Phys 402 Electromagnetic Theory II

"The special theory of relativity owes its origins to Maxwell's equations of the electromagnetic field." Albert Einstein.

Instructor: Dr. Cecille Labuda
Class time/location: MWF 09:00 – 09:50, Lewis 109
Office hours: MWF 10:00 – 11:30, T 2-2:45, Lewis 121; by appointment on Zoom

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Syllabus version: 02/28/2022 ; schedule updated

Text

Griffiths, David J. Introduction to Electrodynamics, 4th edition. Cambridge University Press, ISBN: 9781108420419.

Description

This course is a study of electrodynamics, electromagnetic waves, potentials and fields.

Prerequisites

- Phys 401 and Math 264.
- While not a prerequisite, Phys 308 should be taken before Phys 401/402.

Course Objectives

The general objective of this course is for students to attain mastery in the fundamental topics to be covered in this course which include:

- Electromotive force, Faraday's law and Maxwell's equations
- Conservation of charge, energy and momentum
- Electromagnetic waves
- Potentials fields
- Radiation from charges
- Relativistic electrodynamics

Grading Scale

Plus-minus grades may be assigned.

- $90\% \leq \mathbf{A} \leq 100\%$
- $80\% \leq \mathbf{B} < 90\%$
- $70\% \leq \mathbf{C} < 80\%$
- $50\% \leq \mathbf{D} < 70\%$
- $\mathbf{F} < 50\%$

Evaluation and Calculation of Course Grade

Class Exercises and Summaries (5%) [c]
These consist of in-class exercises, class summaries and blackboard presentations of problem solutions during class meetings. Graded for completion; no make-ups.

Oral Exam [i] (5%)
1 individual oral examination at a time mutually agreed upon by the student and instructor.

Exams (45%) [i]
3 closed-book exams. Part of each exam will be in class and part will be take-home. Exams will be weighted as follows:

- 2 exams highest grades: 17.5%+17.5%=35%
- 1 exam lowest grade: 10%

Homework (20%) [c]. Note that the homework grade will only count if the exam average is >50%. *Otherwise the homework grade will be computed as zero.*

- Homework sets must be turned in at the beginning of class when due. [c]
- Students are encouraged to work together in class and on homework. However, all exams are individual assignments.
- Homework solutions must be presented according to the homework rubric or it may not be graded.

Final exam (25%) [i]

- The final exam will be comprehensive. The format will be similar to the tests, except there will be no take-home problems.

Policies

Covid-19-Related Policies

- Current COVID-19 guidelines for the Spring 2022 semester require that **everyone** wear face masks over the nose and mouth inside university buildings. Please consider wearing higher filtration masks such as KN95 or similar

masks. Current protocols can be found at https://coronavirus.olemiss.edu/.

- If you have a diagnosed health concern that interferes with the wearing of face masks, seek an accommodation with the Student Disabilities Services Office. https://sds.olemiss.edu/
- Students who refuse to wear masks properly in the classroom or otherwise fail to comply with COVID-19 guidelines will be asked to leave the classroom.
- Failure to adhere to COVID-19 health requirements will be deemed as disruptive to the classroom and will be enforced following the Academic Conduct and Discipline procedures. The disciplinary protocol is maintained by the Office of Conflict Resolution and Student Conduct. https://conflictresolution.olemiss.edu/covidupdates.
- If exposed to someone with COVID-19, contact the Student Health Center to get tested 3 to 5 days following exposure. If you are not fully vaccinated, follow quarantine protocols described at https://coronavirus.olemiss.edu/students/.
- If you test positive for COVID-19 at any health care facility, contact the Student Health Center at 662-915-7274 so they can do contact tracing.
- If you contract COVID-19, seek medical attention at the Student Health Center or elsewhere and contact me to let me know that you will be missing class due to a health-related issue.

Attendance

Class attendance is **required**. If a student is absent for more than 3 classes during the semester, the final calculated grade will be **reduced by a letter grade** at the time grades are officially assigned, unless the calculated grade is a C or lower. If you must be absent for exams, you must speak to me before the exam to determine whether the absence will be excused and whether the exam will be rescheduled. For unexpected exam absences, you must contact me by email or telephone within 24 hours after the absence or the exam will not be rescheduled. Allowances will be made for non-attendance due to covid-19 health concerns.

Academic Integrity

By choosing to be part of the University of Mississippi community, every student agrees to abide by the University of Mississippi Creed and the UM Academic Integrity Policy. Cheating is forbidden and, in this course, will result in a zero grade on the given assignment. If a second case of cheating occurs, this will result in an F for the entire course. Unless explicitly permitted by the instructor, distribution of materials provided in this class via the internet or otherwise. Accessing such materials for your own use is also in violation of the UM Academic Conduct Code. Additionally, the distribution of your own class notes is strongly discouraged except for occasional loaning of notes to students also enrolled in the class.

University of Mississippi 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. Students should also contact Student Disability Services at 662-915-7128 so that office can 1) provide you with an Instructor Notification form, 2) facilitate the removal of barriers and 3) ensure you have equal access to the same opportunities for success that are available to all students.

Audio and video recording

Audio and/or video recording of class lectures is not allowed unless explicit permission is given by the instructor. Permitted recordings may not be distributed online or elsewhere and all must be deleted at the end of the semester.

Important Dates

Please see the UM academic calendar (https://registrar.olemiss.edu/fall-2021/)

Examinations

Test dates and topics are subject to change. The final exam date is fixed and cannot be changed.
Final Exam: Wednesday May 4, 08:00 am.

[c] – collaborative [i] - individua

Schedule of Topics (very subject to change): Material from Chapters 7 – 12

Week	Topic	Textbook Sections
01: 01/18 – 01/21	Electromotive force, electromagnetic induction	Ch 7: Electrodynamics
02: 01/24 – 01/28	Electromagnetic induction, Maxwell's equations	Ch 7: Electrodynamics
03: 01/31 – 02/04	Maxwell's equations, charge and energy conservation	Ch 7: Electrodynamics, Ch 8: Conservation laws
04: 02/07 – 02/11	Energy and momentum conservation	Ch 8: Conservation laws
05: 02/14 – 02/18	Momentum conservation **02/14: TEST 1**	Ch 8: Conservation laws
06: 02/21 – 02/25	Conservation of angular momentum	Ch 8: Conservation laws
07: 02/28 – 03/04	Wave motion, the wave equation, electromagnetic waves in vacuum	Ch 9: Electromagnetic waves
08: 03/07 – 03/11	Electromagnetic waves in matter **03/07: TEST 2**	Ch 9: Electromagnetic waves
09: 03/14 – 03/18	**SPRING BREAK**	
10: 03/21 – 03/25	Scalar and vector potentials, gauge transformations	Ch 10: Potentials and fields
11: 03/28 – 04/01	Moving point charges, dipole radiation	Ch 10: Potentials and fields, Ch 11: Radiation
12: 04/04 – 04/08	Dipole radiation, radiation from a point charge	Ch 11: Radiation
13: 04/11 – 04/15	Special theory of relativity **04/11: Test 3**	Ch 12: Electrodynamics and relativity
14: 04/25 – 04/29	Relativistic electrodynamics	Ch 12: Electrodynamics and relativity