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ERTH 3405 [0.5 credit] Geophysical Methods;

An introduction to the tools of applied geophysics including seismology, electrical, magnetic, and gravitational surveying methods. Lecture two hours a week, and a laboratory three hours a week. Most of labs are computer-based geophysical practices to enhance their knowledge on modern and computer-based geophysical methods. Students will use geophysical software which comes with textbook in their labs. Prerequisites: ERTH 2105.

- All lectures are in person
- Labs are in person
- Please note the first lab is after the second lecture. You need your own laptop with its wireless connection for the first lab
- Office hours: Wednesday 10:30-11:30

Course Topics

- Introduction to geophysics; Definitions and scope, use of physical measurements in determining the subsurface properties of the Earth.
- Seismic surveying; Stress and strain, seismic waves, reflection and refraction of seismic waves, critical refraction, rays and waves. Seismic refraction surveying: seismic sources and detectors, geometry of refracted ray paths for horizontal, dipping and undulating layers, data interpretation.
- Electrical surveying; (i) Resistivity of rocks, electrode arrays and current flow in the ground, resistivity sounding and profiling
- Gravity surveying; Basic theory, instrumentation, and anomaly interpretation.
- Magnetic surveying; Basic theory, rock magnetism, Earth's magnetic field, instrumentation, anomaly interpretation.

Course Requirements:

- The lab component of the course must be passed in order to pass the course. You must pass the lab component of the course in order to write the final exam. The final exam must be passed in order to pass the course.
- Labs must be handed in on time. Late labs will be accepted in the instance of illness, or in the instance of emergencies, by consultation with your TAs and instructor. Students must contact their instructor and TAs immediately if they are ill and will miss an exam or the deadline for an assignment. Students must agree with the instructor and/or TAs on how to make up the missed components. If the student is ill for a while and misses an exam, then their TA or instructor will arrange for some accommodation in the future – make a midterm exam added to the final, etc.
- It is the student's responsibility to attend to classes and labs prepared. Reading assignments are mandatory.
- It is your responsibility to refer regularly to the course outline for lecture topics, reading assignments, laboratory topics and pre-lab review or homework.

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- Regularly log onto the course website on Brightspace to check for announcements, course information, laboratory assignments and lecture material.
- Lab exercises will be posted on Brightspace.

Learning Outcomes

- Explain applications and limitations of different geophysical surveying methods [Understanding, Analyzing, Evaluating]
- Analyze and interpret geophysical data using computer-based methods [Applying, Analyzing, Evaluating]
- Perform seismic surveying, analyze and model the observations [Applying, Analyzing, Evaluating]
- Explain, analyze and interpret electrical and magnetic surveying data [Applying, Analyzing, Evaluating]
- Apply, interpret and model the gravitational data for near surface surveying [Applying, Analyzing, Evaluating]

Mark Distribution:

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|---------------------------------------|-----|
| • Laboratory attendance & assignments | 25% |
| • Midterm test | 25% |
| • Final exam | 50% |

Note: The instructor *is required* to report all incidents (or suspected incidents) of plagiarism to the Dean.

Teaching Assignments: TBA by the department

Course Text; Exploration geophysics of the shallow subsurface / H. Robert Burger. c1992.

Note: Books were ordered at bookstore. You may also buy a used one from Haven Books, 43 Seneca St, Ottawa (613) 730-9888.

In-class lecture and Teaching Lab COVID-19 Guidelines:

Please follow the COVID-19 Guidelines from the Carleton University and the department of Earth Sciences.

General Safety Measures

All members of the Carleton community are required to follow general COVID-19 prevention measures and all mandatory public health requirements, including wearing a well-fitted mask that covers the nose, mouth and chin at all times, physical distancing, hand hygiene, respiratory and cough etiquette, mandatory self-screening prior to coming to campus daily, and using the QR codes when entering/exiting a lab.

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The Department will impress on all students, Teaching Assistants, and Instructors, the importance of vaccination for COVID-19. We cannot require that all Carleton Earth Sciences members are vaccinated, but we will emphasize the importance of vaccination in the protection of those at Carleton as well as family and friends off-campus.

Crush Space Congestion

Only one lab or workshop session will be scheduled in the Department at any one time, so staggering of lab start times is not necessary. Two of our three laboratory rooms include sinks with handwashing stations, while the third laboratory room is opposite our Server room which has a sink and handwashing station. The department will set up marked queuing stations in the hallways outside of each lab room.

Students will be instructed to arrive promptly at the beginning of lab or workshop times in order to minimize queuing outside of the lab.

Attendance and Tracking Data

Instructors and TA's will ensure that all users (students, TA's, instructors) of teaching lab rooms will use the QR code system to register their attendance in those rooms. If the QR code system is not functioning, then the instructor/TA will take attendance.

Lab Start and End Times

Start and End times of labs and workshops will be adjusted by five minutes to give students time to wash hands, take their seats, clean their work areas and leave the lab. For example, labs that start at 8:35AM will actually begin at 8:40AM, and labs that end at 11:25AM will actually end at 11:20AM.

Teaching Lab Occupancy and Circulation

Occupancy limits in our teaching labs have been set in consultation with Sal Ugarte. Those occupancy maxima will be posted on lab doors.

