Phys 302 Section 1 Spring 2020
Electricity and Magnetism

Instructor: Dr. Brianna Thomas
[redacted]
Drop-in Office Hours: TBA

Class Time: T/Th 10:50am-12:05pm
Class Location: SCI 112
Web page: Moodle (http://moodle.coastal.edu)

Course Information:

Required Textbook: *Introduction to Electrodynamics*, 4th edition, David J. Griffiths
Recommended: *Mathematical Handbook of Formulas and Tables*, by Murray R. Spiegel (Schaum's Outline Series)

Prerequisites – This class has prerequisites of either *PHYS 212: Essentials of Physics II* or *PHYS 214: Fundamentals of Physics II*, along with *MATH 260: Calculus III* OR *Phys 310: Mathematical Methods in Physics*. Each of these courses are important for successfully completing this course. *PHYS 302* builds on the physical principles introduced in the introductory physics courses while applying techniques introduced in *Calculus III* and *Elementary Differential Equations*. If a student is deficient in any areas they should speak with the professor early on.

Description: A more advanced treatment of the concepts of electricity and magnetism. Electrostatics, magnetostatics, dielectrics, Maxwell's Equations with applications, radiation, reflection, and dispersion. Three hours lecture per week.

Course Objectives and Expectations:

Course Objectives – The course goal is to further develop students' understanding of the foundational principles in electromagnetism. By introducing more substantive mathematical techniques and considering less than idealized situations, students explore in greater depth electromagnetic topics that are first introduced in an introductory physics course. By the end of the semester a student should be comfortable solving electro- and magneto-static problems using a variety of special technics; demonstrate knowledge of Maxwell's equations by applying them to common situations; and apply their foundational knowledge by solving conceptual problems using the formulation of Maxwell's equations.

Student Learning Objectives – Student learning outcomes are measurable statements that specify what students should know and be able to do at the completion of a course. Due to their length, a complete list of the learning outcomes for this course are listed at the end of this document.

What I expect from you:

- Actively engage in class
- Complete assignments on time
- Respect and support your classmates' learning in and out of class
- Advance notice of anticipated schedule conflicts
- Check email and Moodle regularly for course updates

What you can expect from me:

- Enthusiasm for physics
- An atmosphere of respect where questions are welcome
- Clear communication of expectations on assignments and exams
- Available during office hours with an open door policy
- Check and respond to email regularly during normal workday hours

Course Components:

Class Warm-up Questions – Each day has a section of the textbook associated with the class. You are *required* to read that section *before* you come to class, and I assume you are able to learn some basic material on your own. I do not expect you to understand everything you read; however, class time will be much more helpful if you come in having a general idea of what we're going to cover, the rough outline of a derivation, or what points seem the most confusing to you. To help get you thinking about the course content, you will have a few "class prep questions" to answer on Moodle by 8am the day of the associated class period. These will be graded predominantly on thoughtful participation.

In-class – Class time will utilize a combination of lecture and group work. Come prepared to be engaged! During the lecture portion, I will explain concepts, work examples and derivations, and reference warm-up questions.

Homework assignments – One of the best ways to learn physics is through working problems. You cannot truly learn physics without independently tackling the ideas discussed in class and practicing organizing your thinking. On the other hand, sometimes you may get stuck, in which case you are encouraged to work with your classmates or consult other resources (see **"Collaboration policy"**), as long as ***all work you turn in is your own.***

Homework will be assigned on a roughly weekly basis and will be **due at the start of class** on the specified due-date. I will announce a deadline when assigning the problems; this deadline may occasionally be moved later but will rarely be moved earlier. *It is in your best interest to look at the assigned problems after each class period* to see what you are able to do with your new knowledge. Homework assignments are available on Moodle; solutions will be posted after the due date. Homework problems will be graded on a combination of correctness (60%), clarity of presentation (20%, 2-5 below), and neatness/citation of sources (20% 1 and 6 below).

