

PHYSICS 408A: ELECTRICITY & MAGNETISM

FALL 2024

Instructor Information

Prof. Aaron Wirthwein
wirthwei@usc.edu
SHS 370
Office Hours: TBA

Course Information

Lecture 50506: MWF 10:00 – 11:20am ZHS 163

GENERAL COURSE INFORMATION

Welcome to PHYS 408A! This is the first course in the two-semester sequence covering electricity and magnetism at the upper-division, undergraduate level. In this course, we will focus on statics (i.e. electrostatics and magnetostatics), and in PHYS 408B you will focus on dynamics. We will study electric and magnetic fields, learn how to describe the interaction of electric and magnetic fields with matter, and introduce Maxwell's equations in both integral and differential form. In the second semester of this course, we will focus on the implications of Maxwell's equations and study in detail how electromagnetic waves interact with matter. We will study radiation, introduce gauge theory (a glimpse into field theory), and discuss relativistic effects (the special theory of relativity). We may scratch the surface of group theory and discuss modern applications of electrodynamics.

Textbook:

Required David J. Griffiths, *Introduction to Electrodynamics*, 4th ed.

Recommended Edward M. Purcell, David J. Morin, *Electricity and Magnetism*, 3rd ed.
"Practically everything I know about electrodynamics – certainly about teaching electrodynamics – I owe to Edward Purcell." (Griffiths, xiii)

Prerequisite(s):

- PHYS 152 (Fundamentals of Physics II) or PHYS 162 (Advanced Principles of Physics II)

Corequisite(s):

- MATH 245 (Mathematics of Physics and Engineering I)

Course Policies:

- We will use Brightspace to post homework assignments, homework solutions, additional documents, grades, etc. Make sure you have access to the course's Brightspace page.
- Attendance for the midterms and final exam is mandatory. There are no make-up exams. If you have medical circumstances that prevent you from attending the exams, please notify your instructor ASAP.

Disabilities:

Students who need to request accommodation based on disability are required to register each semester with the Office of Student Accessibility Services (OSAS). This office can be found at GFS 120 with phone number (213) 740-0776. A letter of verification to the instructor from OSAS is needed for the semester you are enrolled in. If you have any further questions, please contact the OSAS office or the instructor. Please note that you need to send the instructor a copy of your accommodation letter as the instructor doesn't automatically receive this information.

Registration and Administration:

The Undergraduate Physics Office deals with all administrative aspects of this class. Additional help regarding administrative issues is available from Giovanni Diaz, email address giovannand@usc.edu.

Faculty Liaison:

All courses in the Department of Physics & Astronomy have an assigned Faculty Liaison to serve students as a confidential, neutral, informal, and independent resource when they wish to discuss issues concerning their course without directly confronting their instructor. The Faculty Liaison for this course is Prof. Jack Feinberg (feinberg@usc.edu, (213) 740-1134, SSC 327).

GRADING

Your overall course grade will be determined from the following distribution:

Homework	20%
Midterm 1	20%
Midterm 2	20%
Final Exam	40%

Homework:

Homework will be assigned regularly, roughly once per week. The due dates of the assignments will be determined and posted as we go along but expect to have on average one assignment per week. Your solutions must be hand-written or typed, and you will upload a scan/picture of your solutions to Brightspace. Please be sure that your solutions and scan/picture are legible.

The problems will mostly be from our assigned textbook for the course (see above). The problems will be typed out and the assignments will be posted to Brightspace. Expect the problems to range in difficulty. We encourage you to work together with your fellow classmates. However, you must submit your own work. Any blatant copy of another student's work, online solutions, etc., will be subject to the full penalties of plagiarism as enforced by the University, and will result in all subsequent consequences. *Work together to solve the problems but write up your own solutions.*

Exams:

There will be two midterm exams and one final exam. There are no make-up exams. The midterm exams will be held in class with exact dates to be announced (sometime in early October and November). The final exam is scheduled on Monday, December 16th at 8:00am. You must pass the comprehensive final exam to pass this course.

IMPORTANT DATES FOR FALL 2024

August 26	Fall semester classes begin
September 2	Labor Day (University Holiday)
September 13	Last day to drop/add and change to Pass/No Pass
Early October	Midterm 1
October 10-11	Fall Break
October 11	Last day to withdraw without a “W” on transcript
Early November	Midterm 2
November 11	Veteran’s Day (University Holiday)
November 15	Last day to drop class with mark of “W”
November 27-29	Thanksgiving Break
December 6	Fall semester classes end
Monday, December 16, 8am	Final exam

LIST OF TOPICS

Here is a tentative list of topics with corresponding chapters in the course textbook (see above).

Week	Topic	Chapters
1	Review of vector fields: <i>div</i> , <i>grad</i> , <i>curl</i> ; Gauss’ and Stokes’ theorems; Spherical and cylindrical coordinates	1
2	Coulomb’s law, electric field, field lines, Gauss’ law	2
3	Div E and curl E, Dirac delta function, electrostatic potential	2
4	Work and energy, conductors, capacitors	2
5	Laplace’s equation, method of images	3
6	Separation of variables in Cartesian and spherical coordinates	3
7	Multipole expansion, review of electrostatics in vacuum	3
8	Dielectrics and polarization, fields of polarized objects	4
9	Electric displacement and linear dielectrics	4
10	Magnetic fields and forces, Biot-Savart law	5
11	Div B and curl B, Ampere’s law, Maxwell’s equations	5
12	Vector potential, gauge transformations	5
13	Magnetization, fields of magnetized objects	6
14	Auxiliary field and linear magnetic materials	6
15	Buffer week & Review	

STATEMENTS ON ACADEMIC CONDUCT AND SUPPORT SYSTEMS**Academic Conduct:**

Plagiarism is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime. Provides overall safety to USC community. dps.usc.edu