PHYS 408b: Electricity and Magnetism

Units: 4

Term—Day—Time:

- **Spring 2024**
- **Tuesday and Thursday from 2.00 pm to 3.50 pm**
- **Two 110 minutes classes per week, 15 weeks**

Location:

- **In-Person: GFS 222 (Grace Ford Salvatori Hall)**
- **If needed, the online sessions will be available via Zoom: https://usc.zoom.us/j/92563480100 (check our Blackboard page for the passcode) (remember to sign in using the SSO method)**

Instructor:

- **Dr. Marcin Abram**
- **e-mail: mjabram@usc.edu**

Teaching Assistant:

- **Chi Xu**
- **e-mail: chixu@usc.edu**

Student Hours (also known as Office Hours):

- **Wednesday, from 3 pm to 4 pm**
- **Online: https://usc.zoom.us/j/8934576028 (check the meeting passcode in the "Contacts" section of the Blackboard page of our class)**
- **Everybody is welcome!**
- **Drop-in, drop-out style: You don't have to make an appointment, just join the session and ask your questions or listen to discussions I have with other students.**

Piazza:

- **https://piazza.com/usc/spring2024/phys408b**
- **To self-sign, use the following code: yd5x50n37od**

Course Description

Physics 408 is an upper intermediate-level course in physics that focuses on electrodynamics. In this class, you will study electric and magnetic fields, get practice using advanced mathematical notation, learn how to describe the interaction of electric and magnetic fields with matter, discuss conservation laws, and learn how to motivate Maxwell's Equations. In the second semester of this course, you will focus on the implications of Maxwell's Equations and study in detail how electromagnetic waves interact with matter. We will also talk about radiation, introduce gauge theory (a glimpse into the field theory subject), and discuss relativistic effects (the special theory of relativity and its implications for electrodynamics). If time permits, we will also scratch the surface of the group theory, and we will discuss some modern applications of electrodynamics (e.g., in optics or in condensed matter physics).

This class can be seen as the third course in the curriculum of theoretical physics (with the first being Classical Mechanics and the second being Statistical Physics). Nevertheless, while knowledge of classical physics is recommended, familiarity with statistical physics is optional. Physics 408 is your gateway to studying quantum mechanics (PHYS 438), optics, soft matter physics, condensed matter physics, high-energy physics, field theory, and many other specialized classes. The auxiliary goal of this class is to build on ideas from the introductory physics classes while developing a range of new math skills. To achieve this goal, we will make heavy use of concepts from vector algebra, differential calculus, and integral calculus. We will also use some concepts from the field of quantum mechanics (especially in the second semester when discussing optics; However, don't be alarmed, we will introduce or review all the relevant topics during the class to make sure that nobody is lost).

Learning Objectives

At the end of this course, you will be able to:

1. Describe (quantitatively and qualitatively) the interaction of eclectic and magnetic fields with matter.
2. Discuss and describe the thermal, chemical, and magnetic effects of steady currents.
3. Apply various methods to solve systems consisting of steady and alternating currents.
4. Discuss the microscopic structure of matter and describe its electric and magnetic properties.
5. Motivate the Maxwell's equations and apply them to solve various physics problems.
6. Discuss the conservation laws in the context of electrodynamics.
7. Discuss selected topics from modern physics.
8. Complete a replication study (you will recreate and validate some key findings from a selected peer-reviewed paper).
9. Prepare peer-review reports.
10. Demonstrate your work in the form of a semi-scientific article.
11. Present your findings in the form of a short presentation in the class.

Prerequisite(s)

I have constructed the course with the understanding that you have completed (or you are familiar with the content of):

- ★ Either PHYS 152 (Fundamentals of Physics II) or PHYS 162 (Advanced Principles of Physics II),
- ★ PHYS 304 (Mechanics), and
- ★ PHYS 408a (Electricity and Magnetism I).

Co-Requisite(s) or Concurrent Enrollment

I have constructed the course with the understanding that you have completed (or you are familiar with the content of):

- ★ MATH 445 (Mathematics of Physics and Engineering II).

