PHYS140

Physics IA

S2 Day 2014

Physics and Astronomy

Contents

General Information

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Credit points 3	
Prerequisites (HSC Mathematics Band 4 or HSC Mathematics Extension 1 Band E3 or HSC Mathematics Extension 2 or equivalent) or corequisite of (MATH132 or MATH133 or MATH135 or MATH136)	
Corequisites	
Co-badged status	
Unit description This unit, together with PHYS143, gives an overview of physics, which aims to discover and understand the fundamental laws of nature and use them to explain the phenomena that occur in the universe. This unit includes a broad range of topics suitable for engineering students or those majoring in any of the sciences. Students are introduced to the central topics of classical physics, the physics that describes what we observe in day-to-day life, namely the mechanical, electrical and magnetic behaviour of matter. Topics include: measurement and vectors; Newton's laws of motion; momentum and energy; gravitation; electric charge; electric field and potential; capacitance; simple direct-current circuits; the origin of magnetic fields; and electromagnetic induction. The language of physics is mathematics. Much of what physics has to say can be described using straightforward algebra and calculus from the HSC Mathematics course. This approach is taken. It gives a distinct advantage: a quantitative and usefully different perspective to topics than may be encountered in units of study in biology, chemistry or earth sciences. Regular guided laboratory work enables students to investigate the phenomena discussed in the lectures, using modern techniques in a well-equipped laboratory.	

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:

Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.

Describe and apply Newton’s laws of motion.

Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.

Describe and solve problems in rotational motion, including rolling, torque and angular momentum.

Demonstrate an understanding of gravitational attraction and gravitational potential energy.

Demonstrate an understanding of, and solve problems involving: charges, electric fields/potential, Gauss' law, capacitance, resistance, circuits and Kirchhoff's laws.

Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.

Ability with the basic skills and techniques that are used in experimental physical science.

Ability to keep a record of experimentation that satisfies professional requirements.

General Assessment Information

Macquarie University uses a standards-based assessment system and, as such, satisfactory performance in **all** aspects of the unit assessment is required to pass the unit overall.

Assessment Tasks

Name	Weighting	Due
Tutorial quizzes	20%	Tutorial class
Mid-session Exam	15%	19 September 2014
Laboratory Work	20%	End of each Lab session
Final Examination	45%	See Examination Timetable

Tutorial quizzes

Due: **Tutorial class**
Weighting: **20%**

During the session, in weeks 2-12, you will be provided with a set of *assigned problems* based on the previous week's lecture topics. The week following, in your registered tutorial class, you will complete a 10 minute quiz closely based on one of these assigned problems. These quizzes will be marked by your tutor and returned with feedback. Your best 8 quiz scores (out of a possible 10) will contribute a total of 20% to your final mark.

On successful completion you will be able to:

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.

- Describe and apply Newton's laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.
- Demonstrate an understanding of, and solve problems involving: charges, electric fields/ potential, Gauss' law, capacitance, resistance, circuits and Kirchhoff's laws.
- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.

Mid-session Exam

Due: **19 September 2014**
Weighting: **15%**

A mid-session exam will be held in the 9am lecture time slot on the 19th of September i.e. the end of week 7. This 50-minute exam will cover content from weeks 1-4 inclusive. Further details will be provided in lectures leading up to this date.

On successful completion you will be able to:

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton's laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.

Laboratory Work

Due: **End of each Lab session**
Weighting: **20%**

The laboratory work is designed to introduce you to some of the basic skills and techniques that are used in experimental physical science, and forms an important component of your learning in PHYS140.

All your work must be recorded directly into your laboratory notebook. More detailed instructions and advice will be provided in iLearn and in the laboratory.

Your laboratory notebook will be assessed by one of the demonstrators at the end of each session. Your laboratory notebook stays with the laboratory throughout the semester.

The laboratory component of the unit is compulsory and all experiments must be successfully completed to pass the unit overall. Only under exceptional circumstances will extra catch up sessions be organised; you are responsible for ensuring that you complete all experiments as required during your registered laboratory class.

On successful completion you will be able to:

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton's laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of, and solve problems involving: charges, electric fields/potential, Gauss' law, capacitance, resistance, circuits and Kirchhoff's laws.
- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Final Examination

Due: **See Examination Timetable**
Weighting: **45%**

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable (http://www.timetables.mq.edu.au/exam/).

The final examination will be three hours long and will cover all content not already covered by the mid-session exam. The examination is closed book. A resource sheet of relevant equations and physical constants will be provided.

The use of calculators in examinations for this unit is permitted but, in accordance with the Science Faculty's policy, calculators *with a full alphabet* on the keyboard are not allowed.

On successful completion you will be able to:

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton’s laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.
- Demonstrate an understanding of, and solve problems involving: charges, electric fields/ potential, Gauss’ law, capacitance, resistance, circuits and Kirchhoff’s laws.
- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.

