

GEOG 4221A – Urban Data Science

Course Outline: Section 001 Fall 2026

This course is taught in-person

1. Course Information

*Details about the design and delivery of the course are listed below in Section 6



Classes Start	Fall Reading Week	Classes End	Study day(s)	Exam Period
September 9	October 10-18	December 9	December 10	December 11-22

Thursday September 17, 2026: Last day to add a second-term half course

Wednesday September 30, 2026: National Day for Truth and Reconciliation (non-instructional day).

Monday October 12, 2026: Thanksgiving Holiday

Monday November 30, 2026: Last day to drop a first-term half course without penalty



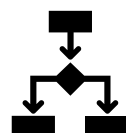
Course Instructor	Contact Information	Office Hours
Naser Ahmed	nahme42@uwo.ca	TBD

Teaching Assistant(s)	Contact Information	Office Hours
TBD	TBD	TBD

2. Calendar Description

This course covers advanced methods and applications of urban data science. Students learn visualizing, measuring, and explaining the city through urban data analytics.

Topics include big and real-time data analysis, geovisualization, urban system simulations, and AI for solving real-world urban challenges. Labs develop computational skills to understand dynamic urban environments.



2 lecture hours, 2 laboratory hours, 0.5 course

Prerequisite(s): Third or fourth year-status, GEOG 2220A/B or equivalent, or permission from the instructor.

Prerequisite checking is the student's responsibility

Senate Regulations state, "unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites."

3. Textbook

There is no required textbook. However, the **recommended** textbooks/papers are below:

1. Allen, J., Greenberg, J., St-Louis, E., Zhang, M., Kali, A., & Chapple, K. (Eds.). (2025). Urban Data Storytelling, Analytics, and Visualization. School of Cities, University of Toronto. Open access.

E-textbook is available here: <https://schoolofcities.github.io/urban-data-storytelling/>

2. Oke, T. R., Mills, G., Christen, A., & Voogt, J. A. (2017). *Urban climates* (Vol. 1). Cambridge, UK: Cambridge University press.

- Chapter 14: Climates of Humans
- Chapter 15: Climate-Sensitive Design

3. Levinson, D. M., & King, D. (2020). Transport access manual: A guide for measuring connection between people and places.

E-textbook is available here: <https://ses.library.usyd.edu.au/handle/2123/23733>

4. Biljecki, F., & Ito, K. (2021). *Street view imagery in urban analytics and GIS: A review*. Landscape and Urban Planning, 215, 104217. **Link:** <https://doi.org/10.1016/j.landurbplan.2021.104217>

5. Kim, J., Park, J., Lee, J., & Jang, K. M. (2024). *Examining the socio-spatial patterns of bus shelters with deep learning analysis of street-view images: A case study of 20 cities in the U.S.* Cities, 148, 104852. **Link:** <https://doi.org/10.1016/j.cities.2024.104852>

6. Jang, K. M., & Kim, J. (2025). Multimodal large language models as built environment auditing tools. The Professional Geographer, 77(1), 84-90. **Link:** <https://doi.org/10.1080/00330124.2024.2404894>

All the course materials, including readings, lecture slides, and lab instructions, will be posted to OWL: <http://owl.uwo.ca>.

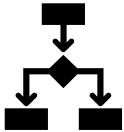
Any changes will be indicated on the OWL site and discussed with the class



4. Course Objectives and Format

Course objectives:

- i. Understand the fundamental concepts, data sources, methods, and emerging technologies used in urban data science.
- ii. Understand the applications of urban data science in addressing urban and environmental issues, including climate, transportation, accessibility, and planning.
- iii. Acquire practical skills in Python, GIS, spatial analysis, machine learning, and Generative AI through hands-on lab exercises and an applied final project.



Mode	Dates	Time	Frequency
Lecture – in-person	Tuesday	2:30 – 4:30 PM	Weekly
Lab – in-person	Thursdays	3:30 – 5:30 PM	Weekly

Current versions of all popular browsers (e.g., Safari, Chrome, Edge, Firefox) are supported with OWL Brightspace; what is most important is that you update your browser frequently to ensure it is current. All JavaScript and cookies should be enabled.

If students need assistance, 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.

5. Learning Outcomes

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

- Collect, clean, manage, and explore urban datasets using Python.
- Analyze and visualize spatial, environmental, and transportation data using appropriate geospatial methods.
- Apply urban data science methods to investigate real-world urban and environmental problems.
- Apply introductory machine-learning and Generative AI tools to urban data analysis.
- Interpret analytical results critically and recognize limitations, uncertainty, and responsible-use considerations.
- Design and communicate a reproducible urban data science project using appropriate data, methods, and visualizations.



