NORTHERN ARIZONA UNIVERSITY

College of Engineering, Informatics, and Applied Sciences

ELECTRICITY AND MAGNETISM I

GENERAL INFORMATION

Department: Applied Physics and Material Science
Course: PHY 331 (Electricity and Magnetism I) – Class Number 2294, Section 001
Term: Spring 2022
Total Units of Course Credit: 3
Prerequisites: PHY 263 and (PHY 265 or CS 122) and (Mat 238 or higher)
Corequisites: None
Mode of Instruction: In person
Meeting Time: MWF 9:10 AM to 10:00 AM
Location: Geology (Building #12), Room 223
Instructor: Dr. Ethan Dolle
E-mail: Ethan.Dolle@nau.edu
Office location: Physical Sciences (Bldg 19), Room 213
Office hours: M-F 1:00 PM to 2:00 PM, in-person or zoom [Link: https://nau.zoom.us/j/88359939977; Passcode: 386819], or by appointment; Masks are required for in-person meetings.
Office Phone: 928-523-9248

COURSE PURPOSE

The goal of this course is to develop methods to solve problems in electricity and magnetism.

STUDENT LEARNING OUTCOMES

Students will be able to apply advanced principles of physics toward the resolution of questions and problems in the physical world relating to the broad area of electricity and magnetism. More specifically, students will develop a working knowledge of Maxwell's equations, both in vacuum and in matter, using static and dynamic charge and current densities. By the end of this course, students will be able to

- Use mathematical methods to solve electric and magnetic problems.
- Use Coulomb's law and Gauss' law to calculate electric fields.
- Calculate electric and magnetic potentials.
- Use the Biot-Savart law and Ampere's law to calculate magnetic fields.

COURSE STRUCTURE AND APPROACH

PHY 331 is a lecture-based course that meets three time per week to investigate and solve problems in electricity and magnetism using Maxwell's equations. Active learning will involve the implementation of group activities to engage students and to synthesize the material more effectively. Homework assignments, in-class quizzes, and exams will be assigned to explore these principles and to provide practice in applying them.

TEXTBOOK AND REQUIRED MATERIALS

- **Textbook:** We will be using *Introduction to Electrodynamics*, by David J Griffiths
- **Course Website:** We will be using the university Bb Learn website at https://bblearn.nau.edu. You are responsible for any material I might post there.
- **What to Bring:** Before coming to class, please read through the sections that we will be working on. Bring paper and a pen or pencil to class every day.

RECOMMENDED OPTIONAL MATERIALS AND REFERENCES

- There are many texts, written at the level of Griffiths as well as more advanced treatments. See me for recommendations.
- There are many texts devoted to the study of MATLAB. However, I have found the online documentation to be better. See https://www.mathworks.com/help/matlab/index.html for more information.
- NAU has many programs to encourage and enable student success. A few links to help point students in the right direction have been provided under *Reference Links* in our Bb Learn course shell.

COURSE OUTLINE

- Ch 1: Vector Analysis
- Ch 2: Electrostatics
- Ch 3: Potentials
- Ch 4: Electric Fields in Matter
- Ch 5: Magnetostatics
- Ch 6: Magnetic Fields in Matter
- Ch 7: Electrodynamics
- Additional material as time permits

ASSESSMENT OF STUDENT LEARNING OUTCOMES

Methods of Assessment

- **Participation:** During class, I expect active participation from everyone. This includes answering poll questions (if any), contributing to class discussions and problem-solving sessions, and completing Exit Tickets. Exit Tickets consist of short questions (on paper) that I will hand out during class concerning text reading, conceptual difficulty, lecture content, etc. I typically grade each exit ticket out of 2 points, based on the amount of effort you put into it. To earn full credit for daily participation, you must answer all poll questions (if any), engage in discussion and problem-solving sessions, and submit an exit ticket (if given). All daily participation is weighted equally. At the end of the semester, I will drop the lowest daily participations and average the rest to give a Participation score.
- **Homework:** At the end of most classes, I will assign a short homework set that will be due at the beginning of the following class. This will involve problems assigned from the book and possibly me. Some homework assignments may utilize MATLAB, designed to familiarize you with the tools of industry that employers will require you to use. Working through homework in groups is highly encouraged, but you must write solutions in your own words, including MATLAB code. Unless stated otherwise, all homework sets are weighted the same. I will accept late submissions only under extenuating circumstances. At the end of the semester, I will drop the lowest homework assignment and average the rest to give a Homework score.
- **Quizzes:** You will have a short, written quiz about once a week to keep you caught up and to give you some feedback on how your problem-solving skills are developing. Unless stated otherwise, all quizzes are weighted the same. At the end of the semester, I will drop the lowest quiz and average the rest to give a Quiz score.
- **Exams:** There will be two midterm exams during normal class times on Mar 4 and Apr 22. The final exam is cumulative and scheduled for Wednesday, May 4 from 7:30 AM to 9:30 AM.

