PHYS143

Physics IB

S2 Day 2016

Dept of Physics and Astronomy

Contents

General Information

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Credit points
3

Prerequisites

Corequisites
MATH130 or MATH132 or MATH135

Co-badged status

Unit description
This unit, together with PHYS140, provides an overview of physics. This unit includes a broad range of topics suitable for engineering students or those majoring in any of the sciences. This unit begins with topics in classical physics: the physics of oscillations and wave motion, including sound waves, diffraction and the wave behaviour of light, leading to an introduction to geometrical and physical optics and the operation of some optical instruments. The unit then moves on to look at some of the theories of modern physics that influence the way that we view the natural world, and the fundamental laws that govern it. An introduction is given to molecular kinetic theory and the important universal laws of thermodynamics, the latter valid for everything from the boiling of a kettle to exploding black holes. Einstein's theory of special relativity and its counter-intuitive views on space and time, the uncertain world of quantum physics, and what the latter tells us about the structure of atoms and nuclei, conclude the unit. 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:

Students will be able to explain Physics concepts, within the topics listed in the unit guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.

Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known

quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.

Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.

Students will be able to record experimental data, display data graphically, analyse data, and present their conclusions in a clear, concise, and systematic manner.

Students will be able to identify sources of uncertainty in physical measurements, be able to propagate these uncertainties through calculations, and express results in a meaningful way.

General Assessment Information

This unit has hurdle requirements, specifying a minimum standard that must be attained in different 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

- 40% in at least 6 of 11 quizzes.

Assessment Tasks

Name	Weighting	Due
Laboratory work	20%	See lab timetable
Tutorial quizes	20%	Tutorial time
Mid session exam	15%	20/4/2015
Final Examination	45%	University Examination Period

Laboratory work

Due: **See lab timetable**
Weighting: **20%**

Satisfactory completion of laboratories is a hurdle requirement. You must obtain a mark of at least 40% in in each of the laboratory activities to pass the unit. If you miss or fail an activity, you must within two weeks arrange a new time to perform the activity - please contact your laboratory manager Danny Cochran in that case.

On successful completion you will be able to:

- Students will be able to explain Physics concepts, within the topics listed in the unit guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.
- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.
- Students will be able to record experimental data, display data graphically, analyse data, and present their conclusions in a clear, concise, and systematic manner.
- Students will be able to identify sources of uncertainty in physical measurements, be able to propagate these uncertainties through calculations, and express results in a meaningful way.

Tutorial quizes

Due: **Tutorial time**
Weighting: **20%**

At the start of each tutorial you will be given a closed-book quiz based on one question from a set provided in class the previous week. This quiz question will be marked by your tutor and your best 8 quiz results will contribute a total of 20% to your final grade.

Satisfactory performance in quizzes is a hurdle requirement. You must obtain a mark of at least 40% in at least 6 out of the 11 scheduled quizzes to pass the unit. No additional quizzes will be offered for those who fail to meet this requirement.

On successful completion you will be able to:

- Students will be able to explain Physics concepts, within the topics listed in the unit guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.
- Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.
- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.
- Students will be able to identify sources of uncertainty in physical measurements, be able to propagate these uncertainties through calculations, and express results in a

meaningful way.

Mid session exam

Due: **20/4/2015**
Weighting: **15%**

A mid-session exam will be held in the first lecture time of week 7. This exam will cover Week 1-4 content.

On successful completion you will be able to:

- Students will be able to explain Physics concepts, within the topics listed in the unit guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.
- Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.
- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.
- Students will be able to identify sources of uncertainty in physical measurements, be able to propagate these uncertainties through calculations, and express results in a meaningful way.

Final Examination

Due: **University Examination Period**
Weighting: **45%**

The final examination will be three hours long and will cover content from the entire unit, with a bias toward week 5-13 content. A data page listing relevant physical constants and core formulae will be provided. All questions in the exam will be compulsory i.e. there will be no choice between questions. A non-alphanumeric scientific calculator is required for the final exam.

