
Physics 342

Classical Physics II: Electricity and Magnetism 4 Credits

Instructor – Dr. Mark Conde



<http://tesladownder.com/Tesla18Week2FullBright3000.jpg>

Overview

Description

This will be a standard undergraduate introduction to the vector-calculus based description of classical electricity and magnetism. Topics covered will include static and dynamic electric and magnetic fields, both in vacuum and in the presence of materials, the Lorentz force law, Maxwell's equations, potential formulations, and Poynting's theorem. These concepts would be covered in three one-hour lectures per week plus one one-hour tutorial/recitation session. However, in 2022, the lectures will be replaced by independent study, with only the one tutorial session being conducted live.

The course will be closely linked to the assigned textbook (Griffiths) although we will cover the topics in a slightly different order.

Course goals and student learning outcomes

Upon completion of this course students will:

- Be familiar with the classical description of electricity and magnetism in terms of Maxwell's equations;
- Be able to solve a wide variety of vector-calculus based problems in electricity and magnetism using Maxwell's equations.

My goal as an instructor is to provide every student with maximum possible opportunity for success. This means that I try to be as flexible as possible with the course requirements, to avoid creating needless hurdles. Nevertheless, some penalties for missed or late work are necessary; my policies in this regard are outlined below.

Instructor information

Instructor:	Dr. Mark Conde
Office locations:	Reichardt room 113 and Elvey room 706C.
Office Phone:	474-7741
Email:	mgconde@alaska.edu
Office hours:	I do not intend to establish fixed office hours for this small class. I will always be available immediately after lectures, or at other times by arrangement. If you need to see me, speak to me after class or send me an email, to setup a time.

Approximate schedule

Week	Dates	Class Topics
1	Jan 10 - Jan 14	Class intro; review of vector calculus, major theorems
2	Jan 17 - Jan 21	Coulomb's law, charge distributions, Gauss's Law
3	Jan 24 - Jan 28	Gauss' Law examples, electrostatic potential, energy density
4	Jan 31 - Feb 04	Electric fields in materials, boundary conditions, Ohm's law
5	Feb 07 - Feb 11	Laplace's & Poisson's equations
6	Feb 14 - Feb 18	Exam 1. Separation of variables, multipole expansion
7	Feb 21 - Feb 25	Method of images, capacitance
	Feb 28 - Mar 04	Ampere's force law, Biot-Savart law, Ampere's circuital law
8	Feb 28 - Mar 04	Lorenz force law, magnetic vector potential
9	Mar 07 - Mar 11	Spring Break
10	Mar 14 - Mar 18	Magnetic fields in materials, Magnetic boundary conditions
11	Mar 21 - Mar 25	Exam 2. Flux linkage, magnetic circuits
12	Mar 28 - Apr 01	Electromotive force, Faraday's law, inductance
13	Apr 04 - Apr 08	Magnetic energy density, displacement current
14	Apr 11 - Apr 15	Maxwell's equations, electromagnetic radiation
15	Apr 18 - Apr 22	Potential potentials, Poynting's theorem. review
	Apr 25 - Apr 29	Finals week
16	May 02 - May 06	Grades Posted

Course components and instructional methods

Course materials

Material for this course will be prepared electronically and will be available *over the web* via the "Blackboard"¹ system at <http://classes.uaf.edu>. Material to be posted this way includes:

- Course syllabus (this document)
- Lecture notes (see comments below)
- Homework problem sets
- Supplementary handouts
- Online student grades

Note that I will not be distributing homework or exam solutions to the web. These will instead be posted in the glass cabinets in the physics departmental area of the Reichardt building.

Lectures

Due to the small enrolment and late change of instructor for this class, I do not intend to present formal lectures. Instead, I have prepared detailed lecture notes with plenty of explanatory text that I will be posting online for students to work through independently. The first lecture for the semester will be an exception to this: I will present this lecture synchronously via zoom at the designated time of 02:15-03:15 pm on Monday January 10, 2022. The link for all zoom meetings associated with this class is:

<https://alaska.zoom.us/j/81100938112?pwd=aHZmN2xcGNjNEkwZkIKT3R1MSt6dz09>

During this first lecture I will go through the class syllabus and explain how the class will run this semester.

¹ All students should have access to Blackboard. Please let me know if you have difficulties with this.

Should it become apparent during the semester that students are not able to understand the course material without lectures, I may be able to add extra class sessions each week. However, I am teaching this class as an overload, so I cannot guarantee that this will be possible.

