

Updated January 6, 2023

PHY 331 - Principles of Modern Electromagnetism

Spring 2023

Instructor: **Dr. Igor Shovkovy**

Polytechnic campus | Tuesday & Thursday | 10:30 a.m. – 11:45 a.m. | [AGBC 145](#)

Course Description: Studies the unified description of electromagnetic phenomena provided by Maxwell's equations in differential and integral form.

Credits: 3 credit hours

Prerequisites: While there are no formal prerequisites for this course, students are expected to know vector algebra, differential calculus and integral calculus. These topics are covered, for example, in **APM 270** (Mathematics of Change I), **MAT 274** (Elementary Differential Equations) or **MAT 275** (Modern Differential Equations). Also, it is highly recommended that students take **PHY 131** (University Physics II: Electricity and Magnetism) before enrolling into this course.

Instructor information

Name: [Dr. Igor A. Shovkovy](#)

Office Location: Wanner Hall 340F

Office Hours: 10:30 a.m. – 11:30 a.m. on **Mondays & Wednesdays**, and by appointment.

To make an appointment, please contact the instructor via email at least 1 day in advance.

Email: Igor.Shovkovy@asu.edu

Phone Number: 480-727-1953

College Contact: This course is offered by the [College of Integrative Sciences and Arts](#) (CISA). For more information about the college, visit our website: cisa.asu.edu/. If you have questions or concerns about this course please speak with your instructor. If your instructor is unable to address your concerns, please send your inquiry to cisa@asu.edu.

Course Learning Outcomes

At the completion of this course, students will be able to:

1. solve conceptual and numerical problems in electromagnetism;
2. apply vector algebra, differential calculus and integral calculus in electromagnetism;
3. use curvilinear coordinates in physics context;
4. understand and explain electromagnetic phenomena using the fundamental laws of physics;
5. effectively communicate physics ideas;
6. use proper terminology in the context of electromagnetism.

Textbook(s)

Required Textbook:

Introduction to Electrodynamics (4th edition) by **David J. Griffiths**
ISBN: 978-1108420419

Additional Textbook (optional):

Field and Wave Electromagnetics (2nd edition) by **David K. Cheng**
ISBN: 978-0201128192



Course Recordings

The contents of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions by students is prohibited, except as part of an accommodation approved by the SAILS Office.

Course Access

Your ASU courses can be accessed by both my.asu.edu and <https://canvas.asu.edu>, bookmark both in the event that one site is down.

Student Success

To be successful:

- check the course daily
- read announcements
- read and respond to course email messages as needed
- complete assignments by the due dates specified
- communicate regularly with your instructor and peers
- create a study and/or assignment schedule to stay on track
- access [ASU Online Student Resources](#) or [CISA Academic Resources](#)

Grading

Your grade will be determined based on the following grading scheme:

A	90% – 100%	Excellent
B	78% – 89.9%	Good
C	66% – 77.9%	Average
D	54% – 65.9%	Passing
E	< 54 %	Failure
XE		Failure due to Academic Dishonesty

Percentage Distribution:

Homework assignments	35%
Mid-term Test #1	15%
Mid-term Test #2	15%
Mid-term Test #3	15%
Final Exam	20%
Total	100%

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Grades on assignments will be usually available within 72 hours of the due date in the Gradebook.

Late or Missed Assignments

As a rule, late homework will **not** be accepted.

However, if an urgent situation arises and you are unable to submit the assignment on time, notify the instructor **BEFORE** an assignment is due.

Follow the appropriate University policies to request an [accommodation for religious practices](#), or to request accommodation for missed assignments [due to University-sanctioned activities](#) or [active military service](#).

Attendance Policy

Class attendance in person is expected. Students are responsible for all material presented in class, all homework, and for all changes to the schedule or plans announced in class.

Follow the appropriate University policies to request accommodation [for religious practices](#), or to request accommodation for missed assignments [due to University-sanctioned activities](#) or [active military service](#).

Course Outline

Detailed schedule: http://shovkovy.faculty.asu.edu/syllabus/2023/Spring/phy331_schedule.pdf

The exact schedule for lectures, quizzes and examinations will depend on how long it takes to cover the material. The following is a tentative schedule:

Date	Description
Jan. 10, 2023	First class
Feb. 9, 2023	1st midterm exam
Mar. 23, 2023	2nd midterm exam
Apr. 25, 2023	3rd midterm exam
Apr. 27, 2023	Last class
May. 2, 2023	Final Exam (9:50 a.m. - 11:40 a.m.) https://students.asu.edu/final-exam-schedule

Assignment Details

Homework is truly one of the most important components in this course. This is because doing homework is the only way to truly learn the material and build a good intuition for physics. Solving physics problems effectively is a skill that students must develop. The only known way to achieve this is by practicing. The lectures will cover the key concepts. The text will elaborate on these concepts and provide further explanation of their meaning and on how one uses them to solve problems. There is no way to do well in this course if you do not give the homework assignments the effort they require. (Allow about **4 hours per week** for reading and homework assignments.) Your homework assignment should be neatly and clearly written. The front page should list your name, the date and the homework assignment number. Each problem should be clearly labeled. The problem solutions should contain detailed explanations. Late homework will **not** be accepted.