The final examination is a hurdle requirement. You must obtain a mark of at least 40% to pass the unit. If your mark in the final examination is between 30% and 39% inclusive then you will be a given a second and final chance to attain the required level of performance.

Copies of past exam papers are available on the e-reserve area of the library web site.

On successful completion you will be able to:

- Students will be able to explain Physics concepts, within the topics listed in the unit

guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.

- Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.
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Delivery and Resources

Classes

Lectures (attend all):

Lecture 1: Monday 10 am X5B T1 Theatre

Lecture 2: Monday 2 pm E7B.T1 (Mason)

Lecture 3: Wednesday 2 pm E7B.T1 (Mason)

Tutorial (register for one and attend this only (compulsory)):

Monday 11 am W6B.282

Monday 11 am E3A.166

Monday 11 am C5A.301

Tuesday 12 pm W6B.382

Tuesday 12 pm E5A.130

Tuesday 12 pm E4B.308

Tuesday 5 pm E5A.130

Tuesday 5 pm E3B.112

Tuesday 5 pm E5A.230

Thursday 1 pm C5A.229

Laboratory (register for one and attend this only (compulsory)):

Tuesday 9 am E7B.114

Tuesday 2 pm E7B.114

Wednesday 11 am E7B.114

Wednesday 3 pm E7B.114

Thursday 10 am E7B.114

NB: One hour Laboratory introduction sessions will occur in week 2 and are compulsory for all students that have not attended the Laboratory introduction session in S1. Full laboratories and tutorials will commence in week 3 of S2.

Required and Recommended Texts and/or Materials

Required Text

Fundamentals of Physics, by Halliday, Resnick, and Walker, extended 10th edition (with Wiley Plus). A used copy is fine, as is the 9th, 8th or 7th edition if you accept that number references to lecture, tutorial and assignment questions will require conversion. An electronic version of the textbook is available from the publisher- check their web site (www.wileydirect.com.au) if you are interested.

Required Resources

Laboratory notes will be available for download on iLearn. There is no longer a requirement to purchase an additional lab manual.

Technology Used and Required

Unit Web Page

PHYS143 has two web pages associated with it: **The primary one is the iLearn page and all class anouncements will be made through this.** The textbook publisher provides a useful webpage, with an electronic copy of the text (for students that purchase the textbook) and many practice problems etc.

Please check the iLearn page regularly for material available for downloading.

Teaching and Learning 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, lecturers and your tutor.

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.

There are no assignments for PHYS143, instead the lecturer will provide a set of 3-6 assigned problems for you to work on each week. Outside of the lecture times, you should aim to spend an average of 3 hours per week understanding the lecture material and working on these assigned problems. At the start of each (compulsory) tutorial session you will complete a 10 min quiz based closely on one of the assigned questions from the previous week. This quiz will be marked by your tutor and this will contribute to your tutorial mark for the unit. You are free to discuss the assigned problems with your classmates as this is a good way to learn and understand the concepts involved. 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.

There will be a mid-session exam in the first lecture time after the mid-session break. The exam will be 50 minutes long and will cover a portion of the content from weeks 1-4.

Physics and Mathematics Assistance at the Numeracy Centre

The Numeracy Centre offers a number of services including a free drop-in service and weekly workshops to assist students in 100-level units. The centre offers assistance with both mathematics (most days and times) and physics (limited days and times) problems, so be sure to check their timetable to see when the best time to access the centre is. Information on on the centre and timetables is available at maths.mq.edu.au/numeracy/.

Unit Schedule

Schedule of Topics

The unit is divided into two halves. The first half, taught by A/Professor Andrei Zvyagin covers the physics of waves and the second, taught by Dr Alex Fuerbach, covers thermodynamics and modern physics.