Recommended Preparation

To succeed with this class, review the information from:

- ★ Introduction to Physics (mostly the sections devoted to electricity and magnetism).
- ★ Classical Physics (PHYS 304), mostly the sections devoted to oscillators, Fourier transform, coupled oscillations, and normal modes.
- ★ Classical Physics (PHYS 408a), electrostatics, electric fields in matter, magnetostatics, and magnetic fields in matter.
- ★ Calculus (you should be able to solve simple integrals in one, two, and three dimensions; you should be able to compute surface and path integrals; you should be able to solve simple differential equations).
- ★ Algebra (you should be fluent in matrix calculus; you should know how to calculate eigenvalues and eigenvectors).
- ★ Quantum Mechanics (a general overview)

Course Elements

This course will be comprised of:

- ★ lectures,
- ★ weekly problem sets (short conceptual and longer quantitative questions),
- ★ two midterm exams,
- ★ a student project (discussed below), and
- ★ a final presentation.

The course will ordinarily be taken for a letter grade. All information regarding the class will be communicated with you via Blackboard (larger announcements) and Piazza (more informal communication).

Description and Assessment of Assignments

Weekly Problem Sets

Each week (with a few exceptions, see the full schedule on page 14), I will publish a problem set. Those are take-home assignments that, in most cases, require you to write down solutions to various quantitative physical problems. Each problem set may also contain a few conceptual questions. While answering conceptual questions, you should cite sources that you used. Each problem set will be worth 20 points. There will be 9 problem sets in total. You will all have approximately 6 days to complete each problem set. The solutions should be uploaded on our Blackboard site in the form of a single PDF file (you can either write the solutions in LaTeX or you can write them by hand, scan the papers, and create a PDF). As long as the problem set is open, you will be able to re-upload your answers (we will only check the last submission). The closing time for the problem set is always the following Thursday at 1 pm PT (Pacific Time). Specifically,

- ★ The deadline for the *first* problem set is on Thursday, January 25, 2024, at 1 pm PST.
- ★ The deadline for the *second* problem set is on Thursday, February 1, 2024, at 1 pm PST.
- ★ …

You can find the full schedule in the "Course Schedule: A Weekly Breakdown" section on page 14.

Note that in those written assignments, the completeness and clarity of your solution (e.g., clarity of your calculations or completeness of your derivations) matter as much as the correctness of your final answer. Writing down just a single final value (even if correct) is not enough. See the general grading rubricks below, which we will use while checking your answers.

Grade Component	**Meets Expectations (75%-100%) For Problem Sets: 15-20 points**	**Approaches Expectations (50%-75%) For Problem Sets: 10-15 points**	**Needs Improvement (0%-50%) For Problem Sets: 0-10 points**
Completeness (25%) 5 points in total	All questions are answered. All cases are considered.	Most questions are answered. The most obvious cases are considered (for example, non-zero forces are examined, but the student didn't consider a special case when B < 0).	The main question is not addressed, or the answer is irrelevant to the task. The analysis of the issues and the events is either vague or incomplete.
Clarity (25%) 5 points in total	A non-expert (e.g., a fellow student) can understand the solutions. All concepts and techniques used are defined and explained. Whenever it is applicable, the solution is accompanied by illustrative plots. The plots are explained and interpreted. There are references to sources (and the citation format is correct).	The teacher (or another professional physicist) can understand the solution, but a non-expert might have some trouble doing so. The solution has some minor shortcuts or some non-fully self-explanatory assumptions. For example, not every step of the analysis is explained, but it is still possible to follow the author's logic. Some references are missing.	It is hard to follow the solutions. The solution has some major shortcuts or hidden assumptions. There are no references in the texts. The analysis or evaluations of the issues and events are vague. It is either hard or impossible to understand or verify the correctness of the calculations.

Validity (50%) **10 points in total**	All calculations are correct. The final values, statements, or plots are correct, and the final interpretation or conclusions are plausible.	Small mistakes in the answers and/or calculations (e.g., a wrong sign, a missing constant). The final answer is close to the correct value (e.g., it differs by a small factor - twice too large or twice too small; however, the general trend is correct).	Major mistakes in the calculations and/or in the analysis. The final values and/or conclusions are incorrect or misleading.

Student Project

Your task is to:

- ★ Perform a replication study of one of the peer-reviewed papers related to the subject of the course.
- ★ Peer-review two projects prepared by your colleagues.
- ★ Address the comments that you received from your peers.
- ★ Present your work (5-7 minutes long presentation) in class.

