS 432 - Section 001
Electromagnetism I

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Fall, 2025

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Office:
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- My office is located beyond the "Center for Solar-Terrestrial Research" double-doors on the Second Floor of Faculty Memorial Hall (the eastern portion of Faculty Memorial Hall is the Microelectronics Center). Ring the doorbell if the double-doors are locked.

Office Hours:
Tuesday 12:00 PM - 1:00 PM,
Thursday 1:30 - 3:00 PM,
Other times by appointment

Lectures (more information below):
Faculty Memorial Hall 407
Tuesdays and Fridays from 2:30 - 3:50 PM

Course Description:

This course focuses on the electromagnetic force and builds upon previous courses including Physics 121/122 and those courses listed in the prerequisites. This course employs mathematical treatments including differential, integral, and vector calculus to explore a variety of topics including electrostatics, magnetostatics, electric fields in matter, and magnetic fields in matter.

Course Objectives:

In the subject areas noted above in this syllabus, you should be able to:

1. Execute various mathematical operations including the derivative, integral (line, surface, and volume), gradient, and curl;
2. Assess the relationship between electrostatic field, charge distribution, and electric potential;
3. Apply Coulomb's Law and Gauss's Law;

4. Identify and apply Laplace's Equation;
5. Calculate electric potential using the method of images;
6. Explain and calculate electric polarization;
7. Evaluate the relationship between dielectrics and electric fields;
8. Apply the Lorentz Force Law;
9. Calculate the magnetic field associated with moving charge by apply either Bio-Savarts Law and Ampere's Law;
10. Apply the multipole expansion technique to calculate static magnetic fields;
11. Evaluate the relationship between current, vector potential, and magnetic field;
12. Evaluate the differences and similarities between diamagnets, paramagnets, and ferromagnets; and,
13. Explain and calculate the interrelationship between magnetic fields, and magnetic susceptibility and permeability;

Required Materials

- **Textbook:** Introduction To Electrodynamics, 5th Edition, David J. Griffiths, Cambridge. University Press, ISBN-13: 978-1-00-939775-9. The textbook has many problems to help you understand the material. Some of these problems are more difficult than others; Griffiths use notation to distinguish the very difficult problem. I recommend that you do as many of these problems as you can.
  - I recommend you obtain the most recent edition, but older editions should be adequate.
- **Canvas**: The digital content for this class (e.g syllabus and homework) is on Canvas.

Physics 432 Tutoring:

In-person tutoring will begin on Tuesday, September 9 through Thursday, December 11, 2025 (last day of class) in Central King Building G12 (Physics Tutoring Center). The tutoring schedule will post: https://physics.njit.edu/physics-tutoring-sign-sheet

Prerequisites

Physics 234 or Physics 234H or Physics 231H and Math 222 or Math 222H and Math 328 or Math 335, all with grade of C or better.

Grading Policy

Your grade will be based on the midterm exam, the final exam, in-class quizzes, and the term's homework score. The approximate weights to be used are as follows:

- **30%** for the Midterm Exam
  - We will have one midterm exam, tentatively scheduled for October 14 2025 during the regular lecture period.

  - This exam will cover Chapters 1 – 3 (inclusive).
  - The exam will contain short and long answer questions, and you will receive a formula sheet (the inside covers of the textbook).
  - The exam will be proctored, and no calculator will be needed. You will work independently.
- **30%** for the Final Exam
  - The final exam will take place during finals week. The exact date is currently to be determined.
  - This exam will be cumulative.
  - The exam will contain short and long answer questions, and you will receive a formula sheet (the inside covers of the textbook).
  - The exam will be proctored, and no calculator will be needed. You will work independently.
- **20%** for class quizzes
  - We will have regular quizzes most Tuesdays (see the schedule below).
  - A quiz will cover the previous week's material and will take place during the first 10 minutes of lecture.
  - Quizzes will contain short answer questions, and you will receive a formula sheet (the inside covers of the textbook).
  - Quizzes will be proctored, and no calculator will be needed. You will work independently.
- **20%** for homework
  - There will be regular homework assignments, based on the textbook's suggested problems.
  - Independent and original solutions to the assigned problems are to be submitted to the instructor either physically or electronically by the assignment's due date.

The term average values used as cutoffs for various letter grades will be in the approximate range of: 85% for A, 80% for B+, 70% for B, 65% for C+, 50% for C, 40% for D, and $< 40\%$ for F.