The textbook sections covered are listed as follows. As a rough guide we will be progressing through the listed chapters at a rate of one every week. You should use this as a guide to plan your textbook reading.

Topic	Chapters (H R W extd 10th edn)

WAVES • Mechanical waves • Sound & hearing	 • 16.1 to 16.7 • 17.1 to 17.3, 17.6 to 17.7
LIGHT • The nature & propagation of light • Geometrical optics and optical instruments • Interference • Diffraction	 • 33.1 to 33.2, 33.4 to 33.7 • 34.1 to 34.6 • 35.1 to 35.5 • 36.1 to 36.2, 36.4
HEAT & THERMODYNAMICS • Temperature, heat, thermal properties of matter, heat capacities • First law of thermodynamics, heat capacities of ideal gas	 • 18.1,18.3 to 18.6 • 19.1 to 19.8
RELATIVITY	• 37.1 to 37.4, 37.6
ATOMIC & QUANTUM PHYSICS • Photons, electrons and atoms, the wave nature of particles	 • 38.1 to 38.7, 38.8, 39.5
NUCLEAR PHYSICS	• 42.1 to 42.6, 43.1, 43.2, 43.4, 43.5

Laboratory Schedule

A full laboratory schedule will be posted on the unit's iLearn page, will be available on all lab computers, and will also be displayed next to the entrance to the laboratory.

Below are the experiments that are available for this unit:

L11-Thin Lenses

L12-Spectrometer

L14-Laser Diffraction

W11-Standing Waves

W12-Ultrasonic Waves

W13-Microwaves

M11-Radioactivity

M13-Torsional Pend.

M14-Gamma of Air

Learning and Teaching Activities

Lectures

There will be three one hour lectures per week. During these the content of the unit will be explained, example problems will be solved and physics principles demonstrated.

Tutorials

There will be one compulsory tutorial per week, starting week 2. At the start of this tutorial students will answer an assignment-style question based on the previous week's work. The rest of the time students will work through problems related to the previous week's lecture content with the help of their tutor.

Laboratory

Three hour laboratory classes will be held in 9 weeks of the semester. During these students will engage in practical exercises to further their understanding of the physics concepts discussed in lectures and to develop their skills at measurement, analysis and verification of physical models.

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

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.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/

Results

Results shown in *iLearn*, 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.

Requirements in order to complete the unit satisfactorily

Satisfactory performance in all assessment components of this unit is a requirement of a passing grade independent of your numerical mark.

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://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.

Graduate Capabilities

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

- Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.
- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.

Assessment tasks

- Laboratory work
- Tutorial quizes
- Mid session exam
- Final Examination

Learning and teaching activities

- There will be one compulsory tutorial per week, starting week 2. At the start of this tutorial students will answer an assignment-style question based on the previous week's work. The rest of the time students will work through problems related to the previous week's lecture content with the help of their tutor.

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

- Students will be able to analyse the description of a physical problem, be able to break the problem into component parts relating to different areas of physics, identify known quantities and apply mathematical models to arrive at a numerical value for an unknown quantity.
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- Laboratory work
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- Three hour laboratory classes will be held in 9 weeks of the semester. During these students will engage in practical exercises to further their understanding of the physics concepts discussed in lectures and to develop their skills at measurement, analysis and verification of physical models.

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

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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:

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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:

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- Students will be able to explain Physics concepts, within the topics listed in the unit guide, in terms of their underlying physical principles, and describe them in terms of concise mathematical models.
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- There will be one compulsory tutorial per week, starting week 2. At the start of this tutorial students will answer an assignment-style question based on the previous week's work. The rest of the time students will work through problems related to the previous week's lecture content with the help of their tutor.
- Three hour laboratory classes will be held in 9 weeks of the semester. During these students will engage in practical exercises to further their understanding of the physics concepts discussed in lectures and to develop their skills at measurement, analysis and verification of physical models.