Students will be directed from the entrance door to the handwashing stations at the back of HP 2120 and HP 2130 through floor signage. After hand washing, students will circulate clockwise to the marked sitting stations in the lab. All sitting stations will be a minimum of 2m apart. Each sitting station will have a chair designated for that station. All excess chairs will be removed from the rooms. At the end of the lab period, students will exit from their stations to their right, one row at a time from front to back, and exit through the front door on the right. Students will maintain distancing of 2m while exiting and entering, and will always be 2m apart during the lab or workshop. If lab materials are located at the front of the lab, then the floors will be marked to indicate 2-metre distancing while students are lined up for those materials. Alternatively, lab materials will be moved to students in the room by the teaching staff.

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In the case of HP 2110, students will use the Served sink and handwashing station before entering the lab.

Inform Students About Procedures

Course syllabi will include laboratory procedures if in-person labs or workshops are part of that course. The Department will post videos on our website and on Brightspace courses demonstrating the safety protocols in all teaching laboratories.

At the beginning of every lab or workshop, the students will receive verbal instructions on how to enter and leave the lab room.

All lab or workshop materials will be set up in advance of the arrival of the students.

All shared equipment, primarily polarizing microscopes, will be cleaned by the students prior to use and after use. Each student will be using one microscope and one microscope camera during a lab or workshop session. The use of an ocular camera means students do not set their eyes on the microscope and only will touch the stage and focus knobs. The correct cleaning materials will be provided to each student. In rare cases, a student may be using a Department laptop computer that will be carefully disinfected after use.

Lab and workshop room procedures will be prominently posted in each lab room.

High-Touch Surfaces / Shared Equipment / Shared Data

Students will be instructed on the cleaning of their lab sitting station prior to starting and after finishing their lab/workshop. Cleaning materials will be provided. We will provide videos of the correct cleaning techniques on Brightspace and in the lab sessions. Instructors will clean computer keyboards, the table, and any other touched surfaces at the front of each teaching lab.

Instructors and TA's will ensure that the teaching labs are indeed properly cleaned after each student group leaves. This includes door handles, sink faucet handles, storage cabinet handles, etc.

Cleaning procedures, especially for high-touch surfaces such as microscope focus dials, will be prominently posted in each teaching lab room.

Brightspace will be used to provide teaching materials for labs or workshops as much as possible, including all lab safety and cleaning protocols.

Contamination Control

Students will bring all of their gear (backpack, coats, etc.) to their sitting station, but will be asked to bring a minimum of gear with them.

Cleaning supplies will be provided in each lab room, and TA's will organize their distribution to students. The supplies will be re-stocked by B. Halfkenny on a daily basis.

Obtaining Assistance

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All participants in in-person labs or workshops will be instructed on how to get assistance while in the room. A hand must be raised to signify the need for help. Students will be asked not to leave their sitting station except for using a washroom. While providing assistance, TA's and instructors will keep a maximum distance necessary from students and, if necessary, wear gloves. Some cleaning of equipment (e.g., microscope focus knobs) may be necessary after the assistance is rendered.

Personal Protective Equipment

Earth Sciences labs or workshops do not require lab coats, safety goggles, gloves, or other PPE.

Training

The Department will provide video training for students on COVID-19 protocols (distancing, hand washing, masks, face-touching, sneeze and cough etiquette, importance of vaccination). We will especially emphasize that students and instructors should not come to campus if they feel unwell. University COVID-19 posters will be prominently displayed, along with Department posters concerning room procedures.

Reminders of protocols, and communication of any changes to those protocols, will be conveyed by e-mail from the Department Chair as well as by instructors at the beginning of lab/workshop sessions.

Non-Compliance

A student who does not comply with posted university or teaching lab protocols will first be addressed by the instructor and, if the behaviour continues, with Campus Safety officers.

If the behaviour repeats, then the Department Chair and Student Affairs will be informed.

Student Illness

A student who falls ill during a lab or workshop will be asked to go home immediately and self-isolate, and to complete the Carleton COVID-19 symptom reporting web tool. If a TA, instructor, or other staff member becomes ill, then their supervisor/manger must be informed.

If the student is incapacitated, then Campus Safety (ext. 4444) must be contacted. The student should be kept at least 2m from other people in the room until help arrives.

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Academic Integrity

It is your responsibility to review Carleton's policy on Academic Integrity - Section 14 of the Calendar.http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/a_cadregsuniv14/

Plagiarism

The instructor is required to report all incidents (or suspected incidents) of plagiarism to the Dean. All work handed in must be your own. Plagiarism and cheating are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

Requests for Academic Accommodation

Please review the Carleton's Student Guide to Academic Accommodations at <http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>, and the websites therein. You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

For Students with Disabilities:

“The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your ***Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation.*** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam . “

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

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For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

For Religious Observance:

1. *As soon as you receive your course syllabus*, identify any potential conflicts between your religious obligations and course requirements. **2.** Make a formal written request to your instructor indicating the nature of the religious obligation and suggest possible alternative dates and/or means of satisfying the academic requirements. *NOTE: Such request should be made during the first two weeks of the term*, or as soon as possible after a need for accommodation is known to exist, but in no case later than the second last week of classes for that term. For detailed information on Religious Obligations please visit our website at: carleton.ca/equity/accommodation/academic.

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline