Faculty of Science and Technology
Department of Earth and Environmental Science
GEOG4553
Spatial Analysis and GIS
Winter 2026

LAND ACKNOWLEDGEMENT

With gratitude and reciprocity, Mount Royal University acknowledges the relationships to the land and all beings, and the songs, stories and teachings of the Siksika Nation, the Piikani Nation, the Kainai Nation, the Îethka Stoney Nakoda Nation (consisting of the Chiniki, Bearspaw and Goodstoney Nations), the people of the Tsuut'ina Nation, and the Métis. See here for MRU's full Land Acknowledgement.

INSTRUCTOR CONTACT INFORMATION

Instructor Name	Office Room#	Office Phone#	Email
Dr. Lan Nguyen	B233S	403.440.6283	lhnguyen@mtroyal.ca
Office Hours: Monday-Thursday 9-10 AM; M/W 2:30-3:30 PM or by appointment			

Students are encouraged to contact instructors with any questions. If attending office hours is not possible, please send an email to the addresses listed above. Messages will receive a reply by the end of the next business day. To **ensure a response**, the **course name** and **number** (e.g., GEOG4553) must be included in the subject line.

COURSE DESCRIPTION

This course is designed to develop advanced knowledge and skills in spatial data science techniques and tools that will be applied to complex real-world issues through GIS mapping, analysis, and modeling. Experiential learning will introduce students to 3D and 4D mapping techniques, multitemporal visualization, machine learning, and AI applications. Students will undertake authentic research projects with a community service learning partner, building hands-on experience with the geospatial project management life cycle.

CLASS TIMES & LOCATION

Lecture	-001: Tuesday	; 10:00 AM – 12:50 PM	; E157A
Lab	-501: Wednesday	; 10:00 AM – 12:50 PM	; E157A

REQUIRED TEXTS/READINGS/SOFTWARE

No textbook is required.

Students will use ArcGIS Pro / Online, Google Earth, and Google Earth Engine, Python / R programming. Access to these platforms and related resources is available through the MRU Library: https://library.mtroyal.ca/statistics/spatial-data.

COURSE CONTENT

Topics may vary depending on class progress and project needs.

- Spatial & 3D Analysis: advanced spatial tools, 3D features, point clouds
- Network & Location Analysis: transportation and utility networks, routing concepts
- Spatial Statistics & Geostatistics: spatial patterns, hotspots, clustering, regression, interpolation
- Spatiotemporal Analysis: space-time data cubes, temporal patterns, multiscale change analysis
- GeoAI & Machine Learning: ML/AI methods for spatial data, deep learning, generative AI in workflows
- Additional Applied Topics: data engineering, geocoding, map automation, project-based applications

COURSE LEARNING OUTCOMES

By the end of this course, students will be able to:

1. Apply advanced spatial analysis and modeling techniques, including spatial statistics, network analysis, geostatistics, and 3D/4D visualization, to investigate complex real-world geographic problems.
2. Analyze and interpret spatial and spatiotemporal patterns using tools such as autocorrelation, point pattern analysis, hotspot detection, clustering, spatial regression, and space-time cubes.
3. Implement machine learning and GeoAI methods for spatial prediction, classification, image analysis, and workflow automation, while critically evaluating model limitations and responsible AI use.
4. Design and execute a complete GIS-based research project, including data engineering, multitemporal data processing, spatial modeling, visualization, and communication of analytical results.
5. Communicate geospatial findings effectively and ethically through professional maps, reports, and presentations, with attention to data quality, uncertainty, privacy, and societal implications.

COURSE DESIGN & DELIVERY

This class will consist of in-person lectures and hands-on activities as well as some online meetings / resources. Exams will be held in-person during class time.

IMPORTANT DATES

- **Midterm:** February 24th, 2026 (Lecture 1 – 6)
- **Research and Scholarship Day (RSD)**: Abstract Submission – Early Mar, Poster Submission – Mid March, Main Street Poster Event – March 31st,2026 and April 1st, 2026
- **Research StoryMap Presentation:** Apr 8th, 2026
- Last day to withdraw from the course with an award of "W" grade: March 20th, 2026.
- **Final Exam Period:** April 15-25, 2026 (Lecture 7 - 11)

Other important dates can be found here:
http://www.mtroyal.ca/academics/StudentRegistrationRecords/CriticalDates/index.php

EVALUATION METHOD/GRADING SYSTEM

Midterm	25%
Final Exam (non-cumulative)	25%
Weekly Assignments (x5)	20%
Research & Presentation	20%
Class Attendance	10%
Total	100%

All exams are closed book and written in person. Midterms are 75 minutes; the final exam is 2 hours. Question formats may include multiple choice, true/false, matching, fill-in-the-blank, short answer, calculations, ordering, labeling, image interpretation, and schematics. Midterms and the final are non-cumulative, except for fundamental concepts that apply across units. The final exam will be scheduled by the MRU registrar (date/time TBA) and may occur up to the last day of the Final Exam Period. Students requiring academic accommodation should inform the instructor at the beginning of the course so that appropriate accommodation may be arranged.

All assessments follow the MRU standard conversion as shown below. Final grades will be represented by a letter grade corresponding to the percentage equivalents.

Grade	GPA	Percent	Description
A+	4.00	95 – 100	Excellent. Superior performance, showing comprehensive understanding of subject matter.
A	4.00	85 – 94	
A-	3.70	80 – 84	
B+	3.30	77 – 79	Good. Clearly above average performance with knowledge of subject matter generally complete
B	3.00	73 – 76	
B-	2.70	70 – 72	
C+	2.30	67 – 69	Satisfactory. Basic understanding of subject matter.
C	2.00	63 – 66	
C-	1.70	60 – 62	
D+	1.30	55 – 59	Marginal performance. Generally insufficient preparation for subsequent courses.
D	1.00	50 – 54	
F	0.00	<50	Fail. Assigned to students who: a) do not meet the academic requirements of the course, or b) cease to continue in the course, but do not withdraw as per Mount Royal University policy.

