EESB21 Exploration Geophysics
Fall 2021

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Physical & Environmental Sciences
UNIVERSITY OF TORONTO
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Lecture: Mon 3-5 pm IC220
Practical: Tues 2-4 pm BV469/EV222/H-Wing Patio

Overview:

This course was designed to provide an introduction to geophysical techniques that are commonly used for subsurface exploration, and their specific applications and limitations. The techniques covered in this course are used for environmental studies, resource exploration (water, petroleum and mineral deposits), hazard detection, forensics and more. The study of each technique will begin in lecture with a review of its underlying physical principles, followed by a discussion of the field data acquisition procedures, data processing and interpretation techniques. Case histories will be used to illustrate real world applications.

While lectures are critically important, it is the practical portion of the course that provides hands-on experience with survey design and use of geophysical equipment in different field settings. Processing and interpretation techniques are covered using software in the computer lab and applied to data collected during field practical. Lab assignments emphasize geological concepts but underlying physical and mathematical principles are also evaluated to ensure a thorough understanding of the methods and their implementation.

Learning Outcomes:

Students should leave this course with the ability to:

1.) Understand the underlying physical and mathematical principles, as well as strengths and weaknesses, of various geophysical techniques.
2.) Recognize which geophysical technique(s) are appropriate for specific problem.
3.) Develop and implement a basic field survey to acquire data with the geophysical equipment used during practical.
4.) Perform basic processing of geophysical data using software and interpret them to address applied problems.

Required Textbook:

Looking Into The Earth: An Introduction to Geological Geophysics by Mussett, A.E. and Khan, M.A. Cambridge; New York: Cambridge University Press. 2000.

Chapter PDFs are available **for free** online through UofT Library/Scholars Portal Books.

Tentative Schedule:

Week	Lecture	Topic	Practical	Location	Textbook	What's Due
1	13-Sep	Introduction to Geophysics			Chapter 1	
2	20-Sep	Data Acquisition and Processing	21-Sep	EV222	Chapter 2/3	
3	27-Sep	Seismology			Chapter 4	
4	04-Oct	Refraction Seismology	05-Oct	H-Wing Patio	Chapter 6	**Lab 1 (08-Oct, 6 pm)**
		Reading Week				
5	18-Oct	Reflection Seismology	19-Oct	BV469	Chapter 7	**Lab 2 (18-Oct, 6 pm)**
6	25-Oct	**Midterm**	26-Oct	*TBD*		
7	01-Nov	Ground-Penetrating Radar	02-Nov	EV222	Chapter 14.8	**Lab 3 (01-Oct, 6 pm)**
8	08-Nov	Ground-Penetrating Radar	09-Nov	BV469	Chapter 14.8	
9	15-Nov	Electrical Resistivity	16-Nov	H-Wing Patio	Chapter 12	**Lab 4 (15-Nov, 6 pm)**
10	22-Nov	Gravity	23-Nov	BV469	Chapter 8	
11	29-Nov	Geophysical Consulting	30-Nov	*TBD*		**Lab 5 (29-Nov, 6 pm)**
12	06-Dec	Presentations/Review				**Lab 6 (06-Dec, 6 pm)**

Mark Distribution:

Lab assignments 40%
Midterm 15%
Individual Presentation 5%
Practical Participation and Field Notebook 5%
Final Exam 35%

Lecture and Practical Attendance:

Students are expected to attend all lectures and practical sessions. Lecture slides will be posted on Blackboard shortly before class. Students are responsible for obtaining notes from any missed class. An understanding of the lecture material will be required to participate in the practical the following day. A portion of your final grade will come from your participation during practical. Students should come prepared to every practical with notebook, pencils and appropriate clothing when a field survey is scheduled.

Field Notebook:

Each student will be expected to maintain a notebook summarizing the field survey portions of the practical. Notes should include location, time, geological, environmental and cultural observations, survey parameters, data tables, etc. Consult with classmates to ensure that all data and observations are obtained. Notes must be augmented to include processing steps and preliminary interpretations following each computer lab practical. The field notebooks will be collected and assessed near the end of the course. They will be graded for neatness, completeness, clarity and accuracy. More details regarding notebook expectations will be given in lecture.

Assignments:

There will be approximately six lab assignments for this course. Some portions can be completed at home while other portions will require data collected during field surveys and the use of software in the computer lab. They must be physically submitted (with any required plots or figures firmly attached) to the class drop box outside EV262. Electronic copies of assignments will not be accepted (with the exception of lab assignment 1). Students are responsible for ensuring their term assignments are submitted on time.

Late or Missed Assignments:

Lab assignments will generally be due at 6 pm exactly two weeks after they are assigned in lecture (with the exception of assignment 1). Late submissions will be subject to an immediate penalty of 50% until two days following the due date (typically Wednesdays at 6 pm). Any submissions after this second deadline will be not be marked.

Individual Presentation:

Each student will give a brief (10-12 min) presentation of a case study for one of the techniques that is discussed in class. The chosen application should be something interesting and novel, and the paper must be approved by the instructor. (E.g., *Seismic crustal imaging using fin whale songs* https://science.sciencemag.org/content/371/6530/731)

The presentation will be structured using the seven-step framework for geophysical work. Details will be given in class.

Exams:

The midterm exam will be scheduled during regular lecture time. The midterm and final examinations will be multiple choice, short answer questions, drawings and some calculations. A formula sheet will be provided. Students will be permitted to bring a non-programmable calculator into both the midterm and final exams. Phone-based calculator apps will not be allowed. Both exams will draw from lecture and practical materials, including lecture slides, chapter readings and lab assignments. There will be no make-up exam for the midterm. If you miss the test for a verifiable reason (as indicated by a doctor's note), the weight of the midterm will be added to the weight of your final exam, with the permission of the instructor.

University Policies

Academic Integrity:

The University treats cases of cheating and plagiarism very seriously.

The University of Toronto's Code of Behaviour on Academic Matters (www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

Potential offences in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment.

On tests and exams cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

Accessibility Needs:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible.

AccessAbility Services staff (located in Rm AA142, Arts and Administration Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability.utsc@utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.