GEOGRAPHY AND ENVIRONMENTAL STUDIES
Carleton University

COURSE OUTLINE - Winter 2026

Course website: https://brightspace.carleton.ca/d2l/home/365792

COURSE: **Custom Geomatics Applications – GEOM 4009A**

PREREQUISITES: GEOM 2005 and (GEOM 3002 or GEOM 3005 or GEOM 3007), or permission of the department.

PRECLUSIONS: None

WORKSHOPS: **In person; Tuesdays 8:35 to 11:25; See Brightspace for** where

INSTRUCTOR: **Derek Mueller**
Email: derek.mueller@carleton.ca
Phone: 613-520-2600 x1984

OFFICE HOURS: By chance or appointment

COURSE DESCRIPTION:
Development and implementation of custom geomatics applications and workflows using programming and various geoprocessing tools. Project design, application development, GIS automation and documentation. (*from Carleton University, Undergraduate Calendar*).

The course is delivered as a 3 hour workshop which will entail both lecture and practical work. The intent of this course is to provide you with the tools needed to develop applications in Python that allow for automation to solve geomatics problems. You will be using the Python programming language (open source language) and various open source libraries that can manipulate geospatial data. QGIS and other programming options available within other GIS platforms/software applications may also be explored. Existing scripts and extensions will be analyzed in order to understand how they can be used to perform a task and you will develop new tools directed to specific problems. The application of these tools will be in the areas of: customization of spatial analysis and batch automation of geoprocessing operations.

LEARNING OUTCOMES:
- Develop Python scripts to automate geospatial data processing and analysis tasks using open-source libraries.
- Apply programming concepts to solve real-world geomatics problems through customized tool development
- Collaborate effectively in a team to manage all aspects of a technical project, including:
  - Code development, implementation, and testing
  - Version control and documentation
  - Client communication and relationship management
  - Scope definition and timeline planning
  - Problem-solving and decision-making
  - Conflict resolution and team dynamics

COMMUNICATION:
This course uses Brightspace, Carleton's learning management system to collect assignments, deliver quizzes, disseminate materials and for discussion. To access your courses on Brightspace go to

http://brightspace.carleton.ca. For help and support, go to http://carleton.ca/students. Any unresolved questions can be directed to Information Technology Services (ITS) by phone at 613-520-3700 or via email at its.service.desk@carleton.ca.

Private correspondence with the instructor should be through a Carleton email account. If you have questions of a general nature, please post these to the discussion board in Brightspace so that others can benefit from the answers. The instructor will check email and Brightspace every 24 hours and do their best to respond to queries within 48 hours.

Information on Brightspace or sent via email will be considered to have been provided to all students within 24 hours of posting and students will be fully responsible for reading and responding appropriately to this information. This includes posts to Discussion forums, so *students are encouraged to subscribe* so they do not miss anything.

COURSE STRUCTURE:
A one term course with workshops, assignments and a team project.

TEXTBOOK/READINGS:
Students are not required to purchase textbooks or other learning materials for this course. You will find what you need online in various locations (primarily via a search engine). If you want to get a head start on Python programming in general (you need a foundation in that before looking at geospatial applications) have a look at any Python textbook (books by O'Reilly publishing are good). The free Python lessons in Software Carpentry are recommended if you need a refresher: https://swcarpentry.github.io/python-novice-inflammation/. Other documentation will be provided as pdf files or web links via Brightspace or on https://github.com/GEOM4009.

TECHNOLOGICAL REQUIREMENTS:
This course will be delivered as in-person workshops using computers on campus. If you choose not to use one of the lab computers, you will need a computer with a 64-bit CPU along with at least 8 GB RAM, 15-25 GB of free hard disk space and a high speed Internet connection. All the software you require will be freely available for Windows/Mac/Linux via conda and QGIS. Environment setup instructions will be provided but you will likely need admin permissions on your computer to install and configure the software.