Attendance:

You will not graded on your attendance. However, it is highly recommended that you attend class as much as possible. If you are sick or feeling unwell, please do not attend class.

Missed Quizzes and Exams:

The general policy is that students who miss an exam will receive a score of zero for that exam. That score will be included in the calculation of their final grade. Students who anticipate an absence from an exam should discuss their situation with the Dean of Students and their Instructor prior to their absence. To receive an "excused absence", the student must present documentation to the Dean of Students and their Instructor justifying their absence. The Instructor and the Dean of Students must concur in permitting an "excused absence" for the exam. Students who miss exams and do not contact and present documentation to their instructor within 7 days of the exam will receive a score of zero for the exam.

Withdrawal:

If you must withdraw from the course, do it officially through the Registrar before the last withdrawal date. If you simply stop attending and stop taking exams, your instructor will have no option other than to assign a course grade of "F".

Honor Code Violations:

NJIT has a zero-tolerance policy for cheating of any kind and for disruptive student behavior. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable.

General Class Expectations:

- Students are required to agree to the NJIT Honor Code at all times.
- College Rule of Thumb: You should expect to spend a minimum of 2 hours in outside work for each hour spent in class each week. That means 6 hours outside of lecture spent on this class alone.
- You should expect to be assessed on learning outcomes by means of exams, in-class quizzes, and homework assignments.
- You are expected to make the time to attend the exams/quizzes.
- Do not create distractions in class that interfere with the work of other students or instructors.
- The schedule below lists the topics covered and text readings. Do the homework problems (it is almost impossible to succeed in physics courses without working a lot of problems), and read the assigned sections of the text before the lecture covering that material.

Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the code of Academic Integrity policy that is found at:
http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Office of the Dean of Students. **Any student found in violation of the code by cheating, plagiarizing, or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Office of the Dean of Students at `dos@njit.edu`

Generative AI

The usage of artificial intelligence (AI) is permitted in this course and no citation is necessary. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

NJIT has adopted the student guide, "AI-U" (updated for 2025) created by Elon University and the AAC&U. More information about this guide is also available on the AI Teaching and Learning Working Group website.

Student Absences for Religious Observance:

NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence. For questions or additional guidance, please review the policy (`https://www.njit.edu/registrar/njit-policy-student-absences-religious-observances`) or contact the Office of Inclusive Excellence at `inclusiveexcellence@njit.edu`.

Approximate Schedule

Date	**Topic**	**Text Chapters**
Tuesday 09/02	Vector Analysis	1.1 - 1.2
Friday 09/05	Vector Analysis	1.3 - 1.4
Tuesday 09/09 - Quiz	Vector Analysis	1.5 - 1.6
Friday 09/12	Electrostatics	2.1
Tuesday 09/16 - Quiz	Electrostatics	2.2
Friday 09/19	Electrostatics	2.3
Tuesday 09/23 - Quiz	Electrostatics	2.4 - 2.5
Friday 09/26	Potentials	3.1
Tuesday 09/30 - Quiz	Potentials	3.2
Friday 10/03	Potentials	3.3
Tuesday 10/07 - Quiz	Potentials	3.4
Friday 10/10	Potentials Conclusion	
Tuesday 10/14	**Midterm covering Chapters 1 - 3 (inclusive)**	
Friday 10/17 **(Recorded and posted to Canvas)**	Electric Fields in Matter	4.1
Tuesday 10/21 - Quiz	Electric Fields in Matter	4.2
Friday 10/24	Electric Fields in Matter	4.3
Tuesday 10/28 - Quiz	Electric Fields in Matter	4.4
Friday 10/31	Electric Fields in Matter Conclusion	
Tuesday 11/04 - Quiz	Magnetostatics	5.1
Friday 11/07	Magnetostatics	5.2
Monday 11/10 is the Last Day to Withdraw from Classes		
Tuesday 11/11 - Quiz	Magnetostatics	5.3
Friday 11/14	Magnetostatics	5.4
Tuesday 11/18 - Quiz	Magnetostatics	5.4
Friday 11/21	Magnetostatics Conclusion	
Tuesday 11/25 - No class	**Thursday Class Meets**	
Wednesday 11/26 - **Friday classes meet**	Magnetic Fields in Matter	6.1
Friday 11/28 - No class	**Thanksgiving Recess**	
Tuesday 12/02 - Quiz	Magnetic Fields in Matter	6.2
Friday 12/05	Magnetic Fields in Matter	6.3 - 6.4
Tuesday 12/09 - Quiz	Magnetic Fields in Matter Conclusion	