



**Earth Observation and Analysis**  
Department of Geography and the Environment  
Winter 2023

**Instructor Information**

Instructor: Dr. Muditha Heenkenda  
Office Location: RC 2006E  
Telephone: 807 343 8010 ext 8746  
E-mail: muditha.heenkenda@lakeheadu.ca  
Office Hours: Monday 1.30 pm to 4.30 pm; Wednesday 1.30 pm to 4.30 pm

**Lab Instructor Information**

Instructor: Mr. Jason Freeburn  
Office Location: RC 2004  
Telephone: 807 343 8010 ext 7890  
E-mail: jason.freeburn@lakeheadu.ca  
Office Hours: TBA

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

**Course Identification**

Course Number: GEOG 2215  
Course Name: Earth Observation and Analysis  
Course Location: RC 2003 & ATAC 3009  
Class Times: Monday & Wednesday 12.30 pm to 1.30 pm (lectures); Tuesday 8.30 am to 10.30 am (lab)  
Prerequisites: GEOG 2232 or a similar course

**Course Description/Overview** - Earth Observation and Analysis course will introduce fundamentals of Photogrammetry, including vertical and oblique photography, photo scale, mission planning, photo interpretation, stereo vision and generating 2D/3D products from photography. Students become familiar with the basic image interpretation principles, image processing, generating Digital Elevation Models (DEM), Digital Surface models (DSM), ortho images and aerial photography applications. This course will also explore state-of-the-art remote sensing techniques such as stereo image acquisition and 3D data capturing and processing using Remotely Piloted Aircraft Systems (RPAS) images.

## Course Learning Objectives

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

- understand the basic principles of photogrammetry/remote sensing;
- identify photo interpretation techniques, including stereo viewing and their applications;
- demonstrate competency in using ArcGIS Pro software for digital image processing;
- describe the general procedure of aerial photography/RPAS mission planning; and
- successfully apply different image processing techniques for generating DEM, DSM and ortho images from aerial images.

## Course Resources

Course Website(s)

- A D2L site will be accessible upon course registration

Required Course Text(s)

- **Recommended (Chapters 2 and 3):** Lillesand, T.M., