

# PHY331: Electricity & Magnetism

Fall 2021, 4 credits

TTh 11:30-1PM

Cousins 127

**Instructor:** Dr. Mariel Meier

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**Office hours:** M 2:00-4:00PM, Th 9-11AM (But I have an open-door policy and am generally available when not in class). If you would like to schedule virtual office hours, please email.

**Textbook:** *Introduction to Electrodynamics* 4<sup>th</sup> edition by Griffiths (Wiley, New Jersey; 2013)

**Prerequisite:** College Physics II (PHY 202); Calculus III (MAT 233) or permission of the instructor

## LEARNING OBJECTIVES OF THE COURSE

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For physics and engineering students, this course reviews topics related to electricity and magnetism that were discussed in PHY-202. Advanced mathematical techniques are employed to solve more complex, less trivial, problems. Electrostatics and magnetostatics in real-world contexts are discussed.

There are three primary objectives for this course:

- Develop a strong conceptual understanding of electric and magnetic phenomena.
- Be able to use multivariable calculus, Fourier analysis, and other methods to develop mathematical models of electric and magnetic phenomena.
- Develop a basic understanding of how computational techniques can be used in problem-solving.

## COURSE REQUIREMENTS

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1. *Reading and Pre-class activities* – Reading is an essential part of this course. Reading before class is very important. Lecture is to clarify your understanding, to help you make sense of the material. I will assume you have done your required readings in advance. In order to encourage you to complete the daily readings, you will be expected to complete brief pre-class activities before most class meetings. Pre-class activities will include both contributing to discussion boards and short, 1-2 question quizzes. These assignments will be graded for completeness as long as an honest effort is made to complete the activity.
2. *Attendance and Class Participation* – Be an active participant in class. Asking and answering questions is an integral part of learning. If you miss class, you may miss an important piece of information. You are expected to read the chapters **before** they are discussed in class. The classroom experience will be much more successful and productive if you are prepared for class. You are responsible for making up any work missed. You may have 4 absences from the course for any reason (sports, illness, sleeping-in). Each additional absence will result in a 10-point deduction to the final course grade. Arriving to class more than 10 minutes late will be considered an absence. *Obviously, we live in unique times. In the event of a mandated quarantine that forces you to miss class I will give you the opportunity to meet with me via Zoom to review the class notes. If you attend these make-up sessions, you will not be considered absent.*

*Homework* – Homework will be assigned regularly. Homework is critical for developing an understanding of course material, not to mention building skills in physical and mathematical problem solving. They will require considerable time and effort. You may ask for two 24-hour extensions to homework submissions during the semester. Extensions must be requested before the due date/time has passed. Anticipate spending **6-8 hours per week** on homework. This is in addition to time spent on reading, pre-class activities, and exam preparation.

**I strongly encourage collaboration**, an essential skill in science and engineering. Social interactions are critical to scientists' success - most good ideas grow out of discussions with colleagues; essentially all physicists work as part of a group. The COVID pandemic of the last year and a half has limited opportunities for students to work together, and has generally decimated our community. To help facilitate group interaction, I will be assigning you to study groups this semester. Study groups are expected to work together on homework and exam review. Groups who demonstrate they are working together in-person or virtually on a homework set will receive 3 points of extra credit on that assignment. Evidence of collaboration can be group photos, screenshots from Zoom sessions, or screen shots of group chats.

While it is incredibly important to work together, it is also important that you OWN the material. Limit yourself to verbal help; don't take written information from others. This will ensure that you think things through independently after you get help. If you do well on homework and poorly on exams, you are probably relying too much on your groupmates. In general, no credit will be given for a correct answer, unless accompanied by a complete and correct derivation. **The point is not to find the answer, but to find out how to construct the answer.** There will be time for peer discussion during classes: try to help your partners get over confusions, listen to them, ask each other questions, critique, *teach each other*. You will learn a lot this way!

3. *Exams* – The course content is broken up into three major units. There will be unit exams at the culmination of each unit, as well as a cumulative final. Midterm exams will be take home format; the final exam will be during the scheduled exam time.