The objective of this assignment is to replicate the key results of a selected peer-review paper. The replication can be either exact or conceptual. In exact replication, you shall follow exactly the methodology described in the paper, use the same data, etc. In contrast, in a conceptual replication, you might test the key idea of the paper in an analogous case, test how the results generalize to different situations, or you can use different (but comparable) data, while still following the same methodology.

Note that depending on the paper you follow, you don't need to repeat every single detail from the paper. Often, replicating just some selected key results might be enough (depending on how long and complex the paper is).

Projects Realization Form (choose one):

- ❏ *(For those who are theory-oriented)* Take a theoretical paper. Such papers are often quite condensed - for example, authors show only the most crucial steps of their calculations. Your job is to explain, step after step, every calculation and result in the paper, making it more accessible to your peers. Whenever applicable, you can also create additional visualizations (e.g., a diagram explaining the main concepts of the paper or some graphs illustrating some nontrivial steps of the derivations).
- ❏ *(For those who are computer-science oriented)* Take a paper where some numerical calculations were performed. Recreate the main result (e.g., the main plot) from the paper by writing your own code. Remember that your goal is to replicate the study, not to complete your own independent research. So, writing your own implementation, follow the methodology described in the paper as closely as possible (in a good paper, all crucial steps should be well articulated). Sometimes, the authors of the paper share both the exact data and the original code. In such a case, you don't have to pretend that the original code does not exist. You can use it as both an inspiration and a guide when writing

your own code. Later, you can use that original code to check and validate your own implementation. If you notice any differences, you should discuss them in your final paper

- ❏ *(For those who are experimentally oriented)* You have to be very mindful - without a proper lab and without access to expensive equipment, you might not be able to repeat many experiments. However, given that electronics are now more accessible than 50 or 80 years ago, you might try to repeat some *older* experiments. Alternatively, if you can find some experimental raw data, you can repeat the analysis process (bonus points if you actually perform a formal hypothesis testing).
- ❏ *(For those who have some original ideas)* Unleash your creativity. Maybe there is another path beyond what I described. I always encourage students to find their own ways of completing the project - however, you *must* consult your ideas with me to make sure that what you propose matches the requirements for the project and the general theme of the class.

Project Objectives:

- ❏ First and foremost, the topic of your project should be relevant to the class (classical electrodynamics, electronics, optics, etc.)
- ❏ The level of difficulty should be appropriate. I don't expect you to replicate any modern papers on quantum electrodynamics - for this, one would first need to finish a course on quantum field theory. However, performing a simple experiment with diffraction (it can be done with a toy laser and an old CD) would be too simplistic (it is something likely covered in PHYS 152 or PHYS 162; it would not be suitable as a semester-long project in 400-level class). In contrast, building a simple antenna and a simple receiver - to demonstrate how a radio works might strike the right balance between complexity and doability.
- ❏ I am not going to suggest any particular topics. One of the objectives of this course is for you to define your own topic and choose an appropriate form of presentation.

The structure and the formatting of the final paper:

Each step of your replication should be documented and delivered in the form of a semi-scientific paper at the end of the semester. The paper should follow the standard format for scientific articles and include an introduction, theoretical background, methods, results, discussion, and conclusion.

We encourage you to use the LaTeX template https://www.overleaf.com/read/xrjhpfnhhdmq that I prepared for you in Overleaf. If you use a WYSIWYG editor, please remember to submit your article in PDF format (not as a docx, rtf, or odt). If you replicate an experiment, attach additional documentation describing how you have built your device, how you collected the data, etc. If you collected original data, share the data as well. If any numerical methods were used to visualize or calculate anything, a link to a GitHub repository with relevant code, scripts, or notebooks (for those who used Mathematica or Jupyter) should be provided. If you are using numerical methods, you are free to use any language of your choice - as long as the code is clear and well-commented (to give me a chance to understand what you did).