Timeline for Assessment

- The final exam date and time is fixed. The midterm exam dates given above are tentative and can change, given sufficient notice. Homework assignments are due at the start of class on most Mondays, Wednesdays, and Fridays. I usually give quizzes on Fridays, but I reserve the right to give pop quizzes.

Tips for Success in the Course

- Forming study groups to work on homework assignments and general study of course content strengthens communication skills, fosters effective collaboration, and greatly enhances the learning and overall experience of the course. While working together on homework assignments in small groups is encouraged, written quizzes and exams are to be done on your own unless stated otherwise. Be sure that you are doing your part in the problem-solving process. Copying assignments will set you up for failure on high-stakes assessments, and plagiarized answers will not be accepted. Moreover, this is a violation of the academic integrity policy set forth by the university (see ACADEMIC INTEGRITY under University Policies below).

- It can be easy to underestimate the time required of a college physics course. Plan on spending at least 8.5 hours every week on physics, including coming to class, reading the text, completing homework assignments, and general study (see COURSE TIME COMMITMENT under University Policies below).
- While reading the text and coming to class are an excellent first step toward mastery, do not expect to understand everything simply through reading or coming to lectures. Just like a foreign language, physics is a subject that is best mastered through practice. I incorporate practice problems into most of the lectures and there are many example problems located in the text. Take the time to work through the problems yourself before reading through the answers.
- If you get stuck, do not be afraid to ask questions in class or come to office hours. It is likely that others are facing similar questions. Asking for help when needed is a sign of strength, not weakness!

GRADING SYSTEM

Your course grade is determined from the above assessment methods utilizing the following weights. I do not round assessment scores, and I will not round course grades up more than 0.5 points. The grading scale is A (≥ 90 %), B (≥ 80 %), C (≥ 70 %), D (≥ 60 %), F (<60%). I reserve the right to lower the scale, but not to raise it.

Assessment	Percentage
Participation	10%
Homework	25%
Quiz	15%
2 Midterm Exams	15% (each)
Final Exam	20%

COURSE POLICIES

Assessment Makeup Policy

- If you can provide an institutional excuse or an approved extenuating circumstance, missed in-class work will not count against you and you will be allowed to submit homework at a later date and/or reschedule a missed exam without penalty. The style and difficulty of makeup exams is not guaranteed to be equivalent to the original. You are responsible for the content that is covered during your absence.
- Without an institutional excuse or approved extenuating circumstance, late homework assignments are docked 50% for each day (M-F) that they are late.
- There is no provision for making up missed participation or quizzes.
- If you miss a midterm or final exam without an institutional excuse or approved extenuating circumstance, I reserve the right to give a more difficult makeup exam at a time outside of class that we arrange via email. However, being granted a makeup exam is not guaranteed.

Attendance

Participation is worth 10% of the course grade while quizzes are worth 15% of the course grade. These can only be earned by attending class.

Shifting Instructional Modalities

If our instructional format is shifted to an NAUFlex modality or a completely online format, in-class activities, including lectures, participation, written quizzes, and exams, will be moved to our Bb Learn course shell. Details will be given through the *Announcement* link in our Bb Learn shell. Note that in such an event, the course will likely remain synchronous.

Statement on Plagiarism and Cheating

The university holds all students to the highest standards of academic integrity. Violations of the NAU Academic Integrity Policy include cheating, fabrication/fraud, facilitation, falsification, obtaining an unfair advantage, plagiarism, and self-plagiarism. Anyone caught violating these standards will have their name forwarded to administration and are subject to disciplinary action, which can include a written warning, a reduced grade or a grade of "F" or "zero" on the assessment, or a reduction of one letter grade or a failing grade in the course. Such zeros will be included in assessment averages. I reserve the right to implement

browser extensions and proctoring software that help to enforce academic integrity, such as HonorLock or ProctorU. See ACADEMIC INTEGRITY under University Policies below.