Tests and exams. There will be *several midterm tests* on the dates shown above in the tentative schedule (the actual dates will be announced in class). The *final exam* at the end of the semester is a comprehensive exam. The use of the textbook and class notes will not be permitted during the tests and exams.

Updated January 6, 2023

Electronic devices. The use of cell phones, iPads, laptops, and other similar devices is not permitted during lectures, tests and exams.

Communicating with your Instructor and Classmates

Classroom Community

To build a course climate that is comfortable for all, it is important that students (1) display respect for all members of the class – including the instructor and students; (2) pay attention to and participate in all interactive student partner/instructor sessions and activities; and (3) observe the rules of appropriate online behavior (also known as *netiquette*). This term is defined by the instructor and includes keeping course discussion posts and oral communication with other students (or the instructor) focused on the assigned topics. Students must maintain a cordial atmosphere and use tact in expressing differences of opinion. In addition, they must avoid racist, sexist, homophobic, or other negative language that may unnecessarily exclude course members. This is not an exhaustive list of behaviors; rather, it represents examples of the types of things that can have a dramatic impact on the course environment. Your final grade may be reduced each time you engage in the types of negative behaviors indicated above.

Community Forum

If your course uses a Canvas discussion topic called "Community Forum" for general questions and comments about the course check the syllabus, announcements, and existing posts to ensure it's not redundant prior to posting a question or comment. You are encouraged to respond to the questions of your classmates.

Email questions of a personal nature to your instructor. You can expect a response within 72 hours.

Chat

The Chat tool in Canvas allows students and teachers to interact in real time. Use Chat only for informal course-related conversations unless your instructor informs you otherwise. Chat is not ideal for questions about assignments; instructors are not required to monitor it and conversations may be buried or lost.

Email

ASU email is an [official means of communication](#) among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly.

All instructor correspondence will be sent to your ASU email account.

Course Time Commitment

Coursework includes all learning activities including reading, watching videos, studying, and completing assignments. Arizona Board of Regents (ABOR) requires 45 hours of coursework per credit for college-level courses, which translates to:

- 1 credit hour = 45 total hours
- 2 credit hours = 90 total hours
- 3 credit hours = 135 total hours
- 4 credit hours = 180 total hours
- 5 credit hours = 225 total hours

ASU courses range in length from 6 weeks to 15 weeks. Below is a breakdown of the 135-hour required time commitment for a three-credit course divided among weeks for courses of various lengths.

Updated January 6, 2023

Course Length	Time on Coursework per Week for a 3-credit course	Total Time Requirement for a 3-credit Course
6 weeks	22.5 hours	135 hours
7.5 weeks	18 hours	135 hours
8 weeks	17 hours	135 hours
15 weeks	9 hours	135 hours

Drop and Add Dates/Withdrawals

If you are unable to take this course for any reason, be aware that there is a limited timeline to [drop or add the course](#). Consult with your advisor and notify your instructor to add or drop this course. If you are considering a withdrawal, review the following ASU policies: [Withdrawal from Classes](#), [Withdrawing as a Financial Aid Recipient](#), [Medical/Compassionate Withdrawal](#), and a [Grade of Incomplete](#).

Grade Appeals

Students must first speak with the instructor of the class to discuss any disputed grades. If, after review, a resolution is not achieved, students may proceed with the appeal process. Student grade appeals must be processed in the regular semester immediately following the issuance of the grade in dispute (by commencement for fall or spring), regardless whether the student is enrolled at the university. Complete details are available in the [CISA Grade Appeals policy](#).

Academic Integrity

Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see provost.asu.edu/academicintegrity.

If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, college, and/or dean. Academic dishonesty includes, but is not limited to, cheating on an academic evaluation or assignment, plagiarizing, academic deceit (such as fabricating data or information), or falsifying academic records. Turning in an assignment (all or in part) that you completed for a previous class is considered self-plagiarism and falls under these guidelines. Any infractions of self-plagiarism are subject to the same penalties as copying someone else's work without proper citations. Students who have taken this class previously and would like to use the work from previous assignments should contact the instructor for permission to do so.

