GEOL261/361 – Applied Geophysics *2020*

Lecturers: **Assoc Prof Andrew Gorman** – Room 2S02a
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Lectures: Thursdays from 8-9am and 12-1pm
Tutorial / Lab Introduction: Thursdays from 2-3pm
Labs: Paleo-Sed Lab Thursdays 3-4:50pm

There are two primary aims of this course:

- to introduce a range of geophysical techniques that can be applied to investigate geological problems
- to examine the physics behind the dynamic behaviour of the Earth.

Course Content
Through the acquisition, reduction and interpretation of data from your own geophysical exercises and surveys, you will become familiar with the use of geophysical methods in understanding the near surface of the Earth. You will gain practical experience with seismic, gravity, magnetic and electrical geophysical techniques. We will utilise computer-based laboratory / tutorial sessions for reduction and interpretation of these datasets. The second aim of the course enables us to examine more deep-seated processes that govern Earth's dynamic behaviour. We shall investigate the forces that formed the solar system and planet, drive convection in the core and mantle, and power plate tectonics. Simple modelling techniques are introduced so that you can perform simulations of Earth's thermal and mechanical behaviour. When you complete this course, you should have a working knowledge of the practical application of geophysical methods at scales appropriate for investigations of near-surface geophysical properties, exploration of mineral resources, evaluation of petroleum basins and also to the larger scales of determination of earth structure.

Prerequisites: EAOS111 and either GEOL112 or 6 points in PHSI

Background requirements: Basic knowledge of elementary mathematics and physics. Successful completion of MATH151 or MATH160 is desirable.

Fieldschool: Three days of geophysical surveys will be undertaken on a weekend in August (see schedule). Please plan to be available**.**

Assessment: 15% Blackboard review quizzes | 10% essay (due Friday 14 August via Blackboard at 11:59pm) | 25% field trip data presentation and interpretation (partially to be worked up in groups) | 50% final examination**.**

Recommended Text:
Mussett, Alan E. and **Khan**, M. Aftab. *Looking into the Earth, An Introduction to Geological Geophysics*, Cambridge University Press, 470 pp., 2000.

Other Useful Text:
Lillie, R.J. *Whole Earth Geophysics: An Introductory Textbook for Geologists and Geophysicists*, Prentice Hall, 361 pp., 1999.

GEOL 261/361 – 2020 – Schedule

Thursdays: Lectures 8-9am and 12-1pm. Tutorials 2-3pm. Labs 3-4.50pm

Gravity – CO		
July 9	1.1	Gravity – Newton
	1.2	Isostasy, Earth's Gravitational Field
	Lab 1	Geophysical Techniques in Excel
July 16	2.1	Gravity as a geophysical exploration tool
	2.2	Gravity modelling and interpretation
	Lab 2	Reduction and interpretation of gravity data
Magnetism – CO		
July 23	3.1	The geomagnetic field
	3.2	Magnetic induction and magnetic anomalies
	Lab 3	Gravity modelling
July 30	4.1	Palaeomagnetism / Remanent magnetism
	4.2	Geomagnetic field history
	Lab 4	Paleomagnetism
Field Methods – AG		
August 6	5.1	Introduction to Field Methods 1
	5.2	Introduction to Field Methods 2
	Lab 5	Field School Planning (for field school happening during the upcoming weekend: August 8-9)
Seismic Methods – AG		
August 13	6.1	Seismic Waves
	6.2	Rays, Snell's Law
	Lab 6	Seismic acquisition
August 20	7.1	Seismic refraction
	7.2	Refraction data analysis
	Lab 7	Seismic refraction analysis methods
Semester Break – August 22 – 30		
Sept. 3	8.1	Seismic reflection
	8.2	The seismic section
	Lab 8	Digital seismic data analysis
Sept. 10	9.1	Global seismology
	9.2	Structure of the Earth
	Lab 9	Fourier Transforms | Field School Seismic Data
Electromagnetic Methods – CO		
Sept. 17	10.1	Introduction to Electrical Methods
	10.2	IP, Resistivity, SP, EM Methods
	Lab 10	Magnetic Data Processing
Sept. 24	11.1	Ground Penetrating Radar 1
	11.2	Ground Penetrating Radar 2
	Lab 11	GPR Data
Inverse Theory – AG		
October 1	12.1	Introduction to inverse theory
	12.2	Optimisation of seismic data interpretation (an example)
	Posters	Presentation of Field School Results
Physics of the Earth – AG		
October 8	13.1	Creation of the Solar System, planetary formation
	13.2	Differentiation, moons, heat flow, the tectonic engine
	Lab 13	Computer simulation of planetary differentiation