MACQUARIE UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF EARTH AND PLANETARY SCIENCES
GEOS205 INTRODUCTION TO GEOPHYSICS
First Semester, 2011

UNIT OUTLINE.

1. Introduction.

Lectures cover, at an introductory level, the more important approaches to the use of geophysics for the exploration and understanding of the structures and processes occurring in the earth's interior. Included are the methods of collecting, processing and interpreting gravity, magnetic, seismic, electrical, radiometric and geothermal data, and their use in assembling the presently held picture of the crust, mantle and core. The physical basis of each of the methods will also be covered in lectures.
Practical classes involve the reduction and interpretation of various geophysical data sets from both exploration and global scale problems.
The field excursion provides an opportunity to carry out field surveys using several geophysical techniques, and to interpret the results in terms of geological structure.

2. Lecturers.

Mark Lackie	Craig O'Neill
98508377	98509673
E7A518	E7A515
mark.lackie@mq.edu.au	craig.oneill@mq.edu.au

Mark Lackie is the Unit Convenor for GEOS205. Queries regarding the unit and its operation should be directed to him.

3. Unit Organisation.

Credit Points: 3
Please note that in 2009, this unit ran as a 4 cp unit, GEOS268.

Prerequisites: GEOS112 or GEOS115 or GEOS116 or GEOS125 or GEOS126

A list of important dates for this year is attached.
There will be two lectures (each one hour) and a three-hour practical session on each of the 13 weeks of first semester.

A two-day field excursion will be held at the University on the weekend specified on the handout detailing times and dates for the unit. Attendance at the excursion is compulsory, as is the submission of a report on the work carried out at the excursion. The scope of the field report will include a discussion of the methods used, data reduction, and interpretation.

4. Key Learning Outcomes

The key learning outcomes for this unit are:

1. understanding of the basic concepts of geophysics;
2. gaining experience in operating geophysical equipment;
3. gaining experience in interpreting geophysical data;
4. gaining experience in modelling geophysical data;
5. understanding scientific methodology;
6. competence in accessing, using and synthesising appropriate information;
7. application of knowledge to solving problems and evaluating ideas and information; and
8. capacity to present ideas clearly with supporting evidence.

5. Graduate Capabilities

Students will enter a globalizing world of major environmental change and resource constraints, of scientific and technological advance and ethical challenge, of continuing political instability and possible international conflicts, of unlimited creativity and increasing social surveillance. To prepare students for life after university, various graduate capabilities are developed through the curriculum. These capabilities are described below.

No.	Capability	Brief Description
1	*Discipline Specific Knowledge and Skills*	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.
2	*Critical, Analytical and Integrative Thinking*	Graduates are to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments.
3	*Problem Solving and Research Capability*	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.
4	*Creative and Innovative*	Graduates will be capable of creative thinking and of creating knowledge.
5	*Effective Communication*	Students develop the ability to communicate and convey their views in forms effective with different audiences.
6	*Engaged and Ethical Local and Global citizens*	Graduates will 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.
7	*Socially and Environmentally Active and Responsible*	Graduates to be aware of and have respect for self and others.
8	*Capable of Professional and Personal Judgement and Initiative*	Graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement.
9	*Commitment to Continuous Learning*	Graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake.

6. Unit Assessment

(i) Topic Tests, 24%
There will be four (4) topic tests, each worth 6% of the final assessment. These will be held during the semester, at intervals usually of three weeks. They will consist of short answer or multiple choice questions relating to the practical work and lecture material from the period preceding the test. Dates will be confirmed in class.

(ii) Excursion Performance and Report, 26%
Performance at, and the report on the field excursion will be assessed, and make up 26% of the final mark. The due dates for external and internal students will be determined in consultation with students at the excursions.

(iii) Examination, 50%
There will be a two-hour final examination covering the material presented during the unit, and counting for 50% of the final mark. The examination will consist of a number of short answer questions on definitions and concepts, followed by an essay section requiring further description of concepts and theory.