EVALUATION:
The evaluation in this course will be based upon your performance in the following elements, most of which are to be submitted on Brightspace (some are in-class evaluations):

Short Assignments	20%
Code-And-Tell Assignment	12%
Participation	20%
Team Project Progress Report1	07%*
Team Project Progress Report2	09%*
Team Project Progress Report3	07%*
Team Project Progress Report4	08%*
Team Project Final Report	12%*
Team Project Presentation	05%*

*Note: Team project grades will be modified according to the peer evaluation multiplier (see below)

Peer evaluation
All team project grades will be adjusted by a multiplier according to a peer evaluation performed at the end of the class. The Peer Evaluation Multiplier (PEM) is calculated by dividing the average peer evaluation score for each person by the average peer evaluation score of the team. For example:

PEM Calculation Example: For member X in team 1
Average peer evaluation score for member X = 32
Average peer evaluation score for entire team = 30
PEM = 32/30 or 1.07
Team Project grade (weighted mean of 6 team grades as above) = 80%
Member X Mark for Team Project = 80 * 1.07 = 85.6%

The instructor reserves the right to adjust the ratio from the peer evaluation in exceptional circumstances. For more information see: https://github.com/derekmueller/peereval

Note that standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Participation
You are either in class for the *entire* workshop, or you are not. Likewise, you are either asking questions and participating in discussions, or you are not. As well, if you are paying attention, you should be able to reflect on and provide some evidence of your learning after class. The participation grade will be split into three components on a ~ weekly basis:

- Attendance (present throughout =1, absent = 0, past ~5 minutes late 0.5);
- Engagement in the workshops (asking questions, offering points of view/information, working on in-class assignments) (engaged throughout=1, not-engaged=0);
- Completion of short online quizzes within 48 hours of the end of select workshops. (completed on time = 1, not-completed = 0)

Note that participation in the team project will be evaluated separately.

Code-And-Tell Assignments
Students will pick a Python package from a list of options, sign up for a time slot, present it to the class and provide a 1-2 page handout (*24 hours before the beginning of the class you are presenting in*) that provides a description of the package, what it is used for, how it relates to other packages and some material to help learn the basics. Graded on specific criteria.

Short Assignments
After some of the weekly workshops there will be a short assignment that will help students consolidate what they learned. e.g., work on a piece of code. Graded with a rubric. Best 4 of 5 assignments @ 5% each.

Team Project and Progress Reports
For this team (3 to 5 students) project you will be required to address a real world request to develop/extend functionality in a geospatial workflow for an organization. You will meet with the 'client', research the topic and develop tools (scripts) and fully document them to meet the needs of the project. The projects and the team membership will be assigned in class.

A series of progress reports for the team projects is required to ensure a continuing flow of progress during this course. Each team will make 4 progress reports. Teams will make a final presentation on the last day of class and hand in a final report with scripts and documentation at the end of term. All these assignments will be graded with a rubric.

Since a large portion of your mark is based on a team effort, you will be asked to comment on and score the participation of each member of your team (including yourself). The scores will be used to determine the Peer Evaluation Multiplier (see above), which will change your grade for the team project based on your contribution.

Note that we will be using GitHub (https://github.com/) to manage team projects and for version control.

Students will be given their own space to work in the GEOM4009 organization (https://github.com/geom4009) and will be **expected to release their team project repository publicly at the end of term**. Please note that students are under no obligation to use their real names in any of the project documentation or link any personal information to their github account (i.e., your username can be an alias).

Other Information
Technical problems occasionally cause delays. Every effort will be made to prevent this from the lab systems perspective. It is your responsibility to reduce your exposure to potential problems by reading and listening to all instructions thoroughly and carefully, and taking care to avoid risky practices. You must practice careful file management (saving files in the proper directories, deleting all unwanted files, naming files thoughtfully, and keeping track of where everything is) at all times.

Late Policy
No late submissions will be accepted for the team project. Short assignments are time stamped by Brightspace upon receipt and the time they are late will be rounded up to the nearest hour. Each student can be late up to 48 hours *in total* without penalty. After this number of late hours is accumulated, any subsequent *late submission* for short assignments will receive zero. The code and tell assignment materials are due 24 hours before the class you are presenting in. Late submissions will receive a 30% penalty for the summary portion of the assignment for each day late (rounded up to the nearest day). Students with medical or other extenuating circumstances which cover the duration of the assignment period will be accommodated. However, students who anticipate missing course deadlines for these reasons must notify the instructor as soon as possible and, at least, within 24 hours of the deadline in question. See the accommodation policy below for more details.

Cell phones and social media:
Students must turn off their cell phones before each class. Interruption of classes by users of cell phones is disruptive and distracting for instructors and students alike. Consultation of social media during classes is similarly inappropriate.