Regarding the format of your article, you are expected to follow either the APS Physical Review or the Nature style guidelines, see:

- https://journals.aps.org/prb/authors (APS Physical Review)
- https://cdn.journals.aps.org/files/styleguide-pr.pdf (APS Physical Review)
- https://www.nature.com/articles/nphys724 (Nature Physics)

Detail description of steps:

1. Prepare and share your work plan by **Tuesday, January 23, by 1 pm PST**. You don't have to know your topic yet. However, you should have a plan for how long your "exploration" phase should last. The plan should include answers to the following questions: When you should have your topic ready, when you should start creating the replication, when you will start writing your final article, etc. Make sure that your plan is consistent with all the deadlines described in this syllabus.
2. Choose your topic. Find relevant literature. Read about your topic. Prepare a literature review and explain what aspect of the original work you will attempt to replicate **by Tuesday, February 6, by 1 pm PST**.
3. Make a detailed outline of your project. Describe again what aspect of the original work you will replicate and what aspect you will leave out (after all, you have limited space, only a couple of pages, including figures and bibliography, see the template that I prepared for you, so you might only be able to replicate a part of the study - depending how long is the original article). Submit your project outline **by Tuesday, February 20, by 1 pm PST**.
4. Complete the necessary calculations (depending on your topic, there will likely be some numerical or analytical calculations). Prepare plots and figures.
5. Write the first version of your article. You should have an early version by March 5 (the two-month mark after the start of the classes). You do not have to upload it yet - it is your internal deadline.
6. Proofread your article. Make sure that all key terms are defined. Make sure that the article has the right structure (introduction, the main content, summary, bibliography). Remember that the list of references at the end of your paper is not enough - your sources must be cited in the article (see the template that I prepared for you).
7. Prepare a PDF of your article. Make sure that the number of words is below the maximum limit. Make sure that your name, affiliation, abstract, and paper title are visible on the first page. Submit the pdf using Blackboard **by Tuesday, March 19, not later than 1 pm PDT (note the change of the time from PST to PDT)**.
8. Choose two articles prepared by your peers (we will coordinate this process to make sure that each article gets an equal number of reviewers). Read the articles. Using the Blackboard forum, give each author suggestions on how they can improve their papers. You should complete this action **by Tuesday, April 2, by 1 pm PST**.

9. Read the suggestions you received from your peers. Address them (either incorporate the suggested changes or challenge them by describing in a separate post why you think those changes would not improve the quality of your work).
10. Submit your final project **by Tuesday, April 16, by 1 pm PST**.
11. Present a short summary of your work (4-5 minutes) **either on Thursday, April 18, Tuesday, April 23, or Thursday, April 25**.
12. Write an academic reflection summarizing your experience. Submit it **by Tuesday, April 30, by 1 pm PST**.

Additional Notes:

You are free to use any sources. However, you must cite all sources that you used (if not, you will violate the academic integrity standards). It might happen that you will cite non-peer-reviewed sources, like technical documentation of certain libraries or technical blog posts. This is acceptable as long as the non-peer-reviewed sources do not constitute the majority of your bibliography. If you decide to use quotes, remember to use them correctly.

If you happened to use text (or images) generated using machine learning generative methods, you should treat it as a citation from a non-peer-reviewed source (you must disclose it, and you should clearly mark sections where you used the generated text of images). The same applies if you generated a text (or images) and then adapted them (modified). You should disclose that practice by clearly marking where the adapted text (or images) are present and cite the source (e.g., the particular model and version of the generative system). The same would be expected if you adapted (copy with some modifications) text from a book or illustration from somebody else's article (assuming that the license of the source permits this). In such a case, you would also be expected to disclose it and properly cite the original author. Not doing this is seen as stealing intellectual property.

Remember that plagiarism (this includes using sources without proper citations) is a major violation of the university's academic integrity standards and will be reported to the Office of Student Judicial Affairs and Community Standards at USC. You can read more about this at https://policy.usc.edu/wp-content/uploads/2023/03/USC_StudentCode_February2023.pdf - you should also review Appendix A: Academic Dishonesty Sanction Guidelines.

Finally, when you create your final article, think about your audience. Your main audience is not the instructor, it is your peers. Write in a way that your colleagues can understand. You can assume certain fluency in math and physics in your readers but do not assume that your audience has any specific prior familiarity with the topic of your project.

Project Grading Criteria:

When checking your work, I will follow the general grading rubric illustrated in the table below.

