PHYS1020

Electric and Magnetic Interactions

Session 2, Weekday attendance, North Ryde 2021

Archive (Pre-2022) - 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

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Credit points
10

Prerequisites
PHYS1010 or PHYS107

Corequisites
MATH132 or MATH135 or MATH1010 or MATH1015

Co-badged status

Unit description
This unit, following on from PHYS1010, provides an overview of physics primarily for students intending to study physics and astronomy beyond first year, but also suitable for those specialising in any of the sciences. As well as broadening their experience in classical Newtonian physics of matter and waves, and Maxwell's theory of electromagnetism, students are introduced to the main theories underlying modern physics: quantum mechanics, thermal physics, and Einstein's theory of relativity, with an emphasis on understanding the interrelationship between these fundamental ideas. PHYS1020 deals with electromagnetism, circuit theory, waves and diffraction, and the effects of special relativity. Fundamentals of experimental method and data analysis are taught in well-equipped laboratories using examples which support and complement the lecture course.

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: demonstrate an understanding of the basic concepts of electricity and magnetism including charge, current, Coulomb's law, the Lorentz force law and Maxwell's equations.

ULO2: interpret and make predictions about physical situations in terms of electric and magnetic fields, electric potential, electric and magnetic flux, electromotive force and electrical circuit properties such as voltage and current.

ULO3: use the laws of electromagnetism to solve a variety of quantitative problems in electrostatics, magnetostatics, circuit theory, induction and electromagnetic waves.

ULO4: interpret mathematically the basic properties of waves and describe the concept of wave-particle duality.

ULO5: perform physical measurements, record experimental data, display data graphically, analyse data, and draw written conclusions in a clear, concise, and systematic manner.

ULO6: identify, record and explain sources of uncertainty in physical measurements; and to undertake appropriate uncertainty analysis of results, including statistical analysis.

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

- 40% in each of the laboratory activities

- participation in at least 7 of the 11 marked quizzes.

FINAL EXAMINATION

You must score at least 40% in the final examination to be able to pass the unit. If you score between 30% and 39% in the final examination you may be given a second chance to reach the hurdle threshold. The mark from the second chance exam will be capped at 40%, and the second chance is only offered if this mark would be sufficient to pass the unit overall.

If you receive special consideration for the final exam, a supplementary exam will be scheduled after the end of the normal exam period. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the
same supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit.

WEEKLY QUIZZES

Weekly quizzes will be completed in iLearn, and will be associated with that week's SGTA. Participation in the SGTA (either on-campus or online) will be a prerequisite for taking the quiz. Details will be provided in iLearn.

There will be 11 quizzes, in weeks 2 to 12 inclusive. To pass the unit, you must attempt at least 7 of the 11 quizzes. There will be a practice quiz in week 1, which does not contribute to your mark, nor to the '7 of 11' requirement.

LABORATORY ASSESSMENT

Satisfactory completion of laboratories is a **hurdle requirement.** You **must** attend **all** laboratory sessions. There is a **online induction module and safety quiz** that needs to be completed in **Week 1** and includes work health and safety information. It needs to be completed by all students regardless of whether this is their first Physics unit or not. You can’t do subsequent lab sessions if you don’t complete the introduction. Students will also need to enrol in groups on iLearn so as to know which experiment to prepare for and complete in week 2. The **next nine lab sessions** involve experimental work and will be assessed. **You must obtain a mark of at least 40% for each of the laboratory sessions in order to pass the unit.**

Preparation is required for each of the lab sessions 2-9. You will find the **Prelab activities** in the Laboratory Resources section of iLearn. Your prelab work will account for some of the marks for each laboratory session.

If you miss a session or fail to achieve at least 40% for any lab session, you must complete a **"Request to schedule a Catch-up laboratory session"** form, which can be found on iLearn. See ilearn for full details about catch up classes and when they are scheduled. **No more than 3 catch ups are allowed for missed labs/lab hurdles**, except where Special Consideration has been approved. If you fail to attend the catch-up class you are booked into, then that will count as another missed lab.

Assessment Tasks

Name	Weighting	Hurdle	Due
Final examination	40%	Yes	Examination period
Weekly quiz	30%	Yes	During the SGTA, weeks 2 to 12
Laboratory record	30%	Yes	In class, see iLearn schedule

Final examination

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

Examination in the University Examination period, covering the entire unit content.

On successful completion you will be able to:

- demonstrate an understanding of the basic concepts of electricity and magnetism including charge, current, Coulomb's law, the Lorentz force law and Maxwell's equations.
- interpret and make predictions about physical situations in terms of electric and magnetic fields, electric potential, electric and magnetic flux, electromotive force and electrical circuit properties such as voltage and current.
- use the laws of electromagnetism to solve a variety of quantitative problems in electrostatics, magnetostatics, circuit theory, induction and electromagnetic waves.
- interpret mathematically the basic properties of waves and describe the concept of wave-particle duality.

Weekly quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 0 hours
Due: **During the SGTA, weeks 2 to 12**
Weighting: **30%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

A series of short tests, taken in SGTAs.