Delivery and Resources

Technology

Audio recordings and copies of slides from lectures will be available in iLearn through the Echo360 system. By virtue of the activities that occur in a physics lecture (demonstrations, problem solving) making use of these resources is not equivalent to attending. These resources are good for review and revision.

The use of calculators in the laboratory classes, when completing quizzes, in the in-session exam and in the final examination for this unit is usually necessary. In accordance with the Science Faculty's policy, calculators *with a full alphabet* on the keyboard are not allowed in the in-session exam or the final examination.

Lecture and Tutorial

This unit consists of three different formal types of activity:

1. Lectures, in which new material is presented, discussed and illustrated by examples and demonstrations.

Attending lectures is an important part of studying physics since it allows you to gain an insight into the subject matter that reading a textbook alone cannot provide. The lecturers can explain the concepts from several points of view, can point out and explain the most important aspects of the material and, very importantly, can illustrate the relationships and connections between the different concepts that are studied in PHYS140 – no subject in physics stands on its own.

2. A weekly tutorial, in which examples illustrating the material are presented for discussion (with fellow class mates and a tutor) and problem solving methods are practiced. Tutorials in weeks

3-13 will have a 10 minute quiz at the start, based on one of the assigned problems issued the previous week.

3. 3-hour laboratory sessions, in which you will develop skills in making measurements of physical phenomena and in the interpretation of collected data.

Lecture and tutorial times - See more detailed unit guide provided in iLearn or your timetable.

Teaching and Learning Strategy

See more detailed unit guide provided in iLearn and discussed in lectures.

Information

Study material is hosted on the iLearn webpage for the unit http://ilearn.mq.edu.au

Students are also encouraged to sign up to the Wiley Plus website to make use of the extended learning resources available there - including interactive problem solving resources. Instructions will be provided in lectures.

Changes since the last offering of this unit

For the first time this session PHYS140 will have a mid-session exam in week 7. Also, this offering will not have marked assignments, instead using a combination of assigned problems, which students can work on together, and weekly short quizzes to test engagement with these assigned problems.

Other material

See more detailed unit guide provided in iLearn and discussed in lectures.

Unit Schedule

The content of the unit is based on the following chapters of the textbook, "Fundamentals of Physics" by Halliday, Resnick, & Walker:

• Mechanics (Dr James Downes): Chapters 1-13, 15 (Extended 10th edition)

• Electricity and Magnetism (Prof Deb Kane): Chapters 21-30 (Extended 10th edition)

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/student_conduct/

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 improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

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

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton’s laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.
- Demonstrate an understanding of, and solve problems involving: charges, electric fields/ potential, Gauss’ law, capacitance, resistance, circuits and Kirchhoff’s laws.
- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment tasks

- Tutorial quizzes
- Mid-session Exam
- Laboratory Work
- Final Examination

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment tasks

- Tutorial quizzes
- Laboratory Work

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton’s laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
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- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment tasks

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- Mid-session Exam
- Laboratory Work
- Final Examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton’s laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
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- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment tasks

- Tutorial quizzes
- Mid-session Exam
- Laboratory Work

- Final Examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton’s laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
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- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment tasks

- Tutorial quizzes
- Mid-session Exam
- Laboratory Work
- Final Examination

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Describe and apply Newton's laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction, kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.
- Demonstrate an understanding of, and solve problems involving: charges, electric fields/ potential, Gauss' law, capacitance, resistance, circuits and Kirchhoff's laws.
- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.

Assessment tasks

- Tutorial quizzes
- Mid-session Exam
- Laboratory Work
- Final Examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Use vector notation to describe physical systems and solve 3-dimensional mechanics problems.
- Describe and apply Newton's laws of motion.
- Demonstrate an understanding of, and be able to solve problems involving: friction,

kinetic energy, work, potential energy, energy conservation; linear momentum of individual particles and systems of particles.
- Describe and solve problems in rotational motion, including rolling, torque and angular momentum.
- Demonstrate an understanding of gravitational attraction and gravitational potential energy.
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- Demonstrate an understanding of, and solve problems involving: magnetic fields, magnetic induction and inductance.
- Ability with the basic skills and techniques that are used in experimental physical science.
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Assessment tasks

- Tutorial quizzes
- Mid-session Exam
- Laboratory Work
- Final Examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Ability with the basic skills and techniques that are used in experimental physical science.
- Ability to keep a record of experimentation that satisfies professional requirements.

Assessment task

- Laboratory Work

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- Ability with the basic skills and techniques that are used in experimental physical science.

Assessment task

- Laboratory Work

Changes since First Published

Date	Description
28/02/2014	The Description was updated.