Grade Component	Meets Expectations (90%-100%)	Approaches Expectations (75%-90%)	Needs Improvement (50%-75%)	Inadequate (0%-50%)
Content	The content matches the topic. The overall quality of the work is high. The topic is challenging. The analysis and the discussion are comprehensive.	The content matches the topic. The overall quality of the work is high - however, there are some minor problems. For example, the discussion part doesn't cover all the important aspects.	The content matches the topic. However, there are some major issues. For example, the analysis and the discussion are far from being comprehensive.	The content does not match the topic; There are major factual mistakes. We detected that *any* part of the text was not written independently (plagiarism).
Support	All claims are supported by relevant citations. Citations are high quality (mostly peer-reviewed sources).	All claims are supported by relevant citations. Citations are low quality (mostly non-peer-reviewed sources).	Not all claims are supported. Citations are low quality (mostly non-peer-reviewed sources).	No citations (note, a simple list of references at the end is not enough)
Clarity	The reader can understand everything without any problem.	There might be a few places in the paper where the reader might have trouble understanding all the details.	There might be several parts of the paper that might be unclear to the reader.	The reader might have trouble understanding what the paper is about.
Organization	The organization of the article makes sense, given the topic. All key sections are present (in correct order).	Minor problems with the organization of the article.	Problems with the organization of the article might affect the ability of the reader to understand the work (e.g., the reader might feel like sections are not connected, and that the flow of the article is abrupt or chaotic).	Not all key sections are present, e.g., there are no abstracts or no conclusions.
Format and Style	The format and the style match the journal's guidelines. In other words: the end product looks like an academic article.	Minor problems with the style and the format.	Major problems with the style and the format.	The format and style of the article violate the journal's guidelines.

Mid-Term Exams

You will be asked to solve problems similar to those that are included in the weekly problem sets. The official dates for our mid-term exams are February 22, from 2 pm to 3.50 pm PST, and April 4, from 2 pm to 3.50 pm PDT (in both cases, we will write it in our regular classroom, GFS 222).

Final Exam

There will be no final exam. With two mid-term exams and a longer student project, you will have enough work this semester.

Technological Proficiency and Hardware/Software Required

Technological proficiency can be helpful but is not required. Note that while some students' projects might require a basic knowledge of a programming language (it could be one of many: R, Python, Julia, Java, or C++) or basic proficiency in some mathematical software (e.g., Mathematica, MATLAB), you can always choose a project that requires less or no programming skills.

Required Readings and Supplementary Materials

For the most part, we are going to follow "Introduction to Electrodynamics" by David J. Griffiths. There are also additional textbooks that you can download free of charge from the USC libraries, https://libraries.usc.edu/, that you might find helpful, for example, Andrew Zangwill's "Modern Electrodynamics" (Cambridge University Press) and many others (just type "Electrodynamics" or "electromagnetism" and see the results).

Grading Breakdown

Course Element	Points
Weekly Problem Sets (8 out of 9)	160 (=20x8)
Work Plan	5
Literature Review	5
Project Outline	5
Project Draft	10
Peer Reviews	20
Student Project	90
Final Presentation	10
Academic Reflection	5
First Midterm Exam	40
Second Midterm Exam	50
TOTAL	**400**

Grading Scale

Course final grades will be determined using the following scale.

Final Grade	% of Total Points	Number of Total Points (rounded down)
A	[92% - 100%]	368-400
A-	[89% - 92%)	356-367.9
B+	[86% - 89%)	344-355.9
B	[81% - 86%)	324-343.9
B-	[78% - 81%)	312-323.9

C+	[75% - 78%)	300-311.9
C	[70% - 75%)	280-299.9
C-	[67% - 70%)	268-279.9
D+	[64% - 67%)	256-267.9
D	[59% - 64%)	236-255.9
D-	[55% - 59%)	220-235.9
F	[0% - 55%)	0-219.9

Assignment Submission Policy

Late solutions to problem-set solutions will not be accepted. The reason is that just after the deadline (during the following lecture), we will all discuss the correct solutions - thus if you send me late work, I won't be able to determine whether your solution is original or not.

Because unforeseen situations might happen to anybody, when calculating the final score, I will drop one problem set with the lowest score. This means that you can forget to submit, be late, or purposely omit one problem set (nominally worth 20 points) and still be able to collect up to 400 points (100%) and receive an A.