## **COURSE POLICIES**

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**Technology in the classroom:** Cellphones can be kept on the desk in silent mode. Students observed texting or using their phones for non-course related purposes will be asked to stow their phone for the remainder of the class. Laptops and tablets should not be used in class except when I have specified that we will need them for an activity, or if you have asked for permission to take electronic notes. If you use an eText and need access to the textbook during class, please inform me of this. If you are observed to be using your laptop or tablet for non-course related purposes, you will be asked to stow the device. If you have a documented reason for using technology in the classroom, please inform me. If you are reprimanded twice in one class period for improper use of technology, you will be marked absent for that class.

**Assignment due dates:** All assignments are due on the date specified on the syllabus and/or on Canvas. Late assignments will not be accepted unless the extended due date is discussed and agreed upon **before the original due date, per the extension policy outlined above.** Late pre-class assignments are never accepted (it defeats the point) however 4 will be dropped from your grade. If you will be absent on a day that an assignment is due in class, you must arrange to turn in the assignment before the start of that class period.

**Dropping the Course:** The course may be dropped with a grade of W through Monday, October 25<sup>th</sup> (provided that the student's work to that point has been of passing quality). After this date the grade of W will be assigned only in the case of withdrawal from the University or prolonged illness.

**Pivot to Remote Learning:** It is my hope that we can make it through the semester entirely in-person. However, I recognize that the University may decide that we must move to remote learning to ensure the safety of our students, faculty and staff. In that situation, as little as possible will change about the course. We will continue to meet synchronously via Zoom. Classes will not be recorded and you will be expected to attend. I will use the Zoom whiteboard just like I would a whiteboard in class, and you will be put into breakout rooms for problem solving sessions. Problem sets will be submitted online – please make sure you have a way to scan and upload your work before the semester begins. Exams will be taken in a synchronous Zoom meeting.

## **EXPECTATIONS**

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Students should be prepared to question, learn and complete assignments in a timely and professional manner. For a four-credit hour course such as this, you should expect to spend **at least 8-12 hours per week** on the coursework, including attending class, reading the textbook, working homework problems, and studying for exams. Students are expected to be courteous and respectful to the instructor and fellow students in all written or verbal communications. In return the instructor will work to provide a respect filled environment in which every student can learn. The instructor will also give students timely and professional feedback (including graded assignments) and assistance in their learning.

There is a zero-tolerance policy for any form of academic dishonesty in this course. Disciplinary action will be taken against any student found guilty of academic dishonesty such as cheating or plagiarism. **If your words match those of others, I will assume you copied rather than composing the answers yourself.** The penalty for being dishonest in this way is far greater than simply getting a wrong answer. Those committing academic dishonesty will be subject to disciplinary action up to and including failing the assignment, failing the course, and/or expulsion from the course or college.

**Academic Honesty:** Persons who come to Oglethorpe University for work and study join a community that is committed to high standards of academic honesty. The honor code contains the responsibilities we accept by becoming members of the community and the procedures we will follow should our commitment to honesty be questioned.

The students, faculty and staff of Oglethorpe University expect each other to act with integrity in the academic endeavor they share. Members of the faculty expect that students complete work honestly and act toward them in ways consistent with that expectation. Students are expected to behave honorably in their academic work and are expected to insist on honest behavior from their peers.

Oglethorpe welcomes all who accept our principles of honest behavior. We believe that this code will enrich our years at the University and allow us to practice living in earnest the honorable, self-governed lives required of society's respected leaders.

Our honor code is an academic one. The code proscribes cheating in general terms and also in any of its several specialized sub-forms (including but not limited to plagiarism, lying, stealing and interacting fraudulently or disingenuously with the honor council). The Code defines cheating as "the umbrella under which all academic malfeasance falls. Cheating is any willful activity involving the use of deceit or fraud in order to attempt to secure an unfair academic advantage for oneself or others or to attempt to cause an unfair academic disadvantage to

others. Cheating deprives persons of the opportunity for a fair and reasonable assessment of their own work and/or a fair comparative assessment between and among the work produced by members of a group. More broadly, cheating undermines our community's confidence in the honorable state to which we aspire."