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:

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- Three hour laboratory classes will be held in 9 weeks of the semester. During these students will engage in practical exercises to further their understanding of the physics concepts discussed in lectures and to develop their skills at measurement, analysis and verification of physical models.

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

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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 outcome

- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.

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- Final Examination

Learning and teaching activities

- There will be three one hour lectures per week. During these the content of the unit will be explained, example problems will be solved and physics principles demonstrated.

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

- Students will be able to analyse real-world problems,be able to develop physical problems based on this analysis, and interpret how numerical results relate to the physical world.

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Changes from Previous Offering

In accordance with Macquarie University's revised assessment policy, hurdle requirements have been introduced.

General Reminders

Student Liaison Committee

The Physics and Astronomy Department values feedback from its students. Once a semester a meeting of the Student Liaison Committee is called and representatives from each of the PHYS/ PHTN/ASTR units have an opportunity to voice their opinions about the structure of the unit and how it is taught. Further information and a call for representatives will be made in lectures closer to the meeting date.

Email Communication

The unit web page and your student email account are the primary ways that the unit lecturers can communicate with you outside of lectures. Please check your students email accounts once a day for messages concerning the unit.

Peter Mason Prize

Peter Mason was a foundation Professor of Physics at Macquarie University. He was a prominent author, ABC science communicator, and respected commentator on science, technology and society. He gave the first lecture at Macquarie University!

The Peter Mason Prize is awarded each year, in accordance with his family's wishes, to the best performing student in PHYS143.

Laboratory Details

Laboratory Requirements

The laboratory component is considered an essential component of your studies and so counts for an appreciable fraction of your final assessment (20%).

The laboratory work is designed to introduce you to some of the basic skills and techniques that are used in experimental physical science. Some of the activities in the laboratory may not relate directly to the material in the lecture course. This is because the laboratory activities are intended not only to illustrate physical concepts but also to introduce you to some techniques of measurement.

This work is designed to be carried out independently of the lectures, although some of these topics will be discussed in lectures. By providing you with instructional material in the form of Laboratory Notes, together with help from the laboratory demonstrators, the laboratory work has been designed to be tackled independently of the lecture material. Indeed there is some advantage in becoming familiar with a topic in an experimental situation before you meet it in lectures. That is often the case in real life! All the information you need for each experiment is contained in the Laboratory Notes. There is no need to spend a long time outside the laboratory hours in preparation, however a quick read through the lab notes beforehand will allow you to make better use of your time in the laboratory

Location of the 100-level Physics Laboratory

The laboratory is located on the ground floor of building E7B, at the NE corner (room 114). Entry is from the courtyard at the opposite end to the main staircase.

Laboratory Attendance Requirements

You are required to attend and to satisfactory complete all rostered laboratory sessions. Each time you attend the laboratory you must sign in and out (legibly) in the attendance book.

If you miss a laboratory session and wish to lodge a "disruption to studies" request you can start this process at ask.mq.edu.au. You will require a medical certificate or other form of evidence to complete this process - contact the unit convenor if you are unsure.

Laboratory Assessment

Details of the laboratory assessment will be outlined in the first session.

Laboratory Safety

You are required to follow all safety guidelines given in the lab manual, and as outlined by your lab supervisor. **Food and drink cannot be taken into the laboratory and students without suitable covered footwear will be refused admission**.

Laboratory Schedule

Introduction laboratories start in the second week of semester. The schedule of labs is posted in the lab and on the PHYS143 iLearn page. Please attend your nominated laboratory session.

Changes since First Published

Date	Description
26/ 07/ 2016	Changes have been made after feedback from the laboratory manager: The laboratory times showed a lab on Friday at 9am. This lab does not exist and was removed from the list. The one hour laboratory introduction session will occur in Week 2 and not in Week 1. The Laboratory Schedule is also available on all lab computers. There is no longer a requirement to purchase a lab manual from the Co-op bookshop. It is not required to buy and use a standard "science book. Students will be given an exercise book in their first laboratory session.