

## **GEOG\*3430 Geomatics for Environmental Analysis (0.5 CR)**

Fall 2023 (In person)

University of Guelph (Main Campus),

Department of Geography, Environment & Geomatics CSAHS

Instructor: Dr John Lindsay

Office: Hutt Rm. 346

Email: [jlindsay@uoguelph.ca](mailto:jlindsay@uoguelph.ca)

Phone: 519-824-4120 ext. 56074

Office hours: Mon. 12:00 - 1:00

**Prerequisite** GEOG\*2420 or GEOG\*2480

### **Overview**

This course is one of four 3<sup>rd</sup> year courses (the others being GEOG\*3420 Remote Sensing of the Environment, GEOG\*3480 GIS and Spatial Analysis, and GEOG\*3440 GIS for Decision Making) in the [Geomatics stream of courses offered by Geography](#). GEOG\*2480 Mapping and GIS is an introduction to the fields of cartography and geographical information science, and GEOG\*2420 provides an introduction to the sister field of remote sensing, both of which can provide the theoretical foundation on which this course is positioned. The focus of this course is on the application of geographical data using GIS and related Geomatics technologies to study catchment processes. The third-year geomatics courses provide the analytical background necessary for the thematic capstone course, GEOG4480 Applied Geomatics.

### **Course Calendar Description**

This course enables students to explore the theory and techniques of GIS and remote sensing in applications related to the study of environmental processes. Focus will be on geomorphometry, spatial hydrology and catchment process modelling. Students reflect on the impacts of uncertainty in source data and the role of digital elevation model data processing techniques in geomatics-based analysis. Students will be trained in application areas including catchment mapping, stream network analysis, soil moisture modelling, automated soils mapping techniques, among other applications.

### **Learning Outcomes**

By the end of the course, you should be able to:

- Understand the foundational theories of geomorphometry including its application to the study of environmental phenomenon.
- Analyze geospatial data using geomatics software to model environmental processes.
- Identified key issues related to digital elevation data.
- Practice communicating concepts through formal written and visual forms.

## Course Organization

This course is a face-to-face (F2F) offering. There will be three lectures per week on Monday/Wednesday/Friday 10:30AM - 11:20AM in MCKN, Room 224. In addition, each student must attend one two-hour lab per week. Again, recognizing the ever-changing situation presented by the ongoing pandemic, I plan to set the lab component of the course up as a remote lab, at least for the early part of the semester, as we try to determine how best to deal with the fourth-wave. We will be using Microsoft Teams for all remote learning aspects of the course.

## Text and Other Resources

Readings for this class will be drawn from the required text:

John P. Wilson (2018) *Environmental Applications of Digital Terrain Modelling*. Wiley Blackwell, ISBN 9781118936214 (Print) or 9781118938188 (Online).

and other reading resources where appropriate for individual topics.

## Import Dates

Friday September 8 — First class

Monday October 9 — Thanksgiving holiday (no class)

Wednesday October 18 — Mid-term examination, in class (worth 32%)

Friday December 1 — lecture to make up for lost Thanksgiving Monday

Saturday December 9 8:30AM - 10:30PM — Final examination, location to be announced (worth 32%)

## Method of Evaluation

The lab material constitutes an integral part of this course as this is where students receive hands-on work with data and must apply the techniques they have learned in lectures. Labs must be handed in to the teaching assistant at the beginning of lab section in the week they are due, with a late **penalty of 10% of the total assignment grade per day**. Lab material may be covered on both the mid-term and final exams.

## Grade Distribution

- Lab Assignments: 6 x 6% = 36%
- Mid Term Exam: 32% (Wednesday October 18, in class)
- Final Exam: 32% (Saturday December 9 8:30AM - 10:30PM)

The mid-term exam will be held **Wednesday October 18**. There will be no lecture that day. **The final exam is NOT cumulative and will only cover topics after the cut-off point (given in lecture) for the mid-term exam.**

## Office Hours

If you are having questions regarding the lab, please see the course TA. TA office hours are to be scheduled and will be announced upon first meeting. For any other matters, including lecture

content and any personal issues, please feel free to visit me during my office hours (Stated above) or e-mail me (jlindsay@uoguelph.ca).