6. Course Content and Schedule

Lecture

Week	Dates (Tuesday)	Topic
Part 1: Foundations of urban data science		
1	Sep 15	Course overview + Introduction to urban data science
2	Sep 22	Urban data sources: sensing the city
3	Sep 29	Urban data wrangling and exploratory analysis
4	Oct 6	Spatial data visualization and urban mapping
5	Oct 13	Reading Week (No Lecture)
6	Oct 20	Midterm
Part 2: Application of urban data science		
7	Oct 27	Urban climate and environment + Final project proposal discussion
8	Nov 3	Urban transportation, networks, and accessibility
9	Nov 10	Data-driven climate-sensitive urban planning and design
Part 3: AI in urban science		
10	Nov 17	AI and urban big data / Machine Learning
11	Nov 24	Final project progress discussion
12	Dec 1	Generative AI for urban data science
13	Dec 8	Course conclusion and exam review + Final project help

Lab

Week	Dates (Thursday)	Lab	Topic	Due date (Wednesday)
1	Sep 17	Lab 1	Intro to Python and Google Colab environment	Varies
2	Sep 24	N/A	Lab 1 help	
3	Oct 1	Lab 2	Urban data analytics	
4	Oct 8	Lab 3	Urban data visualization	
5	Oct 15	N/A	Reading Week (No Lab)	
6	Oct 22	N/A	Lab 3 help	
7	Oct 29	Lab 4	Urban climate and remote-sensing analysis	
8	Nov 5	Lab 5	Urban transportation and accessibility modelling	
9	Nov 12	N/A	Lab 5 help	
10	Nov 19	Lab 6	Machine / Deep learning for urban data science	
11	Nov 26	N/A	Lab 6 help	
12	Dec 3	Lab 7	Generative AI and prompt engineering	

Exam

	Scope	Time	Format
Midterm	Week 1-5	In-class time, Tuesday, Oct 20 th , 2026	Short/long answer questions
Final exam	Week 7-13	Exam to be scheduled by the registrar during the December exam period	Short/long answer questions

Term Project

	Time (Due date)
Proposal (written)	November 10, 2026
Final Report (written)	December 15, 2026

7. **Generative AI Policy**

Overall, this course does not strictly constrain your use of generative AI tools (e.g., ChatGPT, Gemini, Claude). You are encouraged to utilize these emerging AI tools creatively. However, **there is one exception: you cannot use these tools to write your drafts** (e.g., Assignments). Using generative AI tools to edit your writing (e.g., for grammar errors) is acceptable, but you should not rely on them to create the original draft. **Getting technical help (e.g., R/Python code) or information (e.g., search queries) from generative AI tools is permissible.** However, please be mindful of the potential biases and inaccuracies in the responses from generative AI tools.

8. **Communication**



- ☒ Students should check the OWL site every 24 – 48 hours
- ☒ For any other communication, 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 emails received from the University at his/her official university address are attended to in a timely manner. You can read about the privacy and security of the UWO email accounts [here](#).
- ☒ Emails will be monitored daily; students will receive a response in 24 – 48 hours, **excluding weekends**

9. Evaluation

Below is the evaluation breakdown for the course. Any deviations will be communicated.

Assessment	Weighting
Midterm	15%
Final exam	15%
Labs	35%
In-class Activities	5%
Term Project Proposal	10%
Term Project Final Report	20%

The evaluation methods described in the course outline are essential requirements for the course.

Students are responsible for the material covered in the lectures as well as the assigned chapters/sections in the text.

☒ All assignments are due at **11:55 pm EST** unless otherwise specified.

☒ Assignments will be accepted up to **48 hrs** after their scheduled due date, excluding weekends (e.g., if your lab is due on a Wednesday, you have until Friday to hand it in).

☒ After an assessment is returned, students should **wait 24 hours** to digest feedback before contacting their evaluator; to ensure a timely response, reach out within 7 days.



Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

Information about late or missed evaluations:

- ☒ Assignments will **NOT be accepted for grading more than 48 hours** (excluding weekends) after the scheduled due date & time (e.g., if your assignment is due on a Wednesday, you have until Friday to hand it in).
- ☒ Late assessments **without** an academic consideration request will be subject to a late penalty of **10 %/day**.
- ☒ Late assessments **with** an academic consideration request - please discuss the new submission deadline with Naser Ahmed.

Grades will not be adjusted on the basis of need. It is important to monitor your performance in the course. Remember: *You* are responsible for your grades in this course.

10. Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](#).

General Information about missed work:

University policy on academic considerations are described [here](#). This policy requires that all requests for academic considerations must be accompanied by a self-attestation. Further information about academic considerations, and information about submitting this self-attestation with your academic consideration request may be found here.

