PHYS2020

Electromagnetism and Relativity

Session 2, Weekday attendance, North Ryde 2021

Department of Physics and Astronomy

Contents

Session 2 Learning and Teaching Update

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of units with mandatory on-campus classes/teaching activities.

Visit the MQ COVID-19 information page for more detail.

General Information

Unit convenor and teaching staff
Unit Convenor, Lecturer
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Credit points
10

Prerequisites
(PHYS201 or PHYS2010) and (MATH235 or MATH2010 or MATH2055)

Corequisites
MATH236 or MATH232 or 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://students.mq.edu.au/important-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 hurdle requirements, specifying a minimum standard that must be attained in aspects of the unit. To pass this unit you must obtain a mark of at least:

- 50% in the unit overall

as well as

- 40% in the final examination

and

- 40% in each individual laboratory activity (full report or lab book).

In addition, you must also submit a minimum of 8 regular quizzes.

The laboratory will be assessed in the following way:

Each experiment is allotted two weeks for completion and you are expected to complete 5 experiments.

(i) For all experiments apart from experiment 3, the notes in your laboratory notebook will be marked. If those are less than satisfactory, the book will be returned to you for correcting, and then re-marked. All relevant calculations must be done, the appropriate graphs drawn, and uncertainties assessed where appropriate.

(ii) You are required to submit a full report on the experiment you are doing in weeks 6 and 7. This report will be submitted in draft form initially. It will be marked and returned to you with comments for improvement. When the report is resubmitted, your first attempt should also be handed in for comparison. The mark awarded for the report will be that obtained in the second marking. (However, if you obtain more than 7 out of 10 for the initial submission, then handing in the final version is optional.) This strategy gives you the opportunity to use the feedback from staff to help you develop professional report writing skills before your work is finally graded.

Assessment Tasks

Name	Weighting	Hurdle	Due
Regular quizzes	25%	Yes	Weekly
Lab reports	20%	Yes	Fortnightly, detailed schedule posted on iLearn.
Readings and peer-discussions	15%	No	Weekly
Final exam	40%	Yes	Exam period

Regular quizzes

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 0 hours
Due: **Weekly**
Weighting: **25%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Short- and long-form problem solving questions, taken in SGTA sessions

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.

Lab reports

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 24 hours
Due: **Fortnightly, detailed schedule posted on iLearn.**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Laboratory-related tasks, analysis, and reporting

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.

Readings and peer-discussions

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 18 hours
Due: **Weekly**
Weighting: **15%**

Preclass reading, annotation, and peer discussion using the Perusall tool

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.

Final exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **Exam period**
Weighting: **40%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Final exam in the University 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.

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[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
- the Learning Skills Unit 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

Delivery and Resources

Lab books and reports will be marked regularly.

Lecture content, tutorial questions and Perusall readings will form the basis for regular quizzes and final examination assessments of problem-solving skills and understanding of content.

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
- Grade Appeal Policy
- Complaint Management 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 ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

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

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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 Enquiry Service

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

Equity Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

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.

Changes from Previous Offering

This unit has undergone significant changes this year. In the first half of the unit, Thermodynamics was previously taught, while Relativity was previously taught in 3rd year. This year, Relativity replaces Thermodynamics in PHYS2020.