



PHYS188

Advanced Physics I

FY1 Day 2017

Dept of Physics and Astronomy

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General Information

Unit convenor and teaching staff

Lecturer

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Convener

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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 symmetries in physics and passive and active view of transformations

Understanding of scalars, vectors and tensors.

Understanding of the role and use of conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum

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

Theory of angular momentum: converting between spherical, cylindrical, and cartesian coordinate systems, Euler angles

Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation

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 symmetries in physics and passive and active view of transformations
- Understanding of scalars, vectors and tensors.
- Understanding of the role and use of conservation laws. Know and apply, when

- appropriate, the conservation of energy, momentum, angular momentum
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
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- Theory of angular momentum: converting between spherical, cylindrical, and cartesian coordinate systems, Euler angles
- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation

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 symmetries in physics and passive and active view of transformations
- Understanding of scalars, vectors and tensors.
- Understanding of the role and use of conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum
- To be able to apply the Euler-Lagrange equations of motion as an alternative to Newton's laws
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- Theory of angular momentum: converting between spherical, cylindrical, and cartesian coordinate systems, Euler angles
- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation

exam

Due: **End of S2**

Weighting: **50%**

Final exam will be of 3 hours duration. An A4 page of personal notes are permitted. Calculators (including the ones with graphic capabilities) are permitted. Any other devices are not 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 symmetries in physics and passive and active view of transformations
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- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation

Delivery and Resources

Unit materials, reading suggestions, etc will be available from the iLearn page

Unit Schedule

There will be regular weekly meeting in the first Semester. These meetings will begin introducing order-of-magnitude estimation techniques and will introduce the students to research occurring in the Physics and Astronomy department through lab visits and meeting researchers. The main content of the unit will be in Semester 2.

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_2016.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 (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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.

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

- 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 symmetries in physics and passive and active view of transformations
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- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation

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.
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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 symmetries in physics and passive and active view of transformations
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reference frames, stability of rotation

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