University of Mississippi

Department of Physics and Astronomy

Physics 401: Electromagnetism I

Syllabus

Instructors: James Bonifacio and Leo Stein
Email: james.j.bonifacio@gmail.com, lcstein@go.olemiss.edu

Fall 2022

Accessing homeworks/exams will be through Google Classroom. If you are in this course and do not have access to the virtual classroom, email James or Leo ASAP!

Location and time

Classes are Monday, Wednesday, and Friday from 14:00 to 14:50. Location: Lewis Hall room 109. Office hours and location TBD.

Text

We will closely follow the book "Introduction to Electrodynamics" by David Griffiths, covering chapers 1–6. 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

Grade type:	Letter grade A–F
Grade ranges (subject to change):	A = 88% and up B = 75% – 87% C = 65% – 74% D = 55% – 64% F = < 55%
Grade breakdown (subject to change):	50% homework, 20% midterm, 30% final

Homework, tests, and final exam

Homework assignments will be announced via Google Classroom and they must be turned in by midnight on the due date. Late homework will be penalized 20% per day (exceptions and extensions permitted with good cause). Homeworks and exams may be submitted as PDFs or JPGs via the course web site (electronic submission is preferred, especially for the first four homeworks, but physically handing in work may be possible with special arrangement). Homework must be easy to read: please clearly write down your name and the problem set number, do not use a red pen.

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 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. In your email, state how long you expect not to attend class. We can work together to establish a plan for completing the necessary work. You will have access to your texts and the course content. More information on isolation protocols can be found here. Follow the most up-to-date guidance from the CDC.

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. 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.

Classroom Health Requirements

If students test positive for COVID-19 at any health care facility, they must report it to the Student Health Center (here or call 662-915-7274) and they must follow directions from the healthcare provider and isolate. Students with COVID-19 should seek medical attention by a healthcare provider and contact their instructor to let them know that they will be missing class due to a health-related issue.

Other

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

Schedule (subject to change)

Date	Lecture #	Topic
August 22 (M)	1	Syllabus and vector algebra §1.1[1]
August 24 (W)	2	vector algebra §1.1
August 26 (F)	3	differential calculus §1.2
August 29 (M)	4	integral calculus §1.3
August 31 (W)	5	curvilinear coordinates §1.4
September 2 (F)	6	Dirac delta function §1.5
September 5 (M)	—	No class – Labour day holiday
September 7 (W)	7	theory of vector fields §1.6
September 9 (F)	8	the electric field §2.1
September 12 (M)	9	div and curl of $\vec{E}$ §2.2

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

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