(iv) Minimum Requirements.
The minimum requirements needed to obtain a passing grade for the unit include:
a. Attendance at the field excursion
and at least two of the following:
b. A passing grade in the topic tests (as a whole)
c. A passing grade for the excursion assessment
d. A passing grade in the examination

The unit will be assessed as follows:

Task	Weight	Due Date	Linked Learning Outcomes	Linked Graduate Capabilities
Topic Tests (1-4)	24%	See schedule	1,5,6,7	1,2,3,4,9
Field Report	26%	3/6/11	1,2,3,4,5,6,7,8	2,3,4,5,8,9
Final Examination	50%	June	1,5,6,7,8	1,2,3,5

7. Desired Standards

Grade	Standard Required
High Distinction	Demonstrates an extensive knowledge and understanding of the concepts of the course. Analysis skills are very sophisticated with a balance of individual components and larger ideas. Capable of generalising from examples and evaluating ideas.
Distinction	Demonstrates a thorough knowledge and understanding of the concepts of the course. Analysis skills are sophisticated with a balance of individual components and larger ideas. Capable of generalising from examples and evaluating ideas.
Credit	Demonstrates a sound knowledge and understanding of the concepts of the course. Can break down complex problems into components and synthesise multiple factors into a larger idea. Can evaluate the importance and limitations of data.
Pass	Demonstrates a basic knowledge and understanding of the concepts of the course. Analysis is mainly descriptive. Demonstrates limited capacity to identify complex factors within an idea or to combine multiple factors.
Conceded Pass (sorry in 2011 this means you failed)	Demonstrates a limited knowledge and understanding of the concepts of the course. Analysis is mainly descriptive. Demonstrates very limited capacity to identify complex factors within an idea or to combine multiple factors.
Fail	Demonstrates a poor knowledge and understanding of the concepts of the course. Analysis skills are very limited.

8. Textbook and Technology Used.

The textbook for the unit is MUSSETT and KHAN (Looking into the Earth, 2000). The textbook will be available from the COOP Bookshop. Copies of the PowerPoint's shown in the lectures will be available on the unit's WEB page and on the unit CD. The recommended textbook is an excellent text for second year, but you can also consider some of the third year textbooks as well. The two texts you should first consider are SHARMA (Environmental and Engineering Geophysics, 1997) and REYNOLDS (An Introduction to Applied and Environmental Geophysics, 1997), because they cover all the major geophysical topics, and are the recommended texts for the Environmental and Groundwater Geophysics (GEOS305) unit. They have the further advantage of consistently using the SI system of units.

In previous years we used a text by SHARMA (Geophysical Methods in Geology, 2nd Ed, 1986), but this is now out of print. SHARMA covers the global aspect of geophysics in more detail and is a useful reference to have if you can find a 2nd hand copy. In 1998, we used PARASNIS (Principles of Applied Geophysics, 5th Ed) but a change in publisher meant a massive increase in its cost. However, it is a useful text to refer to if you can find a 2nd hand copy. Other useful texts to consider are; TELFORD ET AL (Exploration, fairly mathematical); KEAREY & BROOKS (Exploration, current 3rd year exploration text); FOWLER (Good solid-earth coverage, used in GEOS386); SLEEP & FUJITA (Solid-earth, more mathematical). The solid earth aspect of this unit is best covered in FOWLER. It is strongly recommended that you have access to a geophysical textbook, particularly if you are studying externally.

The unit also has a WEB site which can be found through the Online Learning @ MQ WEBSITE at http://learn.mq.edu.au/. This site contains information such as copies of colour images, copies of overheads and PowerPoint's shown in class, and copies of the practicals that we do in class. The WEB site will also allow access to the digital version of the lectures recorded through the iLecture system. As well, this site will access the on-line quizzes that will need to be completed during the semester. At the start of the year you should be issued with a username and password to access all the WEB sites available for the units you have taken. This will get you into the front page of the GEOS205 WEB site. Please note that some sections within the WEB site require an internal username and password; the username is **geos268** and please see, or call me to obtain the password. Information for students about access to online units is available at https://learn.mq.edu.au/webct/RelativeResourceManager/25994001/Public%20Files/uw/software.html

A list of other texts and references is attached.