Recitation Sessions

While I do not plan to present lectures this semester, I DO plan to conduct one synchronous recitation per week, again using the class zoom link above. There are two purposes for these recitations. First, they will provide an opportunity for students to ask questions and seek help with concepts that need extra clarification. Second, I intend to use this session to work through example problems that I have chosen to correspond closely with homework assigned for that week. My current plan for scheduling the recitations is to use the Friday 02:15-03:15 pm time slot that, under more normal circumstances, would be assigned for a lecture. This will give students time after the recitation over the weekend to tackle the homework problems that will due on Mondays.

Homework

Homework will be assigned each week and will be due at 6 pm each Monday. I will assign homework by uploading the relevant problem sheet to the Blackboard and Gradescope sites for this class. Homework should be submitted via Gradescope – I will explain this process during the first class session.

You are encouraged to work with others, but you are prohibited from simply copying other's work. Homework will count heavily toward your final grade, as well as provide me with feedback regarding your understanding of the material.

Problems assigned in this class can often be solved in several ways, with each solution involving a number of steps. So please be aware that even if you submit a correct solution to a problem, I may not recognize it as correct if it's poorly presented. While I will accept almost any work that you turn in, it is unlikely that I'll award many points for a homework or exam solution unless it:

- Is neatly laid out
- Is largely free from crossing out and over-writing
- Is accompanied by descriptions in words of what you are doing at each step

A minimum cumulative grade of 50% for the homework is necessary to pass the class. All students should be capable of achieving this, given that I generally award at least 25-30% for any genuine attempt at a problem.

Solution sets will be posted in the glass cabinet in the Physics Dept. hall. You are strongly encouraged make copies to help you understand how to approach these problems; it will likely help on tests.

Exams

There will be two exams during the semester and one final. All exams will be delivered via the UAF Gradescope system, and should be completed at home. I will not specify an exact time for these exams. Rather, I will configure Gradescope to allow students to take each exam at any time during the designated week for that exam. Once you start, you will have 24 hours to complete the exam and submit your responses. The preliminary for these exams is to conduct them during these weeks:

- Exam 1: Feb 14 - Feb 18
- Exam 2: Mar 21 - Mar 25
- Final: Apr 25 - Apr 29

Complex formulae and physical constants will be provided for exam problems that require them although, of course, the take-home format will also allow students to lookup any required formulae on their own.

Course policies

Grading

The course grade will consist of the following components

- Two one-hour midterm exams 30% (15% each exam)
- One two-hour final exam 30%
- Homework 40%

I will post all grades online, using the UAF's "Blackboard" system (<http://classes.uaf.edu>). All registered students have access to this system for checking their grades. Please do *check that I have posted all your grades correctly*, and let me know if you think there is an error. Also, please retain all work that we return after grading, in case an error does appear. Returned graded work is proof of your scores.

Final grades will be returned as letter grades with plus/minus modifiers. These will be derived from your overall percentage grade. The approximate conversions for each letter grade will be as follows. A: $\geq 90\%$; B: 75% to 90%; C: 60% to 75%; D: 50% to 60%; F: $< 50\%$. Plus/minus modifiers will subdivide each main grade into three equally spaced sub-levels.

Attendance

UAF policies² include statements that:

- "you must begin attending classes on the first day of instruction or you may lose your place, regardless of whether or not you have paid tuition and fees"
- "you are expected to adhere to the class attendance policies set by your instructors"

In general, I expect at least 90% attendance from all students. Extended periods of consistent absence may lead to a penalty in your overall grade, depending on circumstances.

Class participation

There is no requirement for you to participate actively in class by asking questions or joining discussions, and there is no grade component based on this. Nevertheless, you are of course free to ask questions at any time during the class sessions. Because we have a large amount of material to cover, I may defer answering lengthy or numerous questions until after class.

²See <http://catalog.uaf.edu/academics-regulations/attendance/> and <https://www.uaf.edu/register/services.php#attend>

Missed or late work

Two midterms and a final exam will be given in this course. In the case of documented illness, clash with another UAF commitment, or other emergency, a make-up exam may be given, at the discretion of the instructor. An unexcused absence for an exam will lead to 0 points earned on that exam.

Problem sets will generally not be accepted after the due date, without documented evidence of illness or genuine emergency. Students having documented clashes with other UAF commitments may pre-arrange alternate homework submission deadlines with me. All decisions regarding late homework or alternate deadlines will be at the discretion of the instructor.

Student conduct and academic honesty

It is the responsibility for each student to be informed about the policies for student conduct and safety at the University of Alaska. You are encouraged to read these policies at <https://www.uaf.edu/student-affairs/student-resources/conduct.php#condu>. It should go without saying that students are expected to do their own original work for all assignments. Any deviation from this may be considered academic misconduct and may result in a failing grade and referral to university authorities for possible disciplinary action.

Course requirements and materials

Prerequisites

PHYS F341 or permission of instructor.