Homework Guidelines:

- ***Format (see example):***
    1. All homework should be on one side of the page only with your name at the top of the pages; should be neat, not cramped, and legible; and should have multiple pages stapled together.
    2. Briefly summarize the essentials questions of the problem, so you know what the problem is about without having to reference the textbook.
    3. Include any relevant diagrams, information, and set-up equations.
    4. For conceptual/graphing problems, include a clear, sufficiently detailed explanation of how you got to your answer.
    5. For quantitative problems: a) Start all problems with fundamental equations from the textbook (typically, the boxed equations). b) Solve the problem analytically to the simplest possible form, showing all algebra steps, and c) using brief sentences to explain your reasoning and outlining the logic of the problem. You may find it helpful to number key equations. b) If asked, calculate a final numerical solution. c) Underline or box your final answer. d) Check the answer for reasonableness: eg dimensional correctness, limiting cases, etc.
    6. *Allowed mathematical resources:* You are allowed to use some non-textbook resources to aid in solving more complicated steps in a problem. a) Mathematics handbooks, eg to look up trig identities or an integral solution*. You should reference the book and equation number used in your solution.* b) Mathematica (or WolframAlpha). You may use Mathematica in the same way you would a math handbook - to help find the general solution to a step in the problem - but *must include a print-out of what you did* (this may be a separate page that you reference by line number, or a smaller print-out taped to the homework page at the relevant step). You should NOT enter values specific to the problem for bounds, limits, or variables EXCEPT when there is no clearly defined solution otherwise (as is the case with some special definite integrals). When in doubt, ask for clarification. You may NOT solve the problem in its entirety using Mathematica/WolframAlpha, or use Mathematica/WolframAlpha to generate graphs, unless *explicitly* specified.

- ***Late Homework policy –*** Homework turned in after the deadline will be deducted 20% for every 24-hr period after the deadline, including weekends, until I start grading the problems. *I will not accept any assignments after I start grading*. If you have an anticipated reason that might warrant an extension, come talk to me as soon as you are aware of it. Last-minute or after-the-fact exceptions will only be granted under extenuating circumstances; if you miss a homework due to a last-minute but excusable reason, let me know as soon possible.
- ***Collaboration policy –*** Working together on homework is allowed, and is encouraged if you find yourself stuck on a problem. *However, all assignments must be your own work*. The best approach is to first attempt the homework on your own, then talk and work with a classmate or other resource if you get stuck, then write out the final problem solution *independently* in your own words. You should also ask yourself if you would be able to solve a similar problem on your own without help – as you will have to on the exam. See "Course policies" for an enumeration of behaviors that constitute a violation of academic honesty which will result in grade penalties (see "Course Policies").

Project – Over the course of the semester students are required to perform a mini-research project in which they develop a deeper and more applicable understanding of a personally chosen electro- or magneto-static system that applies the principles studied in this course. Approximately one week prior to the end of the semester, students must submit a brief written summary of the system that includes a clear and concise description of how the system uses the electricity and/or magnetism concepts learned in this course. Accompanying the summary must be an original, textbook style problem and solution that is written by the student and is related to this same system. More information will be provided later in the semester.

Exams – There will be three exams, the last of which will take place during the final exam period. Each exam will cover two chapters of Griffith's text. Exams will be given after Chapters 3, 5, and 7 with sufficient time for homework to be returned for studying. Dates will be announced in class at least a week in advance; tentative dates for Exam 1 and 2 are February 25 and April 7, with Exam 3 being during the final exam period on **Thursday, May 7, 11:00am**. If you have a valid school or health related conflict with attending an exam at the scheduled exam time, you must request an alternative arrangement ***no later than 1 week in advance of the exam***, ideally, you should notify me as soon as you are aware of the conflict.

Grading summary:

Class Warmup Questions	5%
Homework	20%
Project	15%
Exams (20% each)	60%

Grading Scale:

Excellent:	A	100.0 – 90.0
Good:	B+	89.9 – 87.0
	B	86.9 – 80.0
Average:	C+	79.9 – 77.0
	C	76.9 – 70.0
Poor:	D+	69.9 – 67.0
	D	66.9 – 60.0
Failing:	F	59.9 and below

Getting a hold of me

Dedicated drop-in hours – are posted on Moodle and on my schedule outside my office. During these hours I am 100% available to answer any questions you have.

Open door – You are welcome to stop by for any reason if my door is open (> 1in).

By appointment – Set up a specific time in person, via email, or by a call to my office, if you are unable to come to the drop-in hours (times available by appointment are also marked on my schedule).

By email – If it's after hours or my door is closed. I'll get back to you as soon as I can.

Note: I will generally *not* be available before class, as that is when I review warm-up responses for in-class use. Some hours on my posted schedule are explicitly allocated for prep or research. Unless you have an unavoidable conflict, please be respectful of that time being reserved.

Course and University Policies:

Regrades – Requests for a regrade of homework or exams must be ***submitted in writing within a week of your receiving the graded assignment***. You should submit the original, unaltered assignment with a cover sheet describing your request stapled to the front.