UNIVERSITY POLICIES

COVID-19 Requirements and Information

Additional information about the University's response to COVID-19 is available from the **Jacks are Back!** web page located at https://nau.edu/jacks-are-back.

ACADEMIC INTEGRITY

NAU expects every student to firmly adhere to a strong ethical code of academic integrity in all their scholarly pursuits. The primary attributes of academic integrity are honesty, trustworthiness, fairness, and responsibility. As a student, you are expected to submit original work while giving proper credit to other people's ideas or contributions. Acting with academic integrity means completing your assignments independently while truthfully acknowledging all sources of information, or collaboration with others when appropriate. When you submit your work, you are implicitly declaring that the work is your own. Academic integrity is expected not only during formal coursework, but in all your relationships or interactions that are connected to the educational enterprise. All forms of academic deceit such as plagiarism, cheating, collusion, falsification or fabrication of results or records, permitting your work to be submitted by another, or inappropriately recycling your own work from one class to another, constitute academic misconduct that may result in serious disciplinary consequences. All students and faculty members are responsible for reporting suspected instances of academic misconduct. All students are encouraged to complete NAU's online academic integrity workshop available in the E-Learning Center and should review the full *Academic Integrity* policy available at https://policy.nau.edu/policy/policy.aspx?num=100601.

COURSE TIME COMMITMENT

Pursuant to Arizona Board of Regents guidance (ABOR Policy 2-224, *Academic Credit*), each unit of credit requires a minimum of 45 hours of work by students, including but not limited to, class time, preparation, homework, and studying. For example, for a 3-credit course a student should expect to work at least 8.5 hours each week in a 16-week session and a minimum of 33 hours per week for a 3-credit course in a 4-week session.

DISRUPTIVE BEHAVIOR

Membership in NAU's academic community entails a special obligation to maintain class environments that are conductive to learning, whether instruction is taking place in the classroom, a laboratory or clinical setting, during course-related fieldwork, or online. Students have the obligation to engage in the educational process in a manner that does not interfere with normal class activities or violate the rights of others. Instructors have the authority and responsibility to address disruptive behavior that interferes with student learning, which can include the involuntary withdrawal of a student from a course with a grade of "W". For additional information, see NAU's *Disruptive Behavior in an Instructional Setting* policy at https://nau.edu/university-policy-library/disruptive-behavior.

NONDISCRIMINATION AND ANTI-HARASSMENT

NAU prohibits discrimination and harassment based on sex, gender, gender identity, race, color, age, national origin, religion, sexual orientation, disability, or veteran status. Due to potentially unethical consequences, certain consensual amorous or sexual relationships between faculty and students are also prohibited as set forth in the *Consensual Romantic and Sexual Relationships* policy. The Equity and Access Office (EAO) responds to complaints regarding discrimination and harassment that fall under NAU's *Nondiscrimination and Anti-Harassment* policy. EAO also assists with religious accommodations. For additional information about nondiscrimination or anti-harassment or to file a complaint, contact EAO located in Old Main (building 10), Room 113, PO Box 4083, Flagstaff, AZ 86011, or by phone at 928-523-3312 (TTY: 928-523-1006), fax at 928-523-9977, email at equityandaccess@nau.edu, or visit the EAO website at https://nau.edu/equity-and-access.

TITLE IX

Title IX is the primary federal law that prohibits discrimination on the basis of sex or gender in educational programs or activities. Sex discrimination for this purpose includes sexual harassment, sexual assault or relationship violence, and stalking (including cyber-stalking). Title IX requires that universities appoint a "Title IX Coordinator" to monitor the institution's compliance with this important civil rights law. NAU's Title IX Coordinator is Elyce C. Morris. The Title IX Coordinator is available to meet with any student to discuss any Title IX issue or concern. You may contact the Title IX Coordinator by phone at 928-523-3515, by fax at 928-523-0640, or by email at elyce.morris@nau.edu. In furtherance of its Title IX obligations, NAU will promptly investigate and equitably resolve all reports of sex or gender-based discrimination, harassment, or sexual misconduct and will eliminate any hostile environment as defined by law. Additional important information about Title IX and related student resources, including how to request immediate help or confidential support following an act of sexual violence, is available at https://in.nau.edu/title-ix.