9. Extensions and Penalties:

Whenever possible requests for an extension should be submitted prior to an assignment's due date. Late assignments will be date stamped and a penalty of 10% per day (Monday to Friday) will be deducted from the total mark.

10. Academic Honesty and Plagiarism.

Plagiarism involves using the work of another person and presenting it as one's own. If you use the work of another person without clearly stating or acknowledging the source, you are falsely claiming that material as your own work and committing an act of **PLAGIARISM**. This is a very

serious violation of good practice and an offence for which you will be penalised. You should read the University's policies and procedures on plagiarism. These can be found at:
http://www.mq.edu.au/policy/docs/academic_honesty/policy.html
The policies and procedures explain what plagiarism is, how to avoid it, the procedures taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

As such, all assignments must have a signed "Faculty of Science" (FoS) assignment cover sheet attached. These sheets are available from the Science centre or from the FoS WEB page.

11.University Policies

Macquarie is developing a number of policies in the area of learning and teaching. Approved policies and associated guidelines and procedures can be found at Policy Central:
http://www.mq.edu.au/policy/ . There you will find the University's policy and associated procedures on assessment, Special Consideration and grade appeal.

M.A. Lackie
February 2011.

MACQUARIE UNIVERSITY
FACULTY OF SCIENCE

MACQUARIE UNIVERSITY
DEPARTMENT OF EARTH AND PLANETARY SCIENCES
GEOS205 INTRODUCTION TO GEOPHYSICS

Reference List.

Mussett A.E. and Khan M.A., 2000 (QE501.M87/2000, 7-Day loan)
Looking into the Earth
Cambridge
An excellent book for 2nd year, covers exploration and solid earth geophysics.

Sharma P.V., 1997 (TA705.S515/1997, 7-Day loan)
Environmental and engineering geophysics
Cambridge
Covers the title well, not much solid earth geophysics.

Reynolds J.M., 1997 (QC808.5.R49/1997, 7-Day loan)
An Introduction to Applied and Environmental Geophysics
Wiley
Title says it all, not too mathematical, not much solid earth geophysics.

Parasnis, D.S., 1997 (TN269.P32/1997)
Principles of Applied Geophysics
Chapman and Hall, 5th Ed.
Exploration geophysics, with emphasis on mineral exploration

Sharma P.V., 1986 (QE501.3.S48/1986, 7-Day loan)
Geophysical Methods in Geology, 2nd Ed
Prentice Hall
Exploration and global geophysics, not too mathematical.

Kearey, P., Brooks, M.,and Hill I., 2002 (TN269K36/2002, 7-Day loan)
An Introduction to Geophysical Exploration, 3rd Ed.
Blackwell
This text concentrates on exploration aspects.

Sheriff, R.E. 1989 (TN269.S52417/1989)
Geophysical Methods
Prentice Hall
Covers global and exploration topics.

Bott, M.H.P. (QE509.B751/1982)
The Interior of the Earth, 2nd Ed.
Edward Arnold
Useful and readable text on global geophysics.

Telford, W.M., Geldart, L.P., and Sheriff, R.E., 1990. (TN269.T44)
Applied Geophysics, 2nd Ed.
Cambridge.
Comprehensive applied geophysics text currently used for our 3rd year units.

Fowler, C.M.R., 1990 and 2005 (QC806.F625, 7-Day loan)
The Solid Earth
Cambridge
Global and regional geophysics and tectonics, currently used as a text for our third-year unit GEOS385, Geodynamics.

Burger H.R., 1992 (TN269.B86/1992)
Exploration Geophysics of the shallow subsurface
Prentice-Hall
Near surface techniques, good text, useful software supplied.

Beck A.E., 1991 (TN269.B387/1991)
Physical Principles of Exploration Methods 2nd Ed
Wuerz
Basic text, designed for geologists

Sleep N.H. & Fujita K., 1997 (QC806.S54/1997)
Principles of Geophysics
Blackwell Science
Covers the basics, concentrates on solid earth geophysics, more mathematical than Fowler.

