GEOS345

Solid Earth Geophysics

S2 Day 2015

Dept of Earth and Planetary Sciences

Contents

General Information

Unit convenor and teaching staff
Juan Carlos Afonso
juan.afonso@mq.edu.au

A/Prof
Yingjie Yang
yingjie.yang@mq.edu.au

Credit points
3

Prerequisites
GEOS385 and 3cp from PHYS or MATH units

Corequisites

Co-badged status

Unit description
The unit covers the fundamental physics of the solid Earth, including modelling and assessment of geophysical data to understand the working of the Earth's interior. The emphasis is on physical principles and their application to interpret surface observations. Major topics covered in this unit include the Thermochemical state of the Earth, Potential Field Methods, Global Seismology, the Physics of Plate Tectonics, and Inverse Problems. Computational modelling and scientific programming will be used in practicals. Additional minor subjects include thermodynamics of the Earth, elastic and non-elastic processes in the Earth, rock mechanics, earthquake seismology, and mineral physics.

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:

Capacity to present ideas clearly with supporting evidence

Application of geophysical knowledge to solving geoscientific problems and evaluating ideas and information

Competence in accessing, analysing and interpreting geophysical datasets

Understanding of the tools and methods that are used in Solid Earth Geophysics

Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets

Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results

Understanding of scientific methodology

Problem-solving skills relevant to geophysical studies

Assessment Tasks

Name	Weighting	Due
Assignment	20%	week 13
Weekly practicals	25%	every week
Mid Semester Test	15%	week 8
Final Exam	40%	to be confirmed

Assignment

Due: **week 13**
Weighting: **20%**

This assignment is worth 20%. You will hand in a written group report and give a 20-25 min presentation to the class. You will be given specific details about the topic of the report as well as what is expected from the report and presentation when you start the unit.

On successful completion you will be able to:

- Capacity to present ideas clearly with supporting evidence
- Application of geophysical knowledge to solving geoscientific problems and evaluating ideas and information
- Competence in accessing, analysing and interpreting geophysical datasets
- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets
- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results
- Understanding of scientific methodology
- Problem-solving skills relevant to geophysical studies

Weekly practicals

Due: **every week**
Weighting: **25%**

Each week you will have a set of problems to solve during the laboratories/practicals. These will involve a mixture of manual calculations, computer-aided simulations/computations, and hands-on laboratory exercises. Your tutor will carefully oversee your individual performance in each practical and give you a mark out of 10 each week (>9 = exceptional; 7-8 = satisfactory; 7-6 = inconsistent; < 6 unsatisfactory). These marks will be collected at the end of the unit to obtain a final mark that will represent 25% of your final grade.

On successful completion you will be able to:

- Capacity to present ideas clearly with supporting evidence
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- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets
- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results
- Understanding of scientific methodology
- Problem-solving skills relevant to geophysical studies

Mid Semester Test

Due: **week 8**
Weighting: **15%**

This quiz will be given to you at the beginning of the second part of the semester (after the mid-semester public holiday) and it will cover all the contents (concepts only, no calculations) covered up until week 7. You will have 45 mins to answer the questions in writing.

On successful completion you will be able to:

- Capacity to present ideas clearly with supporting evidence
- Competence in accessing, analysing and interpreting geophysical datasets
- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Problem-solving skills relevant to geophysical studies

Final Exam

Due: **to be confirmed**
Weighting: **40%**

The final exam will cover material from the lectures, text-book readings and class exercises. The exam will include questions that ask you to apply your knowledge to interpret and solve problems. Your tutor will discuss the details of the exam later in the semester. There will be an final exam revision at the end of the unit.

On successful completion you will be able to:

- Capacity to present ideas clearly with supporting evidence
- Competence in accessing, analysing and interpreting geophysical datasets
- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Understanding of scientific methodology

Delivery and Resources

Lab materials

We strongly suggest you bring a ruler, pencils and memory stick to the labs. A scientific calculator is recommended, but you can always use the computer in the lab.

Unit booklet

This contains diagrams that will be referred to in lectures and the laboratory exercises. It is available from the iLearn unit page. The completed worksheets are invaluable as an aid during revision for the examination. The booklet is essential for the laboratory exercises and it is not intended to serve as a formal guide to the lectures or study guide for the final exam. You will have to take your own explanatory notes and complement them with extra reading.

Textbooks

We have not been able to identify a single textbook that will cover all the topics in the unit. Therefore, we will compile a set of chapters from different sources for you to read after each lecture and use as a study material for final the exam. Here we list a number of textbooks you may find useful while studying the different topics covered in this unit (all available in the library).

1. Lowrie, W., **Fundamentals of Geophysics**, Cambridge University Press
2. Stacey, F. and Davis, P., **Physics of the Earth** (4^{th} ed.), Cambridge University Press
3. Brown, G. and Mussett, A., **The Inaccessible Earth** (2^{nd} ed.), Chapman & Hall
4. Turcotte, D. and Schubert, G., **Geodynamics**, Cambridge University Press
5. Menke, W., **Geophysical Data Analysis**, Academic Press.
6. Fowler, C.M.R., **The Solid Earth: An introduction to Global Geophysics**, Cambridge University press
7. Davis, G., **Dynamic Earth: Plates, Plumes and Mantle Convection**, Cambridge University press

8. Stein, S. and Wysession, M., **An Introduction to Seismology**, **Earthquakes, and Earth Structure**, Blackwell Publishing
9. Shearer, P., **Introduction to Seismology**, Cambridge University press
10. Ranalli, G., **Rheology of the Earth**, Chapman & Hall
11. Karato, S-I, **Deformation of Earth Materials: An Introduction to the Rheology of Solid Earth**, Cambridge University press.

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/

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://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

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

- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results
- Understanding of scientific methodology

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

- Competence in accessing, analysing and interpreting geophysical datasets

- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets

Assessment tasks

- Assignment
- Final 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:

Learning outcomes

- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets
- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results

Assessment task

- Mid Semester Test

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

- Capacity to present ideas clearly with supporting evidence
- Application of geophysical knowledge to solving geoscientific problems and evaluating ideas and information
- Competence in accessing, analysing and interpreting geophysical datasets

- Understanding of the tools and methods that are used in Solid Earth Geophysics
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- Problem-solving skills relevant to geophysical studies

Assessment tasks

- Assignment
- Weekly practicals
- Mid Semester Test
- Final 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

- Capacity to present ideas clearly with supporting evidence
- Application of geophysical knowledge to solving geoscientific problems and evaluating ideas and information
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- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets
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Assessment tasks

- Assignment
- Weekly practicals
- Final 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

- Application of geophysical knowledge to solving geoscientific problems and evaluating ideas and information
- Competence in accessing, analysing and interpreting geophysical datasets
- Understanding of the tools and methods that are used in Solid Earth Geophysics
- Competence in applying physical principles to understanding the inner working of the Earth and other terrestrial planets
- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results
- Understanding of scientific methodology
- Problem-solving skills relevant to geophysical studies

Assessment tasks

- Assignment
- Weekly practicals

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

- Capacity to present ideas clearly with supporting evidence
- Capacity to employ appropriate geophysical tools and concepts to solve geoscientific problems and to interpret the results
- Understanding of scientific methodology

Assessment tasks

- Assignment
- Weekly practicals
- Mid Semester Test
- Final Exam

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:

Assessment task

- Assignment