On successful completion you will be able to:

- demonstrate an understanding of the basic concepts of electricity and magnetism including charge, current, Coulomb's law, the Lorentz force law and Maxwell's equations.
- interpret and make predictions about physical situations in terms of electric and magnetic fields, electric potential, electric and magnetic flux, electromotive force and electrical circuit properties such as voltage and current.
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- interpret mathematically the basic properties of waves and describe the concept of wave-particle duality.

Laboratory record

Assessment Type [1]: Lab book
Indicative Time on Task [2]: 10 hours
Due: **In class, see iLearn schedule**
Weighting: **30%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Assessment of lab record made during each experimental activity, as well as any prelab preparation.

On successful completion you will be able to:

- perform physical measurements, record experimental data, display data graphically, analyse data, and draw written conclusions in a clear, concise, and systematic manner.

- identify, record and explain sources of uncertainty in physical measurements; and to undertake appropriate uncertainty analysis of results, including statistical analysis.

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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 Writing Centre 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

Required and Recommended Texts and/or Materials

Textbook

Matter and Interactions by Ruth Chabay and Bruce Sherwood.

Either Volume 2 (Paperback) or the combined Volume (hardbound). Note that Volume 1 is the required text for PHYS107 in semester 1.

Web Resources

More information on the required text as well as additional ressource material can be found at http://www.matterandinteractions.org/

There are also other high quality learning resources on the web which we would recommend to you to use in your studies. The HyperPhysics site hosted by the Department of Physics and Astronomy at Georgia State University is widely acclaimed and used. The site also has mathematics learning resources on the maths used in physics.

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html (Mechanics, and, Electricity & Magnetism).

Increasingly there are excellent web-based interactive simulations available – some are in the on-line resources that support the textbook. We encourage you to conduct your own web searches for others, and to develop your own critical judgment of which sites provide high quality resources that assist your learning. Two that we recommend to you are:

• http://www.explorelearning.com/ The Explorelearning Gizmos: follow links to Grade 9-12, Physics, Motion and Force; and Electricity & Magnetism. You will have to register to use this site.

• http://phet.colorado.edu/simulations/index.php?cat=Featured_Sims The University of Colorado, Boulder, Physics Education Technology (PhET) Simulations: follow the links to Motion; Energy, Work & Power; and Electricity, Magnets and Circuits. This site also contains maths resources, for example vector addition.

Technology Used and Required

Lecture notes, tutorial questions and answers, weekly exercises, and other resources will be posted on the PHYS106 iLearn site.

Learning and Teaching Strategy

This unit is taught through lectures and tutorials 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 compulsory experimental component. The experiments are stand-alone investigations and may include topics not covered by the lecture content of this course - 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 tutorial problems and exercises. Attempting tutorial questions and weekly exercises 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.

As mentioned, there are many useful web resources on this material and we encourage you to seek out youtube videos on electromagnetism 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, tutorials, assignments and past exams. It is simply impossible to become adept in this subject by *watching* physics problems, you must *do* physics problems.

Unit Schedule

Lectures will be online.

Laboratory sessions will be on-campus-only.

For SGTA options, please refer to the timetable.

Lectures:

There are two lectures per week, as timetabled. Lectures follow the chapters from Volume II of the textbook Matter and Interactions.

Week 1: The electric field

Week 2: Electric fields in matter

Week 3: Electric fields of distributed charges

Week 4: Electric potential

Week 5: Electric field and circuits

Week 6: Circuit elements

Week 7: Magnetic field

Week 8: Magnetic force

Week 9: Patterns of field in space

Week 10: Faraday's law

Week 11: Electromagnetic radiation

Week 12: Waves and particles

Week 13: Revision

SGTAs

You should attend the timetabled tutorial each week.

Labs

Refer to the Laboratory Practical section.

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 Services and 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.

Student Enquiries

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

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.

Laboratory Practicals

Laboratory Sessions

The laboratory component is an essential component of your studies and so counts for an appreciable fraction of your final assessment. You will be introduced to some of the basic skills and techniques required of practicing physicists, scientists and engineers. **You will be issued with a Laboratory Notebook,** provided with instructional material in the form of **Laboratory Notes** which can be found in the Laboratory Resources section of iLearn, and assisted in the laboratory by a team of demonstrators. For each laboratory session you are required to complete some preparatory work (**Pre-Lab**) before attending your nominated Lab session. To figure out which Prelab to do, please consult the **Laboratory Schedule** on iLearn.

Location: There are two laboratories used for 1st year physics they are both in **14 SCO (formerly E7B):**

Room 114 (Ground floor at the North-East corner of building)

Room 254 (First floor, north-facing side of the atrium)

Please check iLearn to see where your lab class will take place.

Laboratory Safety: You are required to follow all safety guidelines given in the first Lab session, your lab notes, and the lab staff. Food and drink cannot be consumed in the lab, and students without suitable covered footwear will be refused admission.

Covid-19 considerations: Labs are scheduled for on-campus delivery. You will need to comply with a number of Covid safety procedures, including the wearing of masks, sanitising hands and cleaning of work surfaces. In the event that a Covid outbreak causes the suspension of on-campus delivery, then an online version lab program will be provided, at the same time as your timetabled on-campus lab class. Instructions will be provided via iLearn should this change become necessary.