ACCESSIBILITY

Professional disability specialists are available at Disability Resources to facilitate a range of academic support services and accommodations for students with disabilities. If you have a documented disability, you can request assistance by contacting Disability Resources at 928-523-8773 (voice), 928-523-6906 (TTY), 928-523-8747 (fax), or dr@nau.edu (e-mail). Once eligibility has been determined, students register with Disability Resources every semester to activate their approved accommodations. Although a student may request an accommodation at any time, it is best to initiate the application process at least four weeks before a student wishes to receive an accommodation. Students may begin the accommodation process by submitting a self-identification form online at https://nau.edu/disability-resources/student-eligibility-process or by contacting Disability Resources. The Director of Disability Resources, Jamie Axelrod, serves as NAU's Americans with Disabilities Act Coordinator and Section 504 Compliance Officer. He can be reached at jamie.axelrod@nau.edu.

RESPONSIBLE CONDUCT OF RESEARCH

Students who engage in research at NAU must receive appropriate Responsible Conduct of Research (RCR) training. This instruction is designed to help ensure proper awareness and application of well-established professional norms and ethical principles related to the performance of all scientific research activities. More information regarding RCR training is available at https://nau.edu/research/compliance/research-integrity.

MISCONDUCT IN RESEARCH

As noted, NAU expects every student to firmly adhere to a strong code of academic integrity in all their scholarly pursuits. This includes avoiding fabrication, falsification, or plagiarism when conducting research or reporting research results. Engaging in research misconduct may result in serious disciplinary consequences. Students must also report any suspected or actual instances of research misconduct of which they become aware. Allegations of research misconduct should be reported to your instructor or the University's Research Integrity Officer, Dr. David Faguy, who can be reached at david.faguy@nau.edu or 928-523-6117. More information about misconduct in research is available at https://nau.edu/university-policy-library/misconduct-in-research.

SENSITIVE COURSE MATERIALS

University education aims to expand student understanding and awareness. Thus, it necessarily involves engagement with a wide range of information, ideas, and creative representations. In their college studies, students can expect to encounter and to critically appraise materials that may differ from and perhaps challenge familiar understandings, ideas, and beliefs. Students are encouraged to discuss these matters with faculty.

TENTATIVE COURSE SCHEDULE: SPRING 2022

Mon	Wed	Fri
Jan 10 Introductions Ch 1	**Jan 12** Ch 1	**Jan 14** Ch 1
Jan 17 MLK Day – No Classes	**Jan 19** Ch 1	**Jan 21** Ch 1 Quiz 1
Jan 24 Ch 1	**Jan 26** Ch 1	**Jan 28** Ch 2 Quiz 2
Jan 31 Ch 2	**Feb 2** Ch 2	**Feb 4** Ch 2 Quiz 3
Feb 7 Ch 2	**Feb 9** Ch 2	**Feb 11** Ch 2 Quiz 4
Feb 14 Ch 3	**Feb 16** Ch 3	**Feb 18** Ch 3 Quiz 5
Feb 21 Ch 3	**Feb 23** Ch 3	**Feb 25** Ch 3 Quiz 6
Feb 28 Ch 3/4	**Mar 2** Ch 4	**Mar 4** **EXAM 1 (CH 1-3)**
Mar 7 Ch 4	**Mar 9** Ch 4	**Mar 11** Ch 4 Quiz 7
Mar 14 Spring Break	**Mar 16** No	**Mar 18** Classes
Mar 21 Ch 4/5	**Mar 23** Ch 5	**Mar 25** Ch 5 Quiz 8
Mar 28 Ch 5	**Mar 30** Ch 5	**Apr 1** Ch 5 Quiz 9
Apr 4 Ch 5	**Apr 6** Ch 6	**Apr 8** Ch 6 Quiz 10
Apr 11 Ch 6	**Apr 13** Ch 6/7	**Apr 15** Ch 7 Quiz 11
Apr 18 Ch 7	**Apr 20** Ch 7	**Apr 22** **EXAM 2 (CH 4-6)**
Apr 25 Ch 7	**Apr 27** Ch 7	**Apr 29** Ch 7 Quiz 12
May 2	**May 4** **FINAL EXAM** **7:30 AM - 9:30 AM**	**May 6** Commencement

Revised 01/22