COURSE POLICIES

Missed Exams

Students must notify the instructor before the exam if they cannot attend for legitimate medical or religious reasons. Documentation is required. A single make-up exam will be scheduled within one week of the original. Missing both the original and make-up results in forfeited marks.

Late Homework Assignments

Homework assignments submitted up to two days late will receive a 25% penalty per day. No submissions will be accepted after new homework are posted unless extenuating circumstances are discussed with the instructor.

Use of Generative AI (GenAI)

GenAI can be valuable learning resources, especially in courses with significant programming components. When used appropriately, AI can help students understand concepts, debug code, and explore alternative approaches to problem-solving. However, it is essential that AI use supports—rather than replaces—students' own learning. The goal of this course is for each student to develop core skills in programming, critical thinking, and problem-solving. Therefore:

Acceptable Use of AI

Students may use AI tools (e.g., ChatGPT, GitHub Copilot, Claude) to support their learning, including:

- Exploring explanations of programming concepts
- Getting help understanding error messages or debugging code
- Asking for examples to compare with their own approaches
- Brainstorming possible strategies for solving a problem

Requirements When Using AI

If students choose to use AI tools, they must:

1. Acknowledge AI use in their assignment (e.g., a brief note at the end describing what tool was used and for what purpose).
2. Demonstrate understanding of all submitted work. Students must be able to explain and justify their code, including how it works and why they chose that approach.
3. Write and revise their own solutions. AI outputs may inform thinking, but cannot be submitted verbatim as completed answers. Students must adapt, test, and refine any AI-generated ideas themselves.
4. Ensure originality. Students are responsible for avoiding plagiarism or submitting work they do not understand. Over-reliance on AI that results in unoriginal or unexplained work is considered an academic integrity violation.

Unacceptable Use of AI

AI must **NOT** be used to:

- Automatically generate full solutions and submit them without modification or understanding
- Bypass the problem-solving process required in the assignment
- Produce work for exams or other closed-book assessments
- Collaborate improperly (AI is not a "group member")

ACADEMIC ACCOMMODATIONS

If you are a student registered with Access and Inclusion Services and have academic accommodations, please share those accommodations with me via your Accommodate Student Portal as soon as possible.

Some accommodations may require us to communicate about how they will be implemented within the design of this course. If you require Academic Accommodations for practicum or clinical placement, please contact your Access Advisor in Access and Inclusion Services to discuss your specific needs and obtain an Accommodation Letter.

If you are a student experiencing a disability who may require academic accommodations and have not yet registered with Access and Inclusion Services you are encouraged to contact them as soon as possible. You must be registered with Access and Inclusion Services to access Academic Accommodations.

If you require non-disability related Academic Accommodations under other protected grounds (i.e. religious observance, family status) please contact Access and Inclusion Services to explore what accommodations may be available in order to participate fully in your academic studies. Access and Inclusion Services can be contacted at 403-440-6868 or accessibility@mtroyal.ca.

CODE OF STUDENT ACADEMIC INTEGRITY

The University is committed to maintaining a strong culture of Academic Integrity, which is to act with the values of: honesty, trust, fairness, respect, responsibility and courage. Each student is responsible to ensure that they act with honesty and integrity when conducting any and all academic and scholarly activities.

Academic misconduct is an action, whether actual, attempted, or assistance provided to another, in relation to academic and scholarly activity, whether deliberate or inadvertent, that is dishonest, misrepresents information, or creates unfair advantage. This includes, but is not limited to:

> *Plagiarism:* submitting or using the ideas, words, images, code, performance or work of others without appropriate citation or referencing;
>
> *Cheating:* acting dishonestly or unfairly on an exam, assignment, project or other form of evaluation;
>
> *Falsification, Fabrication or Misrepresentation:* using, submitting, or presenting false information or misrepresenting facts for any academic or scholarly purpose;
>
> *Academic Advantage:* engaging in activities that provide an individual (s) with unfair academic advantage as compared to other students.

A lack of familiarity with MRU's regulations on academic conduct does not constitute a defense against its application. Additional resources and tools for students can be found at the Office of Student Community Standards. Students can also review the Code of Student Academic Integrity Policy and the related Code of Student Academic Integrity Procedures.

NOTICE OF RECORDING (if applicable)

Mount Royal University has contracted Google to provide educational technology software for the course GEOG2105; where, the instructor will record lectures using Google Meet and make them available to registered students on Blackboard for up to 10 days after the course is completed. Users, including any recorded student participants, are advised that the personal information collected during the recordings will only be used for educational purposes and is collected under the authority of the FOIP Act – section 33(c) and the Post-Secondary Learning Act in the Province of Alberta. Users are further advised that the downloading of posted videos other than for the purposes of student personal learning through Blackboard,

may violate the copyright of the course instructor or others. For additional questions regarding the collection, use, disclosure and protection of personal information please contact: **Amy Barkman, Department Administrative Assistant**, Faculty of Science and Technology, 4825 Mount Royal Gate SW - Calgary, AB - T3E 6K6 - acbarkman@mtroyal.ca

STUDENT RESOURCES

Many avenues of support are available for students. Please ask if you do not know which resource to turn to or can't find what you are looking for.

Early Support
FST Academic Advising
Student Learning Services
Wellness Services: including support for Mental Health, Student Counselling, Dating/Domestic and Sexual Violence
Support for Indigenous Students (Iniskim Centre)
SAMRU Programs and Services
Office of the Registrar and Student Awards and Financial Aid
Library Access and Resources
Office of Student Community Standards
Career Services