PHYS188

Advanced Physics I

FY1 Day 2016

Dept of Physics and Astronomy

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General Information

Unit convenor and teaching staff
Lecturer
Gabriel Molina-Terriza
gabriel.molina-terriza@mq.edu.au
Contact via x6371
E6A2.409

Convener
Alexei Gilchrist
alexei.gilchrist@mq.edu.au
Contact via 4443
E6B2.610

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:

Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
The role and use of the conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum
Approximations in physical systems, order of magnitude calculations, and dimensional analysis.
Lagrangian mechanics: Using the Euler-Lagrange equations of motion. Orbital motion, elliptic orbits and Kepler's Laws
Theory of rotation in three dimensions (angular momentum, torques, rotation matrices, etc)
Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation, gyroscopes, and boomerangs.

Assessment Tasks

Name	Weighting	Due
project	20%	end of S1 and end of S2
assignment	30%	continuous
exam	50%	end of S1 and end of S2

project

Due: **end of S1 and end of S2**
Weighting: **20%**

Small individual project in first semester; larger project with presentation in second semester.

On successful completion you will be able to:

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
- The role and use of the conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum
- Approximations in physical systems, order of magnitude calculations, and dimensional analysis.
- Lagrangian mechanics: Using the Euler-Lagrange equations of motion. Orbital motion,

elliptic orbits and Kepler's Laws
- Theory of rotation in three dimensions (angular momentum, torques, rotation matrices, etc)
- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation, gyroscopes, and boomerangs.

assignment

Due: **continuous**
Weighting: **30%**

2 Assignments per semester

On successful completion you will be able to:
- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
- The role and use of the conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum
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- Theory of rotation in three dimensions (angular momentum, torques, rotation matrices, etc)
- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation, gyroscopes, and boomerangs.

exam

Due: **end of S1 and end of S2**
Weighting: **50%**

Two end of the term exams (each worth 25% of total).

The two examinations will be of 1.5 hours duration each.

On successful completion you will be able to:
- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]

- The role and use of the conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum
- Approximations in physical systems, order of magnitude calculations, and dimensional analysis.
- Lagrangian mechanics: Using the Euler-Lagrange equations of motion. Orbital motion, elliptic orbits and Kepler's Laws
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Delivery and Resources

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

Unit Schedule

In the first semester student will be introduced to general techniques for investigating physical systems including the appropriate use of approximations, order of magnitude calculations, and dimensional analysis. Real world examples will be explored with an emphasis in developing problem solving capabilities.

In the second semester the dynamics of rotating systems will be developed including orbital mechanics, rotating rigid objects, gyroscopes and boomerangs.

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.

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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
- Approximations in physical systems, order of magnitude calculations, and dimensional analysis.
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- Theory of rotation in three dimensions (angular momentum, torques, rotation matrices, etc)
- Rigid body rotations: parallel axis theorem, moments of inertia, precession, rotating reference frames, stability of rotation, gyroscopes, and boomerangs.

Assessment tasks

- project
- assignment
- exam

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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
- The role and use of the conservation laws. Know and apply, when appropriate, the conservation of energy, momentum, angular momentum

Assessment task

- project

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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
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Assessment tasks

- project
- assignment

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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
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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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
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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

- Know the role & use of mathematics. Being able to identify necessary math techniques (intermediate level) and apply all the basic ones [vectors, derivatives, integrals, partial derivatives, vector calculus, ordinary differential equations, Taylor expansions, etc]
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- 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

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:

Assessment task

- project