The honor code applies to all behavior related to the academic enterprise. Thus, it extends beyond the boundaries of particular courses and classrooms *per se*, and yet it does not extend out of the academic realm into the purely social one.

Examples of cheating include but are not limited to:

- 1.1 The unauthorized possession or use of notes, texts, electronic devices (including, for example, tablets, computers and smartphones), online materials or other such unauthorized materials/devices in fulfillment of course requirements.
- 1.2 Copying another person's work or participation in such an effort.
- 1.3 An attempt or participation in an attempt to fulfill the requirements of a course with work other than one's original work for that course.
- 1.4 Forging or deliberately misrepresenting data or results. Submitting results of an experiment, at which one was not present or present for less than the full time, as one's own.
- 1.5 Obtaining or offering either for profit or free of charge materials one might submit (or has submitted) for academic credit. This includes uploading course materials to online sites devoted, in whole or in part, to aiding and abetting cheating under the guise of providing "study aids." There is no prohibition concerning uploading exemplars of one's work to one's personal website or to departmental, divisional, University or professional society websites for purposes of publicity, praise, examination or review by potential employers, graduate school admissions committees, etc.
- 1.6 Violating the specific directions concerning the operation of the honor code in relation to a particular assignment.
- 1.7 Making unauthorized copies of graded work for future distribution.
- 1.8 Claiming credit for a group project to which one did not contribute.
- 1.9 Plagiarism, which includes representing someone else's words, ideas, data or original research as one's own and in general failing to footnote or otherwise acknowledge the source of such work. One has the responsibility of avoiding plagiarism by taking adequate notes on reference materials (including material taken off the internet or other electronic sources) used in the preparation of reports, papers and other coursework.
- 1.10 Submitting one's own work for a course that was previously submitted for the same course, or another course, without proper citation.
- 1.11 Lying, such as: Lying about the reason for an absence to avoid a punitive attendance penalty or to receive an extension on an exam or on a paper's due date; fraudulently obtaining Petrel Points by leaving an event soon after registering one's attendance and without offering to surrender the associated Petrel Point, or by claiming fictitious attendance for oneself or another; forging or willfully being untruthful on documents related to the academic enterprise, such as on an application for an independent study or on a registration form.
- 1.12 Stealing, such as: Stealing another's work so that he/she may not submit it or so that work can be illicitly shared; stealing reserve or other materials from the library; stealing devices and materials (such as computers, calculators, textbooks, notebooks and software) used in whole or in part to support the academic enterprise.
- 1.13 Fraudulent interaction on the part of students with the honor council, such as: Willfully refusing to testify after having been duly summoned; failing to appear to testify (barring a *bona fide* last-minute emergency) after having been duly summoned; testifying untruthfully.

Students pledge that they have completed assignments honestly by attaching the following statement to each piece of work submitted in partial fulfillment of the requirements for a course taken for academic credit:

"I pledge that I have acted honorably." (Followed by the student's signature)

The honor code is in force for every student who is enrolled (either full- or part-time) in any of the academic programs of Oglethorpe University at any given time. All cases of suspected academic dishonesty will be handled in accordance with the provisions established in this code. The honor council has sole jurisdiction in matters of suspected academic dishonesty. Alternative ways of dealing with cases of suspected academic fraud are prohibited. In cases of alleged academic dishonesty on the part of students, the honor council is the final arbiter. Reference the current Oglethorpe University Bulletin for information concerning all aspects of the honor code.

## **QUESTIONS & CONCERNS**

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If at any time you feel that you are falling behind the material, please email me. There are many ways we can work together to help you better understand the concepts and improve your quantitative analysis skills. It is my goal to make the material as accessible as possible, while still addressing the learning goals of the course. I welcome and encourage feedback to make the class run as smoothly and efficiently as possible.

