

**EESB22 Environmental Geophysics**

Professor Phil Heron

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Office: EV344 (UTSC)

Lecture 1: Tuesday (2-3pm) EV140

Lecture 2: Thursday (3-5pm) EV140

**Course description:**

This course instructs students on the application of geophysical techniques (including gravity and magnetic surveys, electromagnetics, resistivity and seismology) to important environmental issues, such as monitoring climate change and natural hazards, clean energy assessments, and how to build sustainable cities. This lecture-based course teaches students the societal importance of environmental geophysics as well as how to effectively communicate uncertainty when interpreting data.

**Learning outcomes:**

Students should leave this course with the ability to:

1. understand the basic theory behind geophysical techniques such as gravity and magnetic surveys, electromagnetics, resistivity, and seismology (amongst others);
2. apply this theory and techniques for assessments of applied environmental issues including climate change and natural hazard monitoring, and clean energy and water assessments.
3. make informed decisions on where different geophysical techniques are best applied to assess environmental conditions across different temporal and spatial scales;
4. analyze and interpret different forms of geophysical data;
5. communicate geophysical data and related interpretations to specialist and general audiences, in both written and oral forms.

**Topics covered:**

The topics covered will link the use of geophysics to environmental science, including:

- hazard analysis including monitoring of volcanoes, tsunamis, and earthquakes;
- climate change monitoring including permafrost degradation and sea-level change;
- clean water and sanitation assessments including characterization of watershed basin structure, monitoring contamination transport pathways, and radioactive waste monitoring;
- clean energy evaluations including site specific carbon capture and storage potential, assessments of geothermal energy potential;
- and the use of geophysics in the construction of sustainable cities.

**Key dates for Winter 2023:**

Classes Begin	Monday, Jan 09, 2023
Drop Date	Monday, Mar 27, 2023
Last Day of Classes	Monday, Apr 10, 2023

Final Assessment Period	Thursday, Apr 13, 2023 - Thursday, Apr 27, 2023
First Term, Reading Week	Saturday, Feb 18 2023 - Friday, Feb 24 2023
Family Day	Monday, Feb 20 2023
Easter	Friday, Apr 07 2023

**Lectures:**

Lectures will be in person throughout the term, split into one hour on a Tuesday and 2 hours on a Thursday. From week 11 onwards classes will take the form of tutorials/office hours for students to work on their final projects. Lecture slides will be available online before the class starts and for the exclusive use of enrolled students. Public sharing of the material is not permitted.

**Office hours:**

Office hours will be available by appointment.

**Grading, purpose, timing, and submission guidelines for assignments:**

Assignment	Purpose	Assessment	Where	%	Date given	Due date	Time
<b>BR:</b> Background reading	Clear on course objectives	Multiple-choice questions	Online, quercus	5%	12/1	19/1	7 days
<b>A1:</b> Water contamination exercise	Data analysis of Resistivity data, science communication	Problem set on data given	Online, quercus	15%	19/1	30/1	11 days
<b>A2:</b> Permafrost survey	Decision making on survey locations, science communication	Written research grant	Online, quercus	15%	2/2	13/2	11 days
<b>A3:</b> Effective communication	Public communication of research	Poster design and presentation	Online, quercus	20%	16/2	27/2	11 days
<b>A4:</b> Earthquake analysis	Understanding seismic data	Problem set on data given	Online, quercus	15%	2/3	13/3	11 days
<b>A5:</b> Final report	Description of geophysical study	Report on survey for local community and presentation	Online, quercus, in class	30%	21/3	6/4	16 days

(Specific grading will be given on each assignment)

**Late penalty:**

Late assignments will be penalised by 10% a day.

**Methods of assessment:**

Methods of assessment will be split between problem sets, reports, presentations, and a multiple-choice quiz:

- A multiple-choice online quiz will be provided to capture the students' understanding of the objectives and expectations for the course (**BR**). This is essentially a contract between student and instructor on best practices for the coursework.
- Two problem sets on geophysical data interpretation (**A1/A4**). The work here will show the student's understanding of geophysical data based on specific lessons (related to Learning Outcomes 1-2 and 4).
- A written report on planning the location of a geophysical study (**A2**) will show an understanding of the various factors required to conduct a survey (related to Learning Outcomes 1-3).
- A guest speaker will give a workshop on science communication (as part of Experiential Learning), where the students will then produce a document communicating science to the public (**A3**). The reflective assessment will show an understanding of how to communicate science to different audiences across different platforms (e.g., social media, press release, blog post, oral communication) and be related to Learning Outcome 5.
- A **final report** will be written on the design of an Environmental Geophysics project with relevant stakeholder engagement. The report will focus the student's attention on the key learning outcomes: method of geophysical techniques, basic data interpretation, societal impact of geophysics, and measuring uncertainty (related to Learning Outcomes 1-5). There will be a short 3-minute summary presentation of the report on the final class.