Please note that any academic considerations granted in this course will be determined by the instructor, in consultation with the academic advisors in your Faculty of Registration, in accordance with information presented in this course outline.

Absence from Course Commitments

Students must familiarize themselves with the [Policy on Academic Consideration – Undergraduate Students in First Entry Programs](#)

Students missing course work for medical, compassionate or extenuating circumstances can request academic consideration by completing a request at the central academic consideration portal. Students are permitted one academic consideration request per course per term without supporting documentation. Note that supporting documentation is **always** required for academic consideration requests for examinations scheduled by the office of the registrar (e.g. December and April exams) and for practical laboratory and performance tests typically schedule during the last week of the term. Students should also note that the instructor may designate one assessment per course per term that requires supporting documentation. This designated assessment is described elsewhere in this document. Please note that any

academic considerations granted in this course will be determined by the instructor of this course, in consultation with the academic advisors in your Faculty of Registration, in accordance with information presented in this course outline. Supporting documentation for academic considerations for absences due to illness should use the Student Medical Certificate or, where that is not possible, equivalent documentation by a health care practitioner.

Course Assessments that Require Supporting Documentation

For this course, the following assessment has been designated as requiring supporting documentation:

Midterm (in class on Tuesday, October 20, 2026)

Accommodation for Religious Holidays

Students should review the policy for Accommodation for Religious Holidays. Where a student will be unable to write examinations and term tests due to a conflicting religious holiday, they should inform their instructors as soon as possible but not later than two weeks prior to writing the examination/term test. In the case of conflict with a midterm test, students should inform their instructor as soon as possible but not later than one week prior to the midterm.

11. Make-up Examinations

Procedure on makeup assessments for Social Science students and for courses offered by the Faculty of Social Science

Effective September 1, 2026

Students who miss a regularly scheduled test/quiz, mid-term, or final exam may request academic consideration through the Student Absence Portal.

If academic consideration is granted, students should consult the course outline for information regarding how the missed assessment will be addressed and follow any instructions provided by the instructor. At the instructor's discretion, the weight of a missed test/quiz or mid-term may be transferred to another assessment in the course, including the final exam, rather than requiring a makeup assessment. Reweighting is not available for missed final exams.

Students are entitled to **one makeup assessment opportunity** for a missed test/quiz, mid-term, or final exam supported by approved academic consideration. **No additional makeup opportunities will be provided.** Makeup assessments represent the final opportunity to complete a missed course assessment.

What happens if I miss a makeup assessment as a Social Science student or in a course offered by the Faculty of Social Science?

Students who miss a makeup assessment are not eligible for an additional makeup opportunity. Depending on their circumstances, they may:

1. Remain enrolled in the course and accept a grade of zero on the missed makeup assessment. Students should consult the course outline and calculate whether they can still achieve a passing grade in the course.

2. Withdraw from the course through Student Center before the published drop deadline. A course dropped before the deadline will result in a withdrawal (WDN) without academic penalty. Part-time students should consult the Registrar's Office refund schedule to determine whether a tuition refund is available. Students enrolled full-time in 4.0-5.0 courses are generally not eligible for tuition refunds when a course is dropped.
3. If the published drop deadline has passed and the missed makeup assessment is supported by appropriate documentation, students may submit their documentation through the Student Absence Portal to request a WDN (withdrawal without academic penalty). Approval is not automatic and remains subject to Faculty review. Requests for a second makeup assessment will not be considered.

Students are encouraged to carefully consider their ability to complete a makeup assessment as scheduled, as no further opportunities to complete the missed work will be available.

12. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.

1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
2. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
3. Follow weekly checklists created on OWL or create your own to help you stay on track.
4. Take notes as you go through the lesson material. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively.
5. Connect with others. Try forming a study group and try meeting on a weekly basis for study and peer support.
6. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor(s) and or teaching assistant(s).
7. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.



13. Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

14. Western's Commitment to Accessibility

The Department of Geography and Environment strives at all times to provide accessibility to all faculty, staff, students and visitors in a way that respects the dignity and independence of people with disabilities.

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2147 for any specific question regarding an accommodation. Information regarding accommodation of exams is available on the Registrar's website.

More information about "Accessibility at Western" is available.

15. Mental Health

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit Western's Health and Wellness website for more information on mental health resources.

16. Support Services

Western's Support Services
Student Development Centre

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.

17. Important Dates

September 9: Classes resume

September 17: Last day to add a first term half course

September 30: National Day for Truth and Reconciliation (non-instructional day).

October 12: Thanksgiving Holiday – Department Office Closed

October 12-16: Fall Reading Week (No classes; Department Office open)

November 30: Last day to drop a first term half course or a full course without penalty

December 9: Classes end

December 10: Study day

December 11-22: Examination Period