

ES4451/GP9509 Geophysical Field Techniques, Fall 2023**Course description**

This course provides an introduction to the practical application of various geophysical techniques (gravity, magnetics, electrical, electro-magnetics, seismics, or GPR). Geophysical surveys are used for site characterization in assessment of hazard mitigation, anthropological, environmental, and civil engineering studies, and resource exploration. Students will plan, acquire, process, and interpret geophysical field surveys.

Pre-requisites: ES2220 or permission of the Instructor/Department

Instructors: Dr. Sheri Molnar, BGS 1040, smolnar8@uwo.ca; Mahmoud Bagheri (Teaching Assistant), mbaghe2@uwo.ca

Course delivery

Three on-campus instruction days with lectures in XXX YYY lecture room, equipment testing outdoors on campus, and computer tutorials in XXX YYY. Followed by an on-campus planning day, two off-campus field days, an on-campus processing day, two field days, and two remaining days on campus. 11 days total.

All course material will be posted to OWL: <http://owl.uwo.ca>. Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Contingency plan

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

Field Safety

A safety plan will be prepared by the students in consultation with the instructors prior to any field work.

Equipment

Students will make use of Geophysical equipment belonging to Western University. All of this equipment is expensive, repairs are costly and often take more time than the duration of the field school. Students are expected to treat all equipment with the utmost care. Students are allowed to sign out equipment for additional work, design projects, etc., only after they have received training through this course or equivalent.

Learning Outcomes: Students completing the course will be able to:

- operate proficiently basic geophysical instrumentation
- design and carry out geophysical surveys to meet industry needs in site assessments for hazard mitigation, resource exploration, anthropology, environmental or civil engineering
- reduce and interpret data arising from such surveys
- communicate the results of the surveys through professionally written reports and presentations

Evaluation (subject to minor changes on site):

- 1: 15% Written lab reports on field testing of geophysical instruments, small teams/pairs (first three days)
- 2: 10% Oral presentations of survey plans and design for field sites (team marks will be assigned)
- 3: 10% Participation, Professionalism and Classroom Deliverables
- 5: 20% Oral presentations of final field site results (team marks will be assigned)
- 6: 15% Oral interview
- 7: 10% Executive summary report – secondary site
- 8: 20% Final fieldwork report – primary site

Special Note regarding Absences: Due to the compressed format of the course, attendance each day is mandatory. If a student is forced to miss more than one day (over 10% of the overall course grade) with valid documentation (e.g., academic considerations provided by their academic counsellors), they will be issued an INC and asked to complete the course with the next offering of the class. Course fees are non-refundable.

For further information about Academic Considerations, please consult

https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf

For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Course Deliverables

Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, a graphical image, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

1. Individual reports on field testing of instruments (5% per report, small teams/pairs)

The objective is produce a report on the proper functioning of each instrument, and to make recommendations for field procedures to be used in future surveys (i.e., the field sites). The field test data should be quantitatively compared with expected geology and anomalies in the area to document the correct instrument response. Reports on the following instruments are required:

- **Report 1:** Magnetics (with graphed Gravity measurements as Appendix)
- **Report 2:** Electrical resistivity / IP (with graphed EM measurements as Appendix)
- **“Report” 3:** Active- and passive-source seismic methods and GPR method results

Students must submit each report before they will be permitted to participate in the next field test exercise. Each student pair prepares their own report, although collaboration with other student pairs on base maps and data plotting is encouraged. The field tests must be fully documented, all data must be reduced and quantitative interpretations and/or conclusions must accompany the reports. A *brief* discussion of the instruments used (name and model), where and why the exercise was done, and how the data were collected is required. Conclusions should be written with regard to the functioning of the instrument and any recommended field procedures to be used.

Field test reports are to be approximately 750 words per instrument used. Excessive length will be penalized. The field data should be clearly represented in the form of graphs, figures or tables, as appropriate. Base maps need to be detailed, legible and should clearly show the location of each survey, as well as be annotated with any anomalies located. Maps must have a legend, a scale, and a North arrow.

It is not necessary to reproduce all data in the form of tables, your graphs will be sufficient.

