Engineering Physics
ENGPHYS 2A04
Electricity and Magnetism
Undergraduate Studies
Winter 2026
Course Outline

CALENDAR/COUSE DESCRIPTION

This course introduces classical electrodynamics, covering electric and magnetic fields (electrostatics and magnetostatics), Maxwell's equations, and electromagnetic waves. Key laws like Gauss's, Ampere's, and Faraday's are discussed. Emphasis is on physical intuition, problem-solving, and real-world engineering applications. Weekly subjects are divided into 3 lectures, accompanied by regular homework to reinforce understanding and problem-solving skills. Weekly tutorials discuss assignment solutions and mathematics. Labs provide hands-on experience with physical concepts every other week.

PRE-REQUISITS AND ANTI-REQUISITS

Prerequisite(s): Registration in any Engineering Physics or Mechatronics Engineering Program; PHYSICS 1E03; and credit or registration in ENGPHYS 2E04 and MATH 2ZZ3
Antirequisite(s): ENGPHYS 2A03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Jan Sperrhake
sperrhaj@mcmaster.ca

Office Hours:
By appointment

INSTRUCTIONAL ASSISTANT OFFICE HOURS AND CONTANCT INFORMATION

Catherine Luck
luckc@mcmaster.ca

Office Hours:
During open lab periods

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TBA

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The official means of communication with students is via the course webpage on Avenue to Learn.
It is the students' responsibility to regularly check the course webpage for updates and announcements.

COURSE FORMAT AND EXPECTATIONS

Course Dates: 2026/01/06 – 2026/04/07

- 3 classroom-based lectures per week: 12:30 – 1:20 pm, Tue/Wed/Fri

- 1 tutorial per week: Tue 7:30 – 6:20 pm
- Laboratory sessions every other week **starting in week 3** (5 labs in total)
- 2 in-class midterm tests
- A final exam
- Weekly homework assignments starting the first week (11 in total)

Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

There will be two 50-minutes midterm tests held during class time. The dates and locations will be announced in class and on Avenue to Learn. There will be no make-up midterms – if a midterm is missed the weight of the final exam will be increased accordingly.

Weekly assignments will consist of 1-3 problems to solve and are based on current lecture material. New assignments will be available on Avenue to Learn after every Friday lecture and are due the next week. Accommodations allow for an extended deadline.

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- Demonstrate fundamental knowledge of electricity and magnetism to provide background for future courses.
- Understand the physical background and development of Maxwell's equations via vector calculus.
- Demonstrate the ability to solve basic problems in classical electromagnetic theory.
- Perform experiments to validate and explore electromagnetic theory.
- Apply physical concepts of electromagnetism to engineering design problems.

Topics covered include:

- Vector calculus/analysis (vector fields, divergence and curl operators, integral theorems)
- Electrostatics (charges, fields) in vacuum and media
- Magnetostatics (currents, fields) in vacuum and media
- Maxwells equations and their accompanying laws
- Electromagnetic waves and harmonic oscillators
- Transformers, generators, Motors

ENGINEERING ACCREDITATION: GRADUATE ATTRIBUTES AND LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
Estimates outcomes, uncertainties and determines appropriate data to collect in laboratory experiments in electricity and magnetism.	3.3 – Estimates outcomes, uncertainties and determines appropriate data to collect
Demonstrates individual leadership and teamwork and communication abilities to complete labs and reports on time.	6.3 – Works in a group, taking a leadership role as appropriate and relinquishing the leadership role as appropriate

Demonstrates ability to write formal lab reports including appropriate discussion and analysis of results.	7.3 – Constructs effective oral or written arguments as appropriate to the circumstances.

For more information on Engineering Accreditation, please visit: https://www.engineerscanada.ca

INSTRUCTIONAL LABORATORIES

Laboratory manuals will be available on Avenue to Learn. Laboratory work can only be carried out at your scheduled time. All lab sessions must be completed to pass the course.

Labs will be submitted on Avenue to Learn. Please check for updates (due dates, submission types, etc). Details about the requirements for the reports will be given during the lab session.

Attendance will be taken by the TAs during each lab. Lab notes must be signed by the TA and must be submitted with the lab report. Lab reports submitted for labs not attended are not acceptable. Late reports will not be marked and a grade of ZERO will be assigned.

MATERIALS AND FEES

Recommended Texts:
D. J. Griffiths, *Introduction to Electrodynamics*, 4th ed. or later. (more descriptive)
W. Nolting, *Theoretical Physics – Electrodynamics*. (detailed math)

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

COURSE ASSESSMENT DETAILS

The final grade will be determined as maximum/best outcome from one of the following weighting schemes:

Component	Weighting 1	Weighting 2	Weighting 3
Labs (5 total)	20%	20%	20%
Assignments (11 total)	20%	20%	20%
Midterm test 1	15%	0%	15%
Midterm test 2	15%	15%	0%
Final Exam	30%	45%	45%
Total	100%	100%	100%

Weighting scheme conditions:

Weighting 1 is applied for all students (default scheme).
Weighting 2 and 3 will only be applied if the student

- has **written both midterm tests** and obtained at least **20% on each**,
- or has missed the relevant midterm(s) (MSAF)

For each student, all **eligible** schemes are computed, and the **highest resulting percentage** is used as the course grade (subject to the pass conditions below).

Pass conditions:

Labs: Students must attend all labs and submit all lab-related materials to pass.

Exam grades (final + midterms): obtain at least 30 in total.

Total: after applying all **eligible weighting schemes**, the **final course percentage** (the maximum) must be at least **50%**.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

MSAF policy:

- An MSAF for a missed midterm test will automatically allocate the missed grade to the final exam grade component.
- An MSAF for a missed assignment will automatically lead to a 4-day extension for that assignment, but it still needs to be submitted.

GENERATIVE AI

Students may use generative AI for discussing lecture notes to improve understanding of lecture material throughout the course.

Use of generative AI for assignments and/or lab reports is not permitted and strongly discouraged as it can be detrimental to the learning experience. In cases of blatant abuse of generative AI for graded assignments and/or reports zero marks will be awarded where applicable.

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics and the Faculty of Engineering are committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:
1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in

the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

ACADEMIC ADVISING

Academic Advisors are available to assist you with any problems or questions you may have. This includes course selections, changes to your enrolment, McMaster Student Absence Form (MSAF), Religious, Indigenous, or Spiritual Observances (RISO) forms, exams, taking courses at another university (for credit at McMaster), Petitions for Special Consideration, and much more. Below is the contact information for the Office of the Associate Dean (Academic) in the Faculty of Engineering:

JHE-Hatch 301
https://www.eng.mcmaster.ca/programs/academic-advising
(905) 525-9140 ext. 24646

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work". An abbreviated version is provided below.

The University recognizes that students periodically require relief from academic work due to extenuating circumstances. Students seeking relief for missed academic term work are expected to read the ***McMaster Student Absence Form Policy***. The Policy aims to manage these requests by taking into account the needs and obligations of students, instructors and administrators. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in their course. Any concerns regarding the granting of relief should be directed to the Faculty Office.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three (3) calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.

- An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
- The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
- The MSAF cannot be used for academic work that has already been completed or attempted.
- An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
- The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three (3) calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.