Make-up Policy and Additional Points

There are only two ways to earn additional points (not included in the grading breakdown above). The first is the Piazza activity (answering other students' questions, sharing helpful notes, etc.; +3 points in total, awarded at the end of the semester). The second is the in-class activity (presenting problem solutions during our Thursday session; +1 point per solution [limit to 1 point per week per person]). There will be no other make-up exams, tasks, or problem sets. If you are late or if you fail to submit your work, you will not receive any points. Therefore, I encourage you to submit all your work as early as possible (to avoid last-minute internet issues) and always check whether you submitted the right file (it happened a few times in my past classes that a student submitted homework solutions from another class - in every case the mistake was caused by the fact the files had some generic names, e.g. "homework5.pdf" - therefore, please be extra cheerful when submitting solutions - always check what you submitted).

Grading Timeline

We will make every effort to grade and return homework within 10 days after it is received. Homework solutions will be discussed during the lectures. If you need more clarification, you can always ask me either during the lecture or during our weekly student hours (office hours).

Academic Honesty and the Need for Proper Citations

You will get an individual grade at the end of this course, thus you shall write answers to any assignments individually as well. As long as the submission period for the problem set is open, you shall not share your solutions. Specifically, on Piazza, before the deadline is due, you are forbidden to explicitly discuss the solutions to the problems. However, if you see that somebody is stuck, you

can help your colleague by giving them some hints, explaining the concept your colleague struggles with, or suggesting a helpful resource (this can, at the end of the semester, give you a few extra points). If you are uncertain whether a particular hint or help is allowed, ask, and we will be happy to assess the situation for you.

If you happened to find a solution to one of the homework problems in a textbook, on the internet, or with the help of another resource[1], you are obligated to acknowledge this by providing a proper citation. You should also clearly indicate which portion of your solution was inspired by those sources (or people) and what your individual contribution is. I acknowledge that it is hard to unseen things that you have seen, so if you happen to find a similar problem with a solution, you should not pretend that it didn't happen, just acknowledge the source. I will never punish honest behavior. However, if we find that you copied a part of your solution without providing an appropriate acknowledgment or citation, we will see this as a violation of academic integrity. Note that using sources without proper citations is a form of plagiarism, and as such, it is a major violation of the university's academic integrity standards.

The Official Position of USC Regarding Academic Integrity[2]

"The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

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[1] Including AI generative services or systems, like ChatGPT, Bard, Bing Chat, Jasper.ai, Claude, Perplexity, Vicuna, LLaMA, or any other locally run or cloud-based generative chat system.

[2] The following 5 paragraphs must be included in each syllabus, see the official USC Syllabus template at https://cet.usc.edu/teaching-resources/syllabus-template/

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct."

Additional Policies

Names, Gender:

If you have a name and/or pronouns that differ from those in your official USC records, please let me know.

If I am mispronouncing your name, please correct me. I am highly empathetic on this point because my given name (Marcin) is pronounced [ˈmartɕin] using the International Phonetic Alphabet and is often mispronounced in the US.

Mental Health:

If you feel that experiences outside of class are impacting your course performance, please come and talk to me. If you would rather consult someone outside the classroom, you might contact the USC Counseling and Mental Health Services (https://sites.usc.edu/counselingandmentalhealth/) or Student Counseling Services (SCS), (213) 740-7711 – 24/7 on-call.

Faculty Liaisons:

All classes in the Department of Physics & Astronomy have an assigned Faculty Liaison (previously called "Course Ombudsman") 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 class is Prof. Jack Feinberg, e-mail: feinberg@usc.edu, phone 213-740-1134. You can also find him in SSC 327 (room 327 in the Seaver Science Center).

Equity and Diversity and Title IX:

The Office of Equity and Diversity (OED) and the USC Title IX Office work with faculty, staff, visitors, applicants, and students around issues of protected classes: https://eeotix.usc.edu/. Incidents of bias, hate crimes, and microaggressions can be confidentially reported to Student Life: https://studentaffairs.usc.edu.

Accommodations:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. If you have registered accommodations with the Disability Services and Programs Office (https://osas.usc.edu/), please communicate those to me at your earliest convenience so we can discuss your needs in this course. For those on or near campus, DSP is located in STU 301 and is open from 8.30 am to 5.00 pm, Monday through Friday. They can be contacted online or by phone at (213) 740-0776 (Phone) or via email, OSASFrontDesk@usc.edu.

Statement for observance of religious holidays

USC's policy grants students excused absences from class to observe religious holidays: http://orl.usc.edu/life/calendar/absences/. In this case, please contact your instructor in advance (at least a week in advance) to agree on alternative course requirements.

