PHYS188

Advanced Physics I

FY1 Day 2019

Dept of Physics and Astronomy

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General Information

Unit convenor and teaching staff
Convener
Alexei Gilchrist
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Mark Wardle
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Credit points
3

Prerequisites
Admission to BAdvSc

Corequisites

Co-badged status

Unit description
This full-year unit is the first component of the Advanced Science degrees in Physics and Astronomy, and offers accelerated learning via lectures, discussions, homework, and literature-based research projects in a variety of areas of physics including: classical mechanics and astronomy. Topics include: the simple harmonic oscillator, coupled oscillators, Lagrangian methods with constrained and unconstrained systems, orbital mechanics, angular momentum and rotational stability, and non-inertial reference frames. Students are also expected to observe and participate in various activities closely associated with physics and astronomy research activities.

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:

Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.

Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.

Understanding of scalars, vectors and tensors.

To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
Understand the basics of orbital motion and Kepler’s Laws
Understand angular velocity, angular momentum, torque and moment of inertia both in 2D and 3D.
Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

Assessment Tasks

Name	Weighting	Hurdle	Due
project	20%	No	Towards end of S2
assignment	30%	No	continuous
exam	50%	No	End of S2

project

Due: **Towards end of S2**
Weighting: **20%**

An individual project on the subject of choice of a student (approved by the lecturer)

On successful completion you will be able to:

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
- Understand the basics of orbital motion and Kepler’s Laws
- Understand angular velocity, angular momentum, torque and moment of inertia both in 2D and 3D.
- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

assignment

Due: **continuous**

Weighting: **30%**

Bi-weekly assignments

On successful completion you will be able to:

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
- Understand the basics of orbital motion and Kepler’s Laws
- Understand angular velocity, angular momentum, torque and moment of inertia both in 2D and 3D.
- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

exam

Due: **End of S2**
Weighting: **50%**

Final exam will cover material from Semester 2. An A4 page of personal notes is permitted.

On successful completion you will be able to:

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
- Understand the basics of orbital motion and Kepler’s Laws
- Understand angular velocity, angular momentum, torque and moment of inertia both in 2D and 3D.
- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

Delivery and Resources

The first semester will comprise of informal meetings and lab visits which are not assessed.The informal meetings will introduce approximation and calculation techniques that are useful across all physics units. In the first semester, this unit will provide opportunities for students to visit research labs and talk to researchers to order to start developing their professional contacts and a view of where their physics career could take them.

The delivery of the advanced material in the second semester will be through blended lecture-tutorials with an emphasis on problem solving. This material will be assessed.

In general, unit materials, reading suggestions, announcements etc will be available on the units iLearn page.

Unit Schedule

There will be short weekly meetings in the first semester. These meetings will begin introducing order-of-magnitude estimation and approximation techniques and will also introduce the students to research occurring in the Physics and Astronomy department through lab visits and meeting researchers. Though not assessed, the content introduced in this semester should be valuable to students in other units and throughout their career.

In the second semester, students cover advanced content, completing a more in-depth look at order-of-marnitude estimation techniques, then they will cover rotational dynamics, looking at systems with a central force through to the physics of boomerangs and how cats can land on their feet. Lagrangian methods will be introduced as will simple vector calculus. This is an opportunity to play with some interesting physics not normally introduced in a physics curriculum till much later if at all.

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.)*

Undergraduate 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 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

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.

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

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Understand the basics of orbital motion and Kepler's Laws

Assessment tasks

- project
- assignment
- exam

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:

Assessment task

- project

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

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
- Understand the basics of orbital motion and Kepler’s Laws
- Understand angular velocity, angular momentum, torque and moment of inertia both in 2D and 3D.
- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

Assessment tasks

- project
- assignment
- exam

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

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
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2D and 3D.
- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

Assessment tasks

- project
- assignment
- exam

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

- Understanding of general approximation and estimation techniques for physics: order-of-magnitude estimation, dimensional analysis, scaling laws and Taylor expansions.
- Ability to apply estimation techniques in key physical examples from fluid dynamics, atomic theory and material science.
- Understanding of scalars, vectors and tensors.
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
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- Understand rigid body rotations: rotating reference frames, gyroscopes, precession, stability of rotation and boomerangs.

Assessment tasks

- project
- assignment
- exam

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:

Assessment tasks

- project
- assignment
- exam