PHYS2020

Electromagnetism and Thermodynamics

Session 2, Special circumstance, North Ryde 2020

Department of Physics and Astronomy

Contents

Notice

As part of Phase 3 of our return to campus plan, most units will now run tutorials, seminars and ot her small group learning activities on campus for the second half-year, while keeping an online ver sion available for those students unable to return or those who choose to continue their studies onli ne.

To check the availability of face-to-face and onlin e activities for your unit, please go to timetable vi ewer. To check detailed information on unit asses sments visit your unit's iLearn space or consult yo ur unit convenor.

General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites
PHYS201 or PHYS2010

Corequisites
MATH235 or MATH2010

Co-badged status

Unit description
This unit introduces the principles, theory and application of the two great pillars of 19th century classical physics: electromagnetism and thermodynamics. We first develop the theory of 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 explore their power for understanding phenomena in electrostatics, magnetostatics and electrodynamics. We then address the thermodynamic principles which guide our understanding of the physical world: the conservation of energy and the increase in entropy. We motivate the introduction of macroscopic state functions such as temperature, pressure, and volume to characterise the state of a system, and connect them with the concept of the equation of state, including the case of ideal and Van der Waals gases. The formulation of the Zeroth through the Third Laws of Thermodynamics are used to understand the concepts of reversible and irreversible engines as exemplars of all thermodynamic systems. Finally, we make a connection between entropy and information theory. 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: apply thermodynamic principles to describe physical systems and solve quantitative and qualitative problems concerning thermodynamic systems.

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 (report or lab book).

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

Assessment Tasks

Name	Weighting	Hurdle	Due
Lab reports	20%	Yes	weekly
Regular quizzes	25%	Yes	weekly
Final exam	40%	Yes	Exam period
Readings and peer-discussions	15%	No	weekly

Lab reports

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 24 hours
Due: **weekly**
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.

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.
- apply thermodynamic principles to describe physical systems and solve quantitative and qualitative problems concerning thermodynamic systems.

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.
- apply thermodynamic principles to describe physical systems and solve quantitative and qualitative problems concerning thermodynamic systems.

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.
- apply thermodynamic principles to describe physical systems and solve quantitative and qualitative problems concerning thermodynamic systems.

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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

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://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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 *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/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.

Changes from Previous Offering

The subject has been adapted to accommodate COVID-19 shutdown. It is similar to the previous offering of PHYS202 in 2019.