Hybrid Classroom Policies

The official recommendation of the university is that we should have classes in person. By default, the classes will not be recorded unless I'm aware that some students are prevented from attending the class by some unavoidable factors. While I am obliged to follow the official recommendation, we should still be mindful of our own health and the health of other people. If you are sick and you think your physical presence could put you or others at risk (e.g., you could expose them to a virus you struggle with), inform me, and I will provide you a Zoom link to our class.

Special Accommodations

If you need any special accommodations, tell me. If you are in a situation that prevents you from attending the lectures (either in person or remotely), e.g., the time of the lectures collides with your work or with other obligations (e.g., you are a primary caregiver for a child, elderly parents, or other dependants), please let me know as well. I will work with you to find a suitable arrangement that is fair to both you and other students.

Course Schedule: A Weekly Breakdown

	Topics	**Readings**	**Deliverables**
Week 1 January 9 January 11	Introduction. Electromotive force.	Griffiths, Chapter 7	---
Week 2 January 16 January 18	Electromagnetic induction.	Griffiths, Chapter 7	---
Week 3 January 23 January 25	Maxwell's equations.	Griffiths, Chapter 7	Work Plan (January 23) Problem Set 1 (January 25)
Week 4 January 30 February 1	Conservation laws.	Griffiths, Chapter 8	Problem Set 2 (February 1)
Week 5 February 6 February 8	Mechanical waves.		Literature Review (February 6) Problem Set 3 (February 8)
Week 6 February 13 February 15	Electromagnetic waves in vacuum.	Griffiths, Chapter 9	Problem Set 4 (February 15)
Week 7 February 20 February 22	Electromagnetic waves in matter. *(Midterm Grading Period begins)*	Griffiths, Chapter 9	Project Outline (February 20) **Midterm** **(February 22)**

Week 8 February 27 February 29	Potential and Fields.	Griffiths, Chapter 10	Problem Set 5 (February 29)
Week 9 March 5 March 7	Radiation.	Griffiths, Chapter 11	Problem Set 6 (March 7)
Spring recess			
Week 10 March 19 March 21	The special theory of relativity.	Griffiths, Chapter 12	Project Draft (March 19) Problem Set 7 (March 21)
Week 11 March 26 March 28	Relativistic mechanics. *(Midterm Grading Period ends)*	Griffiths, Chapter 12	Problem Set 8 (March 28)
Week 12 April 2 April 4	Relativistic electrodynamics.	Griffiths, Chapter 12	Peer Review Reports (April 2) **Midterm** **(April 4)**
Week 13 April 9 April 11	Special topic.	TBA	Problem Set 9 (April 11)
Week 14 April 16 April 18	Final project presentations.		Project Submission (April 16) Final Presentations (April 18)
Week 15 April 23 April 25	Final project presentations.		Final Presentations (April 23 and April 25) Academic Reflection (April 30)

Note that the plan of the topics (especially the order) is provisional and can be modified during the semester. This plan should aid us but should not restrict us. If I notice that another order (or another topic) would work better for you, I will adjust the plan of topics accordingly.

Student Hours (also known as Office Hours)

I will host one 60-minute meeting per week. Those Student Hours (also known as Office Hours) are dedicated times when you can come to ask questions and resolve confusion about course material, as well as discuss career and educational goals as they relate to this course.

No special appointment is needed, however, if you sent me an email or posted a question on Piazza a day earlier, announcing a type of question you have, I might be able to prepare a better answer for you in advance. If you have any sensitive questions, you can also contact me via mail mjabram@usc.edu and we can schedule a 1-on-1 meeting via Zoom outside the student hours period. You can also always chat with me after the class.

Improving the Syllabus

If you notice any typos or mistakes in the syllabus, or if you find any part confusing or unclear, please let me know (either in class, after class, during office hours, writing on Piazza, or via

e-mail). I put a great deal of effort into proofreading everything, but typos and omissions are still possible. Therefore, I would appreciate your feedback.

When approaching this syllabus, we should follow the spirit of the law, not the letter of the law - meaning, a typo or clumsy wording should not be an excuse for creating legal loopholes if the intended meaning of the document is easy to infer. Nevertheless, I don't want to have any students confused about what is expected from them - so if you find any ways to improve this syllabus, please tell me.

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.