A *suggested* format for the field test reports is:

Objectives: Discussion of where and why survey was performed

Instruments: Instruments used, operating principles and what exactly is measured (be brief)

Procedure: Brief review of survey procedure (specific to each geophysical method), including setup used

Results: Show and describe your primary data (graphs, images, etc). Brief discussion of results, addressing sources and magnitude of errors and limitations

Data analysis and interpretation: This is where you describe what you think your data mean (refer back to the objectives)

Conclusions and recommendations: I don't mind if this is very brief, but it must be suitable

Bibliography: Include a correctly formatted reference to the manual, and any other material you used.

Standards/Assessment of reports: Professional standards in written work are critical in this course.

- Your reports are expected to be clearly written to a high standard.
- Figures are expected to be annotated prior to inclusion in the report, inserted as an image of high quality, numbered and captioned below, and *included* within the text (images should not float around; captions should not be inserted text boxes).
- You must refer to each Figure at least once in the text to provide context. Figures should appear after they are referred to (do not start a section with a graph or image).
- Maps are essential: they must be legible, with a legend, scale, North arrow, etc.
- Appendices are allowed for presentation of large volumes of data, but must be summarized within the text.
- A bibliography is always required, and correct referencing style is expected.
- Any formulas are to be treated as a part of the text, and punctuated accordingly *and numbered*.
- Formulas must be either derived or properly referenced, and any previous results (mathematical, geophysical, or geological) must be referenced.

2. Design Proposals for each field site (10%, student team oral presentations)

A "Request for Proposal" will be issued by the "client" for two field sites. In response to the "Request for Proposal", students will be assigned to "design teams" to orally present one single proposal to the "client" for each of the two field sites. The proposals should consist of at least:

- Proposed field layouts (locations, spacing, etc.) for each survey type (magnetic, EM, resistivity, seismics, ...)
- A preliminary itinerary with daily timetables and team assignments

Careful attention must be paid to prepare a proposal that can be carried out in the time available. The resulting proposal will serve as a field guide on the field locations. We will discuss and build the proposal together - students should be prepared to defend the proposal and modify accordingly.

3. Participation, Professionalism and Classroom deliverables (10%)

Participation and Professionalism will be assigned in consultation between all course instructors, on the basis of:

- Initiative, enthusiasm, professionalism
- Respect for colleagues, instruments, and sites
- Safety consciousness
- Equipment management and cleanliness
- Field notebook

Classroom deliverables: As data are collected each day, students will be expected to download data from the equipment and/or transcribe data from field notes into digital form, prepare figures representing the data and representing the field layouts, and upload to the OWL course site using logical and unique file names and on a timely basis.

4. Final field site results presentations (20%, student team oral presentations)

Each team presents a final oral presentation for each site. This should include at least: visual summaries of the data collected (maps, representative profiles), preliminary evaluation of the data with regard to the fieldwork proposals and detailed plan for follow-up work (data reduction, geophysical modelling).

These are presentations to management on the success (or otherwise) of the field excursion, and a specific proposal for data reduction, geophysical modelling and final reporting. A management board will be appointed, to be made up of instructors present. Student marks will consist of two components: presentation and content.

5. Oral interview (15%)

Students will be given an oral interview on the final day of the course, designed to test general levels of knowledge and insight into any of the methods covered by the course, and any of the field operations conducted.

6. Executive summary report, secondary site (10%)

A 600 word summary report on the secondary site assigned to the student written for the “client” (see the earlier “Request for Proposals”), containing information on the number and type of surveys conducted, the quality of the data, any major difficulties encountered, the processing attempted, and a summary of the integrated interpretation with the major conclusions.

8. Final field site report, primary site (20%)

One single professional-level report is required on your primary site, written for the “client”. Each student must prepare their written reports individually, although students are encouraged to organize the tasks of data processing, and data modelling in such a way as to equalize the workload amongst them. Nevertheless, *all written work submitted will be considered to be the independent work of the student who submits it.*

The final reports should contain approximately 3000 words. Insufficient or excessive length will be

penalized. It is suggested your reports follow this format:

- Abstract
- Table of contents
- Introduction
- Geological setting
- Geophysical survey methods
- Data preparation and reduction
- Results
- Integrated interpretation
- Conclusions and Recommendations
- Bibliography
- Appendices

Figures should appear within the body of the text. Appendices may be used to present large volumes of data without interrupting the flow of the report.

Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Accommodation Policies

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.

This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). **One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course.** You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Counselling site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the Chair of the Department or email the Science Students' Council at ssc@uwo.ca.