University of Mississippi

Department of Physics and Astronomy

Physics 401: Electromagnetism I

Syllabus

Instructor: Dr. James Bonifacio
Email: jjbonifa@go.olemiss.edu

Fall 2023

Accessing homeworks and lecture notes will be through Blackboard.

Location and time

Classes: Monday, Wednesday, and Friday from 14:00 to 14:50 in Lewis Hall room 109.
Office hours: Mondays 15:00 to 16:00 in Lewis 211A.

Text

We will closely follow the book "Introduction to Electrodynamics" by David Griffiths, covering chapters 1–6. I will post lecture notes for this material. The definitive reference, at a higher level, is Jackson's "Classical Electrodynamics."

Course goals and learning outcomes

This is the first half of a standard course on electromagnetism in the undergraduate curriculum for physics.

Key concepts (time permitting): vector calculus, curvilinear coordinates, electric field and potential, work and energy in electrostatics, Laplace's equation, separation of variables, multipole expansions, electric fields in media, Lorentz force, magnetostatics, magnetic vector potential, magnetic fields in media.

Goals: Understanding of electrostatics, magnetostatics, and matter in static fields; relevance to physical systems; strengthen tools of vector calculus; applying multivariate and vector calculus and special mathematical tools (e.g., multipole/Legendre expansion). These goals are to enhance students' mathematical reasoning, critical thinking, and analytical reasoning.

Evaluation

Grades:

Letter grade	Percentage range
A	[90, 100]
A-	[88, 90)
B+	[85, 88)
B	[77, 85)
B-	[75, 77)
C+	[72, 75)
C	[65, 72)
D	[55, 65)
F	[0, 55)

Grade breakdown: 35% homework (top 10 contribute), 25% midterm, 40% final.

Homework and exams

Homework assignments will be announced via Blackboard and must be submitted by midnight on the due date. The grading for these assignments is divided as follows: 20% of your grade will be attributed to attempting all problems and submitting the homework on time, while the remaining 80% will be based on the accuracy of your solutions. As a result, late homework submissions can score a maximum of 80%. Exceptions and extensions can be granted for good cause, but requests for these must be made at least 12 hours before the deadline. Any homework handed in after the solutions have been posted will receive a score of zero. Similarly, answers copied from external sources will also be given a score of zero. Homework can be submitted in person, or digitally as PDFs or JPGs via the course website. Please ensure that your submissions are legible.

The midterm and final examinations will be conducted in-person. You are permitted to bring up to five sheets of A4 or letter-sized paper with your own notes or formulas written on both sides. However, no other resources or materials will be allowed during the examination.

Attendance

There is no strict attendance requirement, but you are strongly advised to attend class. Attendance has a strong correlation with performance. It is recommended that you read the book or lecture note sections in advance and come ready to participate. If you miss an exam or cannot turn in homework, please inform the instructor beforehand and get a doctor's note if applicable. Absences from tests count as zeros, unless they are justified. If you must be absent during a test for a University sponsored event, you must discuss this with the instructor before the test date.

If you need to isolate due to contracting COVID-19 at any point this semester, you must do so, and email the instructor as soon as possible. We will work with you to help you continue your progress in the course.

Academic Integrity

Violations of the University's policy of academic integrity will result in a failing grade and other disciplinary actions. A student with a documented case of plagiarism or cheating in this course will receive a failing grade for the course and may face disciplinary action by the University, including expulsion. In particular, do not turn in problem set solutions copied from online or a solutions manual or produced by an AI system. Copying solutions does nothing to enhance your learning. If this occurs then you will get an automatic zero for the problem set. It if happens more than once, it will be reported to the chair of the department.

Disability Access and Inclusion

The University of Mississippi is committed to the creation of inclusive learning environments for all students. If there are aspects of the instruction or design of this course that result in barriers to your full inclusion and participation, or to accurate assessment of your achievement, please contact the course instructor as soon as possible. Barriers may include, but are not necessarily limited to, timed exams and in-class assignments, difficulty with the acquisition of lecture content, inaccessible web content, and the use of non-captioned or non-transcribed video and audio files. If you are approved through SDS, you must log in to your Rebel Access portal at https://sds.olemiss.edu to request approved accommodations. If you are NOT approved through SDS, you must contact Student Disability Services at 662-915-7128 so the office can: 1) determine your eligibility for accommodations, 2) disseminate to your instructors a Faculty Notification Letter, 3) facilitate the removal of barriers, and 4) ensure you have equal access to the same opportunities for success that are available to all students.

Other

If a change in the syllabus becomes necessary during the semester, it will be discussed in class and then posted on Blackboard. This website will also contain up-to-date information on the class schedule, homework assignments and complementary material.

Schedule (subject to change)

Week	Date	Lecture #	Topic	Homework
1	August 21 (M)	1	syllabus and vector algebra §1.1[1]	
	August 23 (W)	2	vector algebra §1.1	
	August 25 (F)	3	differential calculus §1.2	
2	August 29 (M)	4	integral calculus §1.3	
	August 30 (W)	5	curvilinear coordinates §1.4	PS1 due
	September 1 (F)	6	Dirac delta function §1.5	
3	September 4 (M)	—	No class – Labour day holiday	
	September 6 (W)	7	theory of vector fields §1.6	PS2 due

[1] §$n.m$ refers to section m of chapter n of "Introduction to Electrodynamics" by Griffiths.

	September 8 (F)	8	the electric field §2.1	
	September 11 (M)	9	div and curl of $\vec{E}$ §2.2	
4	September 13 (W)	10	div and curl of $\vec{E}$ §2.2	PS3 due
	September 15 (F)	11	electric potential §2.3	
	September 18 (M)	12	electric potential §2.3	
5	September 20 (W)	13	work and energy §2.4	PS4 due
	September 22 (F)	14	work and energy §2.4	
	September 25 (M)	15	conductors §2.5	
6	September 27 (W)	16	conductors §2.5	
	September 29 (F)	17	midterm exam 2pm – 4pm	
	October 2 (M)	18	Laplace's equation §3.1	
7	October 4 (W)	19	the method of images §3.2	PS5 due
	October 6 (F)	20	separation of variables §3.3	
	October 9 (M)	21	separation of variables §3.3	
8	October 11 (W)	22	multipole expansion §3.4	PS6 due
	October 13 (F)	23	multipole expansion §3.4	
	October 16 (M)	24	polarization §4.1	
9	October 18 (W)	25	polarization §4.1	PS7 due
	October 20 (F)	26	the field of a polarized object §4.2	
	October 23 (M)	27	the electric displacement §4.3	
10	October 25 (W)	28	linear dialectrics §4.4	PS8 due
	October 27 (F)	29	linear dialectrics §4.4	
	October 30 (M)	30	Lorentz force §5.1	
11	November 1 (W)	31	Lorentz force §5.1	PS9 due
	November 3 (F)	32	the Biot–Savart law §5.2	
	November 6 (M)	33	the Biot–Savart law §5.2	
12	November 8 (W)	34	div and curl of $\vec{B}$ §5.3	PS10 due
	November 10 (F)	35	div and curl of $\vec{B}$ §5.3	
	November 13 (M)	36	magnetic vector potential §5.4	
13	November 15 (W)	37	magnetic vector potential §5.4	
	November 17 (F)	38	magnetization §6.1	
	November 20 (M)	—	no class – Thanksgiving holidays	
14	November 22 (W)	—	no class – Thanksgiving holidays	
	November 24 (F)	—	no class – Thanksgiving holidays	
	November 27 (M)	39	field of a magnetized object §6.2	
15	November 29 (W)	40	the auxiliary field $\vec{H}$ §6.3	PS11 due
	December 1 (F)	41	linear and nonlinear media §6.4	
	December 4 (M)	—	final exam 4:00–7:00 pm	