University of Mississippi

Department of Physics and Astronomy

Physics 402: Electromagnetism II

Syllabus

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Spring 2024

Accessing homeworks and lecture notes will be through Blackboard.

Location and time

Classes: Monday, Wednesday, and Friday from 15:00 to 15:50 in Lewis Hall room 109.
Office hours: Mondays 16:00 to 17:00 in Lewis 211A.

Text

We will closely follow the book "Introduction to Electrodynamics" by David Griffiths, covering chapters 6–12. 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 second half of a standard course on electromagnetism in the undergraduate curriculum for physics.

Key concepts (time permitting): magnetic fields in media • going from electrostatics to electrodynamics • mutual and self inductance • Maxwell's equations • conservation laws • waves in general and electromagnetic waves • energy and momentum in the electromagnetic field • reflection, transmission, absorption, and dispersion • waveguides • potential formulation and gauge transformations • special relativity and relativistic EM.

Goals: Reinforce understanding of electrostatics and magnetostatics; understanding of Maxwell's equations and interactions with matter, and relevance to physical systems; learning tools of waves; applying multivariate and vector calculus and special mathematical tools (e.g. multipole/Legendre expansion); introduction to special relativity. 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, 25% midterm, 40% final.

Homework, tests, and final exam

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	January 22 (M)	—	no class — snow day	
	January 24 (W)	—	no class — snow day	
	January 26 (F)	1	syllabus and finish §5.4[1]	
2	January 29 (M)	2	magnetization §6.1	
	January 31 (W)	3	field of magnetized object §6.2	
	February 2 (F)	4	$\vec{H}$ field §6.3, linear media §6.4	
3	February 5 (M)	5	EMF §7.1	
	February 7 (W)	6	EMF §7.1	PS1 due

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

	February 9 (F)	7	Induction §7.2	
	February 12 (M)	8	Induction §7.2	
4	February 14 (W)	9	Maxwell's equations §7.3	PS2 due
	February 16 (F)	10	Maxwell's equations §7.3	
	February 19 (M)	11	charge and energy §8.1	
5	February 21 (W)	12	charge and energy §8.1	PS3 due
	February 23 (F)	13	momentum conservation §8.2	
	February 26 (M)	14	momentum conservation §8.2	
6	February 28 (W)	15	waves in 1D §9.1	PS4 due
	March 1 (F)	16	midterm exam 3pm – 5pm	
	March 4 (M)	17	waves in 1D §9.1	
7	March 6 (W)	18	waves in vacuum §9.2	
	March 8 (F)	19	waves in vacuum §9.2	
	March 11 (M)	—	no class — Spring break	
8	March 13 (W)	—	no class — Spring break	
	March 15 (F)	—	no class — Spring break	
	March 19 (M)	20	waves in media §9.3	
9	March 20 (W)	21	waves in media §9.3	PS5 due
	March 22 (F)	22	absorption and dispersion §9.4	
	March 25 (M)	23	absorption and dispersion §9.4	
10	March 27 (W)	24	potential formulation §10.1	PS6 due
	March 29 (F)	—	no class — Good Friday	
	April 1 (M)	25	potential formulation §10.1	
11	April 3 (W)	26	distributions §10.2	
	April 5 (F)	27	distributions §10.2	
	April 8 (M)	28	field of point charges §10.3	
12	April 10 (W)	29	field of point charges §10.3	PS7 due
	April 12 (F)	30	dipole radiation §11.1	
	April 15 (M)	31	dipole radiation §11.1	
13	April 17 (W)	32	point charges §11.2	PS8 due
	April 19 (F)	33	point charges §11.2	
	April 22 (M)	34	special relativity §12.1	
14	April 24 (W)	35	special relativity §12.1	PS9 due
	April 26 (F)	36	relativistic mechanics §12.2	
	April 29 (M)	37	relativistic mechanics §12.2	
15	May 1 (W)	38	relativistic electrodynamics §12.3	PS10 due
	May 3 (F)	39	relativistic electrodynamics §12.3	
	May 9 (Th)	—	final exam 4pm – 7pm	