PHYS2020

Electromagnetism and Relativity

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
Convener, lecturer
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Credit points
10

Prerequisites
PHYS2010 and (MATH2010 or MATH2055)

Corequisites
MATH2020 or MATH2110

Co-badged status

Unit description
The first half of the unit introduces the principles, theory and application of classical electromagnetism, which describes the properties and behaviour of electric and magnetic fields and their interaction with charged matter. Maxwell's four laws of electromagnetism are revisited, in the powerful language of vector calculus. We apply these laws to understand a range of phenomena in electrostatics, magnetostatics and electrodynamics. In the second half of the unit, we introduce the postulates of special relativity and explore their implications for the nature of spacetime. We determine how to refine Newtonian mechanics to be correct in the relativistic limit and show the deep connection between the geometry of spacetime and electromagnetism. Advanced techniques of experimental physics including indirect measurement of microscopic quantities are covered in guided laboratory sessions, as are data analysis techniques and report writing.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: use symmetry arguments to derive electric and magnetic fields from various configurations of charges and currents.

ULO2: apply differential and integral calculus to scalar and vector fields in cartesian, spherical, and cylindrical coordinates.

ULO3: solve electromagnetism problems involving constant as well as time dependent electric and magnetic fields.

ULO4: understand the origin of the transformation laws in special relativity from Einstein's postulates, and discuss and numerically analyse simple relativistic problems.

ULO5: safely use experimental equipment to perform specified measurements, and analyse and interpret the results in the context of discipline knowledge.

General Assessment Information

This unit has lectures and SGTAs covering content on electromagnetism and special relativity, and laboratories with experiment on a range of topics.

The lecture content from the first half of the unit will be assessed using a take-home problem set due in week 8. The assignment will be released no later than 26 August, Wednesday week 5.

The practical component of the unit will be assessed via a portfolio of documentation, due in week 13. We will guide you through the process of building your lab portfolio throughout the session.

The content from both the first and second halves of the unit will be tested in the final exam.

Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through http://connect.mq.edu.au/.

Short Extensions

For some assessment types, students are allowed to request an extra 3 calendar days to complete eligible assessments. No reason or evidence is required. This only applies to individual assessments with the Short Extension flag in CMS marked as 'yes'. Please ensure that the unit guide specifies whether short extensions apply to any of the assessments in your unit.

Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience technical concerns. For any late submission of time-sensitive tasks, such as scheduled tests/ exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration. For example, if the assignment is worth 8 marks (of the entire unit) and your submission is late by 19 hours (or 23 hours 59 minutes 59 seconds), 0.4 marks (5% of 8 marks) will be deducted. If your submission is late by 24 hours (or 47 hours 59 minutes 59 seconds), 0.8 marks (10% of 8 marks) will be deducted, and so on.

Requirement to pass this unit:

To pass the unit you must acheive a total mark of 50% or greater.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Final Exam	50%	No	University Examination Period	Individual	No	Observed
Laboratory work	30%	No	02/11/2026	Individual	Yes	Open
Assignment	20%	No	16/09/2026	Individual	Yes	Open

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **University Examination Period**
Weighting: **50%**
Groupwork/Individual: Individual
Short extension [3]: No
AI Approach: Observed

You will undertake a final examination during the formal examination period.

On successful completion you will be able to:

- use symmetry arguments to derive electric and magnetic fields from various configurations of charges and currents.
- apply differential and integral calculus to scalar and vector fields in cartesian, spherical, and cylindrical coordinates.

- solve electromagnetism problems involving constant as well as time dependent electric and magnetic fields.
- understand the origin of the transformation laws in special relativity from Einstein's postulates, and discuss and numerically analyse simple relativistic problems.

Laboratory work

Assessment Type [1]: Portfolio
Indicative Time on Task [2]: 24 hours
Due: **02/11/2026**
Weighting: **30%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

A portfolio of laboratory records and experimental analysis.

On successful completion you will be able to:

- safely use experimental equipment to perform specified measurements, and analyse and interpret the results in the context of discipline knowledge.

Assignment

Assessment Type [1]: Problem-based task
Indicative Time on Task [2]: 10 hours
Due: **16/09/2026**
Weighting: **20%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Problems covering the first half of the unit to develop problem solving skills.

On successful completion you will be able to:

- use symmetry arguments to derive electric and magnetic fields from various configurations of charges and currents.
- apply differential and integral calculus to scalar and vector fields in cartesian, spherical, and cylindrical coordinates.
- solve electromagnetism problems involving constant as well as time dependent electric and magnetic fields.
- understand the origin of the transformation laws in special relativity from Einstein's postulates, and discuss and numerically analyse simple relativistic problems.

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- Academic Success for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation.

[3] An automatic short extension is available for some assessments. Apply through the Service Connect Portal.

Delivery and Resources

The content from both the first and second halves of the unit will be tested in the final exam.The main text for the unit is Griffiths, "Introduction to Electrodynamics".

This unit is taught through lectures and SGTA (Small Group Teaching Activities) and through undertaking laboratory experiments. We strongly encourage students to attend lectures because they provide a much more interactive and effective learning experience than studying a text book. The lecturer is able to interpret the physics that you will be learning, showing you the relationships between different components/concepts and emphasising the key physics principles involved. Questions during and outside lectures are strongly encouraged in this unit - please do not be afraid to ask, as it is likely that your classmates will also want to know the answer. You should aim to read the relevant sections of the textbook before and after lectures and discuss the content with classmates and lecturers.

This unit includes a experimental component. The experiments are stand-alone investigations and include topics not covered by the lecture content of this unit - they are an important part of the learning for this unit and the skills learned are essential for a well-rounded physics graduate.

You should aim to spend an average of 3 hours per week understanding the material and working on the SGTA (Small Group Teaching Activity) problems and exercises. Attempting SGTA (Small Group Teaching Activity) questions is one of the key learning activities for this unit. It is by applying knowledge learned from lectures and textbooks to solve problems that you are best able to test and develop your skills and understanding of the material. SGTAs will include formative quizzes, to help you assess how your learning is progressing.

As mentioned, there are many useful web resources on this material and we encourage you to seek out youtube videos and other resources. However, while reading over the lecture notes and reading the textbook are very important, reading notes and watching physics videos are *passive* learning activities. It is critical that a substantial portion of your study time in physics is devoted to *active* learning strategies by attempting numerous problems from the text, SGTA, assignment and past exams. It is simply impossible to become adept in this subject by *watching* physics problems, you must *do* physics problems.

Methods of Communication

We will communicate with you via your university email and through announcements on iLearn.

Queries to convenors can either be placed on the iLearn discussion board or sent to the unit convenor via the contact email on iLearn.

Unit Schedule

The first half of this unit is electromagnetism, and the second half is special relativity.

Lectures and SGTAs start in week 1, and labs start in week 2.

Full details of the **l**ab program will be provided in iLearn. Please check in week 1 for details of any preparation required for your week 2 lab session.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit connect.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and

courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Ask a Study Coach
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit https://students.mq.edu.au/support/technology/service-desk.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Unit information based on version 2026.02 of the Handbook