Textbooks

Required:

- *Introduction to Electrodynamics*, Third (1999) or Fourth (2013) Editions, by David J. Griffiths, Published by Pearson. (I will be using the fourth edition mostly, but the third edition should be just fine, if you already have it.)

Recommended additional reading:

- *Field and Wave Electromagnetics*, by David K. Cheng
- *Elements of Electromagnetics*, by M. N. O. Sadiku
- *Electromagnetics for Engineers*, by Fawwaz T. Ulaby
- *Electromagnetic Concepts and Applications*, by Stanley V. Marshall et al.

In fact there are lots of great electromagnetism textbooks available these days. The list above just happens to be a few that I use and am familiar with.

Technology Requirements

Course materials will be delivered via Blackboard, which means students will require easy web-browser access to the internet. Most material will be delivered in PDF format, so that students will need access to Adobe Acrobat Reader or other third-party equivalent software.

Calculators will be permitted (and required) during exams. There will be no need for anything elaborate; an easy-to-use scientific calculator with trigonometric, exponential, and logarithmic functions is all that you will need. Remember that it is much more important to present the correct formulae and reasoning for solving a problem than it is to arrive at the correct numerical value. Please, explain your reasoning when presenting solutions to homework and exam problems. I will award partial points for correct reasoning, if presented, even if the final answer is incorrect or incomplete.

In general, it is better to work with algebraic variables whenever possible; numerical values should not be substituted in until absolutely necessary.

Other issues

Complaints and concerns

You are always welcome to discuss your concerns with me. However, if you have a concern that you feel cannot be resolved by discussion with me, you may wish to contact the Physics Department chair, Dr. Truffer. If your concern cannot be resolved at the department level, you may also discuss the matter with the Dean of the College of Natural Science and Mathematics.

Student Health and Counseling Center

The University provides health and counseling services through its Student Health and Counseling Center, which is located at 612 N. Chandalar Drive, on the 2nd floor of the Whitaker Building (the same building as Fire and Police, across from the bus turn around.) Their web site is at <http://www.uaf.edu/chc/>. The center will see students on an appointment basis. The number to call for an appointment is 474-7043. It is best to do so at 8:00 AM in the morning, because they are scheduled daily on a first come first serve basis.

Disabled students

Disability services are provided free of charge, and are available to any student who qualifies as a person with a disability. Student seeking special accommodations for a disability must first discuss their needs with Disability Services. Call 474-5655 to schedule an appointment.

UAF Disability Services is located in the Whitaker Building, room 208. Extensive support is available, as described at <http://www.uaf.edu/disability/>

As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations for all students' needs.

COVID-19 Statement

COVID-19 statement: Students should keep up-to-date on the University of Alaska policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Other UAF Student Support Resources

- Speaking Center (907-474-5470, speak@uaf.edu, Gruening 507).
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor).
- UAF Math Services, uafmathstatlab@gmail.com, Chapman 305 (for math fee paying students only).
- Developmental Math Lab, Gruening 406.
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120).

For more information and resources, please see the Academic Advising Resource List:

https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf

Emergency notification plan

Students will receive emergency notifications via phone or email. Please check your UAOnline account to confirm your emergency notification settings. For more information, please refer to the Student Handbook. In cases where you do not have access to your devices, as your instructor, I will take responsibility to relay any emergency notifications.

Extended absence policy:

The university of Alaska Fairbanks recognizes that students may need to miss more classes than allowed by a particular instructor as specified in course policies. Extended absences are defined as missed classes or course work by students beyond what is permissible by the instructor's written course policies. Students may need to miss class and/or course work for a variety of reasons, including, but not limited to:

- Bereavement
- Personal illness or injury
- Serious illness of a friend, family member or loved one
- Military obligations
- Jury service
- Other emergency or obligatory situations

For more information, go to the Students Handbook or the Center for Students Rights and Responsibilities

REQUIRED INFORMATION FOR UNDERGRADUATE SYLLABI

STUDENT PROTECTIONS AND SERVICES STATEMENT:

Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations.

UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: <https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/>.

As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities.

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: <https://alaska.edu/nondiscrimination/>.

INCOMPLETE GRADE POLICY:

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy: "The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an "I" grade."

EFFECTIVE COMMUNICATION:

Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from the UAF Department of Communication's Speaking Center (907-474-5470, speak@uaf.edu) and the UAF English's Department's Writing Center (907-474-5314, Gruening 8th floor), and/or CTC's Learning Center (604 Barnette Street, 907-455-2860).

COVID-19 STATEMENT:

Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

ADDITIONAL INFORMATION

The University of Alaska has detailed and ever-changing requirements for courses and course syllabi. The purpose of this statement is to indicate that, in addition to requirements explicitly stated here, all other current overarching UAF policies also apply to this course – whatever the heck they may be this time around....