



**Advanced GIS and Spatial Analysis**  
Department of Geography and the Environment  
Winter 2024

**Instructor Information**

Instructor: Dr. Muditha Heenkenda  
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Office Hours: Monday/Thursday 10.30 am to 12.30 pm

**Lab Instructor Information**

Instructor: Mr. Jason Freeburn  
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Office Hours: TBA

**Teaching Assistant (TA) Information: NA**

**Course Identification**

Course Number: GEOG 4211  
Course Name: Advanced GIS and Spatial Analysis  
Course Location: Zoom & ATAC 3009  
Class Times: Monday & Wednesday 8.30 am to 9.30 am (lectures); Wednesday  
12.30 pm to 2.30 pm (lab)  
Prerequisites: GEOG 2232 or a similar course

**Course Description/Overview** - Introduces advanced spatial analysis techniques such as spatial raster interpolation, watershed analysis, spatial pattern analysis and network analysis. Hands-on experience in manipulating vector and raster data for different tasks will be gained through ArcGIS Pro software. Students have an opportunity to apply acquired skills to two real-world applications. Each application includes a range of data sources and spatial analysis techniques. Students can develop their project management and presentation skills by completing the steps required to take a GIS project from the initial step to the final map production and presentation.

## Course Learning Objectives

Upon successful completion of this course, students will be able to:

- understand advanced spatial analysis techniques: spatial interpolation, spatial statistics and network analysis;
- identify key concepts related to GIS/Remote Sensing and explore how to apply them to solve real-world problems;
- formulate research objectives and research questions, and search for background information;
- identify required data sources, design data preparation and advanced techniques to achieve a geospatial solution;
- effectively work independently or as a group to fulfil project requirements and to meet deadlines; and
- develop perspectives on GIS, including the pros and cons, as both a decision-support technology and a research tool.

## Course Resources

Course Website(s)

- A D2L site will be accessible upon course registration

Required Course Text(s)

- Recommended: Chang, Kang-tsung. 2019. Introduction to Geographic Information Systems (9th edition). McGraw Hill Education.  
Available for a 6-month rental period:  
<https://www.mheducation.com/highered/product/introduction-geographic-information-systems-chang/M9781259929649.html>
- Reading materials from the course website

## Course Schedule/Outline

<b>Week starting from</b>	<b>Lecture (Monday 8.30 to 9.30 am)</b>	<b>Lecture (Wednesday 8.30 to 9.30 am)</b>	<b>Lab exercise (Wednesday 12.30 pm to 2.30 pm)</b>
Jan. 8	Course Introduction Review lecture (Introduction to GIS and ArcGIS Pro)	Raster data analysis	<b>Lab 1:</b> Introduction to ArcGIS Pro (using vector data)
15	Raster data analysis and Terrain Mapping	Raster data analysis and Terrain Mapping	<b>Lab 2:</b> Introduction to ArcGIS Pro (using raster data)
22	Spatial interpolation	Viewshed and Watershed analysis	<b>Lab 3:</b> Spatial interpolation in ArcGIS Pro
29	Introduction to Term Project 1 (group of 4-6 students)	Term project 1	<b>Lab 3 cont.:</b> Watershed analysis
Feb. 5	Term project 1	Term project 1	Term project 1
12	Spatial statistics (pattern, cluster/outlier)	Spatial statistics – hot spot analysis and heat maps	Term project 1 presentations
19	<b>Study break</b>		
26	Spatial regression	Spatial statistics – modelling spatial relationships	<b>Lab 4:</b> Spatial pattern analysis
March 4	Introduction to Term Project 2 (group of 4-6 students)	Term Project 2	<b>Lab 4 cont.:</b> Modelling spatial relationships
11	Network analysis	Network analysis	<b>Lab 5:</b> Network Analysis
18	Network analysis	Term project 2	<b>Lab 5:</b> Network Analysis
25	Term project 2	Term project 2	Term project 2
Apr. 1	Term project 2	Term project 2	Term project 2 presentations

*Note that this document is subject to change pending unforeseen circumstances.*

## Assignments and Evaluations

Item	Date(s)	Value
Lab Assignment(s)	before the next lab assignment, TBA in class	40%
Quizzes	At the end of each topic	15%
Term project 1	Feb. 14, 2024	20%
Term project 2	Apr. 3, 2024	25%
Total		100

## Late Assignments

Late assignments will automatically receive a deduction of 10% per day unless an extension is agreed upon with the instructor before the due date.

## Course Policies

(relevant University/Faculty or Program regulations/policies)

- The link to the behavioral standards (this could be a reference to the [Code of Student Behaviour and Disciplinary Procedures](#) also known as The Code),
- Attendance is expected for each lecture and lab unless communicated with the instructor ahead of time,
- Participation is expected in all class discussions, group work and collaborative efforts.

## Regulations – General Information from the [Academic Calendar](#)

“It is the responsibility of each student registered at Lakehead University to be familiar with, and comply with all the terms, requirements, regulations, policies and conditions in the Lakehead University Academic Calendar. This includes, but is not limited to, Academic Program Requirements, Academic Schedule of Dates, University and Faculty/School Policies and Regulations and the Fees and Refund Policies and Schedules.”

## Collaboration/Plagiarism

Plagiarism is defined in [University Regulation IX](#) with additional examples in Article I, Section 1 of The Code. Sanctions associated with Academic Misconduct are defined in Article II of The Code and Enforcement Procedures are outlined in Article III of The Code.

Students wishing to learn more about Academic Misconduct are encouraged to read the [University and relevant Faculty Regulations](#) and The Code (noted above) and access other resources on the [Teaching Commons](#) website.

**University Policies** – all University Policies can be found [here](#). Pay particular attention to those found under the Category of “Regulations” and “Student-Related”. If you have a

question, please let me know by email or in-class. If you have a question, it is likely that at least a few others in the class are wondering the same thing.

**Supports for Students** – there are many resources available to support our students. These include but are not limited to:

- [Health and Wellness](#)
- [Student Success Centre](#)
- [Student Accessibility Centre](#)
- [Library](#)
- [Academic Support Zone](#) (Writing and Math Tutoring Centre)

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities and/or medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please contact Student Accessibility Services <http://studentaccessibility.lakeheadu.ca> (SC0003, 343-8047 or [sas@lakeheadu.ca](mailto:sas@lakeheadu.ca))