If you have any questions about your work and the academic integrity policy, please discuss your assignment or concerns with your instructor, teaching assistant, or your college Academic Integrity Officer in advance of submitting an assignment. Student resources on Sun Devil Integrity and strategies for completing your work with integrity and avoiding plagiarism are available here: [ASU Student Resources for Academic Integrity](#) or provost.asu.edu/academicintegrity for more information.

Harassment Prohibited

ASU policy prohibits harassment on the basis of race, sex, gender identity, age, religion, national origin, disability, sexual orientation, Vietnam era veteran status, and other protected veteran status. Violations of

Updated January 6, 2023

this policy may result in disciplinary action, including termination of employees or expulsion of students. Students are encouraged to report harassment to instructors and the Dean of Students Office.

Student Conduct

ASU and the College of Integrative Sciences and Arts expects and requires its students to act with honesty, integrity, and respect. Required behavior standards are listed in the [Student Code of Conduct and Student Disciplinary Procedures](#), [Computer, Internet, and Electronic Communications policy](#), [ASU Student Academic Integrity Policy](#), and outlined by the [Office of Student Rights & Responsibilities](#). Anyone in violation of these policies is subject to sanctions. [Students are entitled to receive instruction free from interference](#) by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per [Instructor Withdrawal of a Student for Disruptive Classroom Behavior](#). The Office of Student Rights and Responsibilities accepts [incident reports](#) from students, faculty, staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Title IX

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, <https://goto.asuonline.asu.edu/success/online-resources.html>.

Student Accessibility and Inclusive Learning Services (SAILS)

Qualified students with disabilities who will require disability accommodations in this class are encouraged to make their requests to the instructor at the beginning of the semester either during office hours or by appointment. Note: Prior to receiving disability accommodations, verification of eligibility from the Student Accessibility and Inclusive Learning Services is required. Disability information is confidential.

Student Accessibility and Inclusive Learning Services (<https://eoss.asu.edu/accessibility>)

Email: Student.Accessibility@asu.edu

SAILS Phone: 480-965-1234

SAILS FAX: 480-965-0441

Tutoring

Free tutoring support is available in person and online for most courses. Services are offered through ASU's University Academic Success Programs for currently enrolled students.

- Tutoring is available in math, business, science, statistics, and engineering courses.
- Writing tutoring is available for any writing project at any stage of the writing process.
- Supplemental Instruction (SI) facilitates collaborative study groups for selected courses.
- Graduate academic tutoring is available for writing and statistics.
- Academic skills tutoring can help with critical reading, study skills, note taking, and more.
- Resources are available through our YouTube channel, Zoom recordings, and handouts.

Visit <https://tutoring.asu.edu/> or call (480) 965-9072 for more information about these services, to view our schedules, or to book an appointment.

Statement on Inclusion

Arizona State University is deeply committed to positioning itself as one of the great new universities by seeking to build excellence, enhance access, and have an impact on our community, state, nation, and the world. To do that requires our faculty and staff to reflect the intellectual, ethnic, and cultural diversity of our nation and world so that our students learn from the broadest perspectives, and we engage in the advancement of knowledge with the most inclusive understanding possible of the issues we are addressing through our scholarly activities. We recognize that race and gender historically have been markers of diversity in institutions of higher education. However, at ASU, we believe that diversity includes additional categories such as socioeconomic background, religion, sexual orientation, gender identity, age, disability, veteran status, nationality, and intellectual perspective.

Mental Health

As a student, like anyone else, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating, and/or lack of motivation. These emotional health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. ASU Counseling Services provides counseling and crisis services for students who are experiencing a mental health concern. Any student may call or walk-in to any ASU counseling center for a same-day or future appointment to discuss any personal concern. Here is the website: eoss.asu.edu/counseling. After office hours and 24/7 ASU's dedicated crisis line is available for crisis consultation by calling 480-921-1006.

Establishing a Safe Environment

Learning takes place best when a safe environment is established in the classroom. In accordance with [SSM 104-02](#) of the Student Services Manual, students enrolled in this course have a responsibility to support an environment that nurtures individual and group differences and encourages engaged, honest discussions. The success of the course rests on your ability to create a safe environment where everyone feels comfortable to share and explore ideas. We must also be willing to take risks and ask critical questions. Doing so will effectively contribute to our own and others' intellectual and personal growth and development. We welcome disagreements in the spirit of critical academic exchange, but please remember to be respectful of others' viewpoints, whether you agree with them or not.

Updated January 6, 2023

All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the [Office of the Dean of Students](#). If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances.

Prohibition of Commercial Notetaking Services

In accordance with [ACD 304-06 Commercial Note Taking Services](#), written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the note taker's name as well as the instructor's name, the course number, and the date.

Course Evaluation

Students are expected to complete the course evaluation. The feedback provides valuable information to the instructor and the college and is used to improve student learning. Students are notified when the online evaluation form is available. The results are always anonymous and cannot be reviewed by the instructor/department until after final grades have been posted.

Trigger Warning

Please note that some course content may be deemed offensive by some students, although it is not my intention to offend anyone. In addition, some materials that we link with online might also be considered offensive, troubling, or difficult to review in terms of language or graphics. I attempt to provide warnings when introducing this kind of material; yet, if I forget to do so, or if something else (in my materials or posts from fellow students) seems offensive, please contact me at igor.shovkovy@asu.edu, or the faculty head, Dr. Douglas Green (email: DM.Green@asu.edu).

Academic Affairs Manual

For a complete guide to Arizona State University course policies, please refer to the [Academic Affairs Manual \(ACD\)](#).

Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. Remember to check your ASU email and the course site often.

SCHEDULE of Lectures, Exams, and Homework assignments**PHY 331 - Principles of Modern Electromagnetisms**

Spring 2023

Instructor: Igor Shovkovy

Tue, Thu

10:30 a.m. – 11:45 a.m.

AGBC 145 (Poly)

#	Date	Description	Reading material	Homework	Weekday
1	10-Jan-23	Class introduction, syllabus, etc.; Vectors	Sec. 1.1		Tue
2	12-Jan-23	Differential calculus	Sec. 1.2	(hw 1)	Thu
3	17-Jan-23	Integral calculus	Sec. 1.3		Tue
4	19-Jan-23	Curvilinear coordinates	Sec. 1.4	(hw 2)	Thu
5	24-Jan-23	Coulomb law	Sec. 2.1.1 - 4		Tue
6	26-Jan-23	Gauss law	Sec. 2.2.1 - 3	(hw 3)	Thu
7	31-Jan-23	Applications of Gauss's law	Sec. 2.2.3 - 4		Tue
8	2-Feb-23	Electric potential	Sec. 2.3.1 - 2	(hw 4)	Thu
9	7-Feb-23	Poisson's equation	Sec. 2.3.3 - 4		Tue
	9-Feb-23	1st midterm exam (lectures 1-9)			Thu
10	14-Feb-23	Electrostatic boundary conditions	Sec. 2.3.5	(hw 5)	Tue
11	16-Feb-23	Work & energy in electrostatics	Sec. 2.4.1 - 4		Thu
12	21-Feb-23	Conductors	Sec. 2.5.1 - 3		Tue
13	23-Feb-23	Capacitors	Sec. 2.5.4	(hw 6)	Thu
14	28-Feb-23	Laplace's equation	Sec. 3.1.1 - 6		Tue
15	2-Mar-23	The method of images	Sec. 3.2.1 - 2	(hw 7)	Thu
	7-Mar-23	Spring Break: No classes			Tue
	9-Mar-23	Spring Break: No classes			Thu
16	14-Mar-23	Application of the method of images	Sec. 3.2.3 - 4		Tue
17	16-Mar-23	Separation of variables	Sec. 3.1.1 - 4	(hw 8)	Thu
18	21-Mar-23	Electric dipole	Sec. 3.4.1 - 2, 4		Tue
	23-Mar-23	2nd midterm exam (lectures 10-18)			Thu
19	28-Mar-23	Polarization; Field of a dielectric	Sec. 4.1, 4.2.1 - 3	(hw 9)	Tue
20	30-Mar-23	Electric currents, magnetic fields, Lorentz force	Sec. 5.1.1 - 3		Thu
21	4-Apr-23	The Biot-Savart law	Sec. 5.2		Tue
22	6-Apr-23	Applications of Biot-Savart law	Sec. 5.2	(hw 10)	Thu
23	11-Apr-23	Ampere's law	Sec. 5.3.1-2		Tue
24	13-Apr-23	Application of Ampere's law	Sec. 5.3.3	(hw 11)	Thu
25	18-Apr-23	Ohm's Law	Sec. 7.1		Tue
26	20-Apr-23	Faraday's Law	Sec. 7.2		Thu
	25-Apr-23	3rd midterm exam (lectures 19-26)			Tue
27	27-Apr-23	Maxwell's equations & Review	Sec. 7.3.1 - 3		Thu
	2-May-23	Final Exam (9:50 a.m. - 11:40 a.m.)	https://students.asu.edu/final-exam-sched		Tue