## Lecture Topics and Lab Schedule

Please note that topics may change or their sequence and may be altered to suit a more natural progression of the main learning objectives. A sample of topics covered in this course may include:

1. Introductory material.
2. Modelling topography.
3. Extracting information from topography:
  - a. An overview of LSPs
  - b. Measuring surface shape: slope, aspect and curvatures; hillshade
  - c. Topographic roughness and complexity
  - d. Flow accumulation
  - e. Local topographic positions; elevation residuals; catchment position
  - f. Visual exposure and landscape visibility
  - g. Modelling insolation
  - h. Hypsometry and the distribution of height values
4. Streams and watershed mapping
5. Landform classification
6. Applications in soil science
7. Applications in vegetation mapping
10. Conclusions and the future of geomatics for environmental analysis

Please note **individual readings to support lecture materials will be assigned at the start of each lecture and will be posted in the lecture slides.** Certain topics may be covered in more than one week (e.g., *Extracting Information from Topography* will take many weeks to cover), while others will be fully explored in one or two 50-minute lectures.

## Laboratory Exercises

The labs are designed to familiarize you with the use of geomatics software for modelling environmental phenomena, and to teach you problem solving skills. You are going to solve a variety of problems using specialized software (QGIS, Whitebox Workflows, Python programming). By completing the labs, you will gain practical experience in using the program

to create and edit datasets, manipulate and analyze data, and generate maps that communicate spatial information effectively. At the same time, you will lay the foundation for learning any other GIS software.

Your Graduate Teaching Assistant (GTA) will make an arrangement with you regarding handing in the labs. Your GTA will be available to help you during the scheduled lab times. GTAs are not required to be available outside of these times! If your GTA helps you outside of scheduled times, then he/she is doing you a favour; please be considerate of this.

All of the labs require that you submit your own work. It's okay to learn the program with a classmate, or to ask other people for help when you run into trouble. However, the labs that you submit must be the product of your own effort.

Depending on your experience, you will have to learn specialized software and a range of new skills in order to complete these labs. This is a real challenge—even for someone who is familiar with computers. From previous experience, when students had difficulty completing the labs, problems often occurred because of unfamiliarity with the computer and its operating system. You need to be a competent computer user, or be willing to upgrade your skills in the first weeks of the course. Losing 10 hours of work because you didn't copy your files properly is no fun!

### Laboratory assignment schedule (DRAFT SCHEDULE)

- Lab 1 starts week of September 18 (Week 2)
- Lab 2 starts week of October 2 (Week 4)
- Lab 3 starts week of October 16 (Week 6)
- Lab 4 starts week of October 30 (Week 8)
- Lab 5 starts week of November 6 (Week 9)
- Lab 6 starts week of November 20 (Week 11)

Note, compared with some of the other Geomatics courses (i.e., GEOG\*3420 and GEOG\*3480), which tend to have fewer larger lab assignments, **this course aims to have more, smaller and more focused assignments**. Lab due dates are subject to change in the event of unforeseen scheduling conflicts. Please confirm the exact due dates and times with your GTA well in advance. These should be provided during the GTA introduction of each new lab assignment. Changes to this schedule will be posted on CourseLink if required.

### Laboratory Times

You have been assigned to one of the three/four lab periods. All labs take place in the Hutt Building, Room 231. Your TA will be available to help you during your lab period. The computer facilities in Room 231 will be available outside these times on a first-come, first-served basis during scheduled free times. A schedule will be posted on the door of Room 231.

You must attend your assigned lab period. If you missed your assigned lab period for a valid reason, attend another session and inform the TA that you normally are in another lab (identify time and TA). You may not change your lab period without the permission of the instructor.

- 0101 Friday 11:30 AM - 1:20 PM Hutt 231

- 0102 Tuesday 12:30 PM - 2:20 PM Hutt 231

## Disclaimer

Please note that unforeseen circumstances (e.g., a pandemic) may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

## Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g. final exam or major assignment).

For information on current safety protocols, follow these links: <https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/>

<https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives

## E-mail Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

## When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. [See the undergraduate calendar for information on regulations and procedures for Academic Consideration.](#)

## Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

## Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 7 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

## Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

[The Academic Misconduct Policy is detailed in the Undergraduate Calendar.](#)

## Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.