Uploading of course materials:
Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).
Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Plagiarism:
The University Senate defines plagiarism as "*presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own."* This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else, including the unauthorized use of generative AI tools (e.g., ChatGPT);
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or

mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotations marks.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty follows a rigorous process for academic integrity allegations, including reviewing documents and interviewing the student, when an instructor suspects a violation has been committed. Penalties for violations may include a final grade of "F" for the course.

The university's full Academic Integrity Policy can be found here.

Generative Artificial Intelligence (AI) Policy:

In this course, the use of generative AI *is permitted but only under specific conditions*. Students are encouraged to avail themselves of these tools to help them learn course material or enhance features that they are developing for the team projects. However, AI also has the potential to short-circuit learning by quickly generating computer code and written or other content that can be submitted for grading without any oversight, understanding or further student input. Students are *not permitted* to do this as it undermines the course learning objectives.

Students are fully responsible for the content of the coursework that they submit. They should have an understanding of the material that they submit that is commensurate with the grade that they achieve, and should be able to explain decisions that they made on their (individual or team) assignments so it is clear that they did the work. Their assignments should not contain fake references, hallucinations or other hallmarks of AI. If students use AI to assist in their assignments, they should properly document how they used it (see citing Generative AI on the MacOdrum Library website).

If a student is suspected of violating this AI policy, they may be interviewed by the course instructor and may be subject to an allegation under Carleton's Academic Integrity Policy. All students will be given an opportunity to discuss/explain the code that they contributed to the team project with the instructor in an interview at the end of the term.

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Statement on Student Mental Health

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult https://wellness.carleton.ca/. Here is a list that may be helpful:

Emergency Resources (on and off campus):

- https://carleton.ca/health/emergencies-and-crisis/emergency-numbers/
- Suicide Crisis Helpline: call or text 9-8-8, 24 hours a day, 7 days a week.
- For immediate danger or urgent medical support: call 9-1-1

Carleton Resources:

- Mental Health and Wellbeing: https://carleton.ca/wellness/
- Health & Counselling Services: https://carleton.ca/health/
- Paul Menton Centre: https://carleton.ca/pmc/
- Academic Advising Centre (AAC): https://carleton.ca/academicadvising/
- Centre for Student Academic Support (CSAS): https://carleton.ca/csas/
- Equity & Inclusivity Communities: https://carleton.ca/equity/

Off Campus Resources:

- Distress Centre of Ottawa and Region: (613) 238-3311 or TEXT: 343-306-5550, https://www.dcottawa.on.ca/
  Mental Health Crisis Service: (613) 722-6914, 1-866-996-0991, http://www.crisisline.ca/
  Empower Me: 1-844-741-6389, https://students.carleton.ca/services/empower-me-counselling-services/
  Good2Talk: 1-866-925-5454, https://good2talk.ca/
  The Walk-In Counselling Clinic: https://walkincounselling.com

Academic Accommodation:
Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (https://carleton.ca/FASS-FPA-teaching-regulations/accommodation/).

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Academic consideration for medical or other extenuating circumstances: Students must contact the instructor(s) as soon as possible, and normally no later than 24 hours after the submission deadline for course deliverables. Please be prepared to complete the Academic Consideration for Coursework Form.

Other Important Locations on Campus:
Writing Services https://carleton.ca/csas/support/ (4th Floor, MacOdrum Library)
Centre for Student Academic Support https://carleton.ca/csas/ (CSAS, 4th Floor, MacOdrum Library)

CLASS SCHEDULE/TOPICS (Subject to modification!!)

Month	Day	Topic	Assign.	Notes
Jan	06	01 – Introduction and review	1	
	13	02 – Flow, functions and IDEs	2	
	20	03 – Creating scripts	3	Team projects assigned
	27	04 – Working as a team		
Feb	03	NO CLASS		Project progress report 1 due
	10	05 – Advanced geospatial libraries – raster	4	
	17	READING WEEK – NO CLASS		
	24	06 – Advanced geospatial libraries – vector	5	Project progress report 2 due
Mar	03	07 – Visualizations		
	10	08 – Errors and bugs		Project progress report 3 due
	17	09 – Packaging, sharing and documenting code		
	24	10 – Work on Projects / TBD		
	31	11 – Work on Projects / Interviews with students		Project progress report 4 due
Apr	07	12 – Project Presentations / Interviews with students		
	08	NO CLASS		Project final report due

Note:

- Short Assignments are given in the week indicated and are due the following Monday (except #4)
- Team reports are due on the Sunday before the class indicated.