Technology use – ***Cell phones*** are great for taking pictures of your group work for later reference, or as a calculator for the rare numerical answer. Please don't use them in class otherwise. Computers are not of much help in this class unless you have a tablet, and with the layout of the classroom it's virtually impossible to hide what you're doing if you use one for non-class purposes. Please be respectful of your classmates!

Class disruptions – If classroom distractions are a consistent problem, I reserve the right to make up lost time with an increase in homework assignments. If a single person is the source of disruptions, they will be asked to leave.

Accommodations – Coastal Carolina University is committed to equitable access and inclusion of individuals with disabilities in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act. Individuals seeking reasonable accommodations should contact Accessibility & Disability Services (843-349-2503 or https://www.coastal.edu/disabilityservices/). If you need accommodations in class, please notify me within one week of the start of class so I can plan accordingly.

Academic Honesty – Coastal Carolina University's Statement of Community Expectations
Coastal Carolina University is an academic community that expects the highest standards of honesty, integrity and personal responsibility. Members of this community are accountable for their actions and reporting the inappropriate action of others and are committed to creating an atmosphere of mutual respect and trust.

Cheating and Plagiarism are defined for Coastal Carolina University in the Student Code of Conduct, as are the procedures for dealing with such violations of community trust. For this course, a first cheating or plagiarism violation will result in a 'zero' grade for that problem, as second will result in a 'zero' grade for the whole assignment, and a third violation will result in an automatic failing grade.

In this course, some activities are meant to be collaborative (peer instruction, group work), some are meant to be largely done individually with outside help allowed either via peers or the professor (homework assignments), and some are meant to be completed as an individual (exams and projects).

The following constitute a violation of academic honesty: copying work from a classmate, a previous student of the class, a solution manual, or the internet (including websites such as Bartleby, Chegg, etc); "co-writing" a non-collaborative assignment; letting others copy your work; failing to reference non-textbook sources; citing complete sentences with only one reference note; or using other forbidden resources. "I didn't know it was cheating!" is not an excuse – when in doubt, ask.

Revisions

This syllabus describes the course as best it can. The instructor reserves the right to make changes in its content. If changes must be made to it during the semester, students will be immediately notified.

Weekly Schedule:

See Moodle for a detailed schedule that will be updated weekly. Pace: ~1 section/class day. ***Important Note:*** We will not be meeting in person on Tuesday March 3rd, due to a scheduled departmental event.

Student Learning Outcomes for PHYS 302

This course covers a lot of definitions, concepts, and techniques. Compiled together it would appear that the class covers a tremendous number of topics. Furthermore, as each lecture focuses on one particular topic and/or technique it is possible to lose sight of the bigger picture and the context with which the material is being presented. Listed below are the student learning outcomes for this course. Student learning outcomes are measurable statements that specify what students should know and be able to do at the completion of the course.

1. Students should develop a foundational understanding of electromagnetism that are essential in the practice of physics. Students should be able to:
    a. state Maxwell's equations in both differential and integral forms, the Lorentz force law, and the standard boundary conditions used in electromagnetism
    b. state Maxwell's equations in the presence of materials
    c. define the three types of charges and currents (linear, surface, and volume) and be able to calculate each
    d. calculate the electric and magnetic fields from a charge or current distribution respectively
    e. relate the electric and magnetic fields to their associated potentials and describe the benefits of working with the potentials
    f. compare and contrast the properties of conductors and dielectrics (insulators) and describe how those properties arise at the atomic level
    g. summarize polarization and magnetization (including permanent magnetics) on the atomic level
    h. calculate the electric and magnetic fields from a polarized or magnetized material
    i. describe qualitatively and quantitatively electric and magnetic dipole moments

2. Students should reinforce their expert-like problem solving skills. Students should be able to
    a. evaluate multi-dimensional integrals in rectilinear, cylindrical, and spherical coordinates to arrive at values for electromagnetic quantities, such as the total electric charge, electric fields, and magnetic fields
    b. use Green's (divergence) and Stoke's theorems to simplify volume, surface, and line integrals
    c. use the Dirac delta function to evaluate integrals
    d. explain the concept of flux and calculate it formally
    e. recognize symmetries in systems and use those symmetries to simplify required calculations
    f. use Gauss and Ampère's laws to calculate the electric and magnetic fields respectively when symmetry permits
    g. solve Laplace's equation using the Method of Images, Separation of Variables, and a multipolar expansion