Specific references to these texts, and to further reference material will be given as the unit progresses.

E-Readings (http://www.lib.mq.edu.au/reserve/)

Barton C.E., 1988. Global and Regional Geomagnetic Reference Fields. *Exploration Geophysics* **19**, 401-416.

Clark D.A., 1997. Magnetic Petrophysics and Magnetic Petrology: Aids to geological interpretation of magnetic surveys. *AGSO J. Australian Geology and Geophysics* **17**, 83-103.

Emerson D.W., 1990. Notes on Mass Properties of Rocks - Density, Porosity, Permeability. *Exploration Geophysics* **21**, 209-216.

Featherstone W.E., 1995. The Global Positioning System (GPS) and its use in Exploration geophysics. *Exploration Geophysics* **26**, 1-18.

MACQUARIE UNIVERSITY
DEPARTMENT OF EARTH AND PLANETARY SCIENCES
GEOS205 INTRODUCTION TO GEOPHYSICS

Class Times, 1st Semester, 2011

Day Students:

Lectures:	12 pm Tuesday in W6B338 2 pm Tuesday in W6B325
Practical Class:	3 pm - 6 p.m. Tuesday, E5A132 9 am – noon Wednesday, E5A132
Field Excursion:	Saturday 30 April and Sunday 1 May
OR	
Field Excursion:	Saturday 7 and Sunday 8 May

External Students: (no class in 2011)

On-Campus Session:	Saturday 16 and Sunday 17 April
Field Excursion:	Saturday 7 and Sunday 8 May

End of Teaching: Friday 3 June.

MACQUARIE UNIVERSITY
DEPARTMENT OF EARTH AND PLANETARY SCIENCES
GEOS205 INTRODUCTION TO GEOPHYSICS

SCHEDULE OF LECTURE AND PRACTICAL TOPICS, 1st SEMESTER 2011

DATE	LECTURER		TOPIC	PRACTICAL
Week 1 22 Feb	Mark Lackie	L1 L2	Introduction Wave motion and seismic waves	Seismic waves
Week 2 1 Mar	Mark Lackie	L3 L4	Seismographs and Travel time curves Earthquakes	Earthquake Interpretation
Week 3 8 Mar	Mark Lackie Craig O'Neill	L5 L6	Seismic exploration GPR	Refraction Interpretation
Week 4 15 Mar	Mark Lackie	L7 L8	Gravity: Fundamental principles Reduction of gravity data	*Topic Test 1* Reduction of Gravity Data
Week 5 22 Mar	Mark Lackie	L9 L10	Modelling and Interpretation of gravity data Isostasy	Gridding GPR & Isostasy
Week 6 29 Mar	Mark Lackie	L11 L12	Physics of magnetism The earth's magnetic field	*Gravity Modelling
Week 7 5 April	Mark Lackie	L13 L14	Magnetic Surveying Techniques Interpretation of magnetic data	*Topic Test 2* *Magnetic Modelling
			Mid Semester Recess	
Week 8 26 April	Mark Lackie	L15 L16	Introduction to electrical methods Methods of electrical surveying	Two layer Resistivity prac
			Field Excursion (30 April - 1 May)	
Week 9 3 May	Mark Lackie	L17 L18	Induced Polarization, self potential Electromagnetic exploration	Field data intro *Three layer Resistivity
			Field Excursion (7 - 8 May)	
Week 10 10 May	Mark Lackie	L19 L20	Palaeomagnetism Reversals, geomagnetic time scale	*Topic Test 3* *Field data Compilation
Week 11 17 May	Mark Lackie Craig O'Neill	L21 L22	Radiometric surveying Geothermics	*Field data Compilation
Week 12 24 May	Mark Lackie	L23 L24	GPS Exploration Geophysics	*Field data Compilation
Week 13 31 May	Craig O'Neill	L25 L26	Geophysics of the Lithosphere Satellite Geophysics	*Topic Test 4* Field data Compilation