**Spread of grades throughout the course:**

Week	BR	A1	A2	A3	A4	A5
1	5%					
2		15%				
3		15%				
4			15%			
5			15%			
6				20%		
7				20%		
8					15%	
9					15%	
10						
11						30%

12						30%
13						30%

**Week by week Syllabus (and grouped themes of water, climate change, communication, natural hazards, sustainability):**

Week	W/c	Tue (2-3pm)	Thurs (3-5pm)	Assignment
1	9/1	L01: Geophysics Introduction	L02: SciComm Introduction	BR
2	16/1	L03: Water contamination	L03: Water contamination	A1
3	23/1	L04: Water resources	L04: Water resources	A1
4	30/1	L05: Climate change I (Permafrost)	L05: Climate change I (Permafrost)	A2
5	6/2	L06: Climate change II (Glaciers)	L06: Climate change II (Glaciers)	A2
6	13/2	L07: Science communication workshop	L07: Science communication workshop (guest speaker)	A3
7	20/2	Reading week	Reading Week	A3
8	27/2	L08: Natural hazard monitoring I (earthquakes)	L08: Natural hazard monitoring I (earthquakes)	A4
9	6/3	L09: Natural hazard monitoring II (volcano)	L09: Natural hazard monitoring II (volcano)	A4
10	13/3	L10: Sustainable cities	L11: Clean energy	
11	20/3	A5 outline	L12: Summary of geophysical techniques	A5
12	27/3	A5 Tutorials	A5 Tutorials	A5
13	3/4	A5 Tutorials	A5 summary presentation	A5

### Academic Integrity

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://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.

**Quercus info:**

This course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. The site is dynamic and new information and resources will be posted regularly as we move through the term, so please make it a habit to log in to the site on a regular, even daily, basis. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. Once you have logged in to Quercus using your UTORid and password, you should see the link or "card" for [EESB22H3 S]. You may need to scroll through other cards to find this. Click on the [EESB22H3 S] link to open our course area, view the latest announcements and access your course resources. There are Quercus help guides for students that you can access by clicking on the "?" icon in the left side column.

Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.

**Religious Accommodations**

The University has a commitment concerning accommodation for religious observances. I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. According to University Policy, if you anticipate being absent from class or missing a major course activity (like a test, or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

**Specific Medical Circumstances**

If you become ill and it affects your ability to do your academic work, consult the course instructor right away. Normally, you will be asked for medical documentation in support of your specific medical circumstances. The University's Verification of Student Illness or Injury (VOI) form is recommended because it indicates the impact and severity of the illness, while protecting your privacy about the details of the nature of the illness. You can submit a different

form (like a letter from the doctor), as long as it is an original document, and it contains the same information as the VOI. For more information, please see <http://www.illnessverification.utoronto.ca/> If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services (AS) as soon as possible. A student registered with the AS isn't usually asked to provide a VOI because registration with AS already requires students to provide health-related documentation.

### **Accommodation for Personal Reasons**

There may be times when you are unable to complete course work on time due to non-medical reasons. If you have concerns, speak to me. It is also a very good idea to speak with an academic advisor.

### **Participation and engagement**

Please stay on task if you choose to use laptops or other mobile devices during class. These tools can be useful to take notes, refer to class readings, or look up important course concepts. However, checking social media, texting or other non-course specific activity distracts from your learning and can ultimately result in receiving a lower grade in this course. I've taught in prisons where laptops or mobiles are not permitted – however, there is strong engagement in these classes as a result due to the lack of ability to check emails or social media. Happy to talk more about this if needed.

Recording or photographing any aspect of a university course - lecture, tutorial, seminar, lab, studio, practice session, field trip etc. – without prior approval of all involved and with written approval from the instructor is not permitted. For further information on University policies, please refer to the following links for details.

The university has a responsibility to provide academic accommodations, including the use of technology to access the lecture in a way that will be accessible to them (e.g. recording lectures, using laptops, etc).

### **Equity, Diversity and Inclusion**

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

### **Contact**

For any questions, large or small, please do not hesitate to email me: [Philip.heron@utoronto.ca](mailto:Philip.heron@utoronto.ca)