**Counseling Services:** Free and confidential counseling services are available on campus. Licensed counselors are here to provide a space where you can get support and guidance privately about whatever is on your mind. For more information see their website, e-mail [counselingcenter@oglethorpe.edu](mailto:counselingcenter@oglethorpe.edu), or text inquiries to 1 (470) 231-5836.

**Respect for Diversity:** It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you. If you would feel more comfortable discussing your concerns about this course with an outside person, Dr. Charlie Baube is the division chair ([cbaube@oglethorpe.edu](mailto:cbaube@oglethorpe.edu)).

## GRADING POLICY

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### Grading scale:

A.....90-100	(A-....90-92)
B.....80-89	(B-....80-82, B+....87-89)
C.....70-79	(C-....70-72, C+....77-79)
D.....60-69	(D+....67-69)
F.....0-60	

Note that Incomplete (I) is given only under the rarest of circumstances. Refer to section 6.20.2 of the 2020-2021 Bulletin for a summary of requirements.

Due to inherent uncertainties in evaluating student work, course grades are rounded to 2 significant figures before determining final grade. That is an 82.4 would result in an assigned grade of B-, while an 82.5 will result in an assigned grade of B. **I will not consider grade change requests at the end of the semester** however I do reserve the right to consider student effort for those who are right at those boundaries between grades – that is, a student who ends with a 82.4 but has been actively attending office hours or emailing questions may find that they have earned a B when all is said and done. I will never abuse that right by *lowering* student grades arbitrarily.

*Your grade will be computed as follows:*

Pre-class Activities	15%
Homework	35%
Midterm exams (3 exams equal weight)	30%
Final Exam	20%

**Course Schedule PHY331** *(These dates are tentative and subject to change)*

<b>Tuesdays</b>		<b>Thursdays</b>	
<b>8/31</b>	1.1–1.2: Calc Review	<b>9/2</b>	1.3: Vector Calculus
<b>9/7</b>	1.4-1.6 Coordinate Systems & Delta Functions HW 1 due	<b>9/9</b>	2.1: Electric Field
<b>9/14</b>	2.1: Electric Field HW 2 due	<b>9/16</b>	2.2: Gauss' Law
<b>9/21</b>	2.3: Electric Potential HW 3 due	<b>9/23</b>	2.4-2.5: Potential Energy & Conductors
<b>9/28</b>	<b>Receive Unit 1 Exam</b> HW 4 due	<b>9/30</b>	3.1: Laplace's Equation
<b>10/5</b>	3.2: Method of Images	<b>10/7</b>	3.3: Sep. of Variables
<b>10/12</b>	3.3: Sep. of Variables HW 5 due	<b>10/14</b>	3.4 Multipole Expansion
<b>10/19</b>	<b>NO CLASS – Fall Break</b>	<b>10/21</b>	Review & HW Help
<b>10/26</b>	4.1-4.2: Polarization HW 6 due	<b>10/28</b>	4.3-4.4: Dielectrics
<b>11/2</b>	<b>Receive Unit 2 Exam</b> HW 7 due	<b>11/4</b>	5.1: Lorentz Force
<b>11/9</b>	5.2: Biot-Savart Law HW 8 due	<b>11/11</b>	5.3: Amperes Law
<b>11/16</b>	5.2-5.3 continued	<b>11/18</b>	6.1-6.2: Magnetization
<b>11/23</b>	6.3-6.4: Magnetic fields in Matter HW 9 due	<b>11/25</b>	<b>NO CLASS</b>
<b>11/30</b>	<b>Receive Unit 3 Exam</b> HW 10 due	<b>12/2</b>	Computational Methods + Review
<b>12/7</b>	Computational Methods + Review	<b>12/9</b>	<b>FINAL EXAM</b> HW 11 due

**Important Dates**

September 3<sup>rd</sup> – last day to add or drop a course

September 6<sup>th</sup> – Labor Day

October 18-19 – Fall Break

October 25 - last day to withdraw

November 24-26 - Thanksgiving Break

December 7 - Last day of classes

**December 9 11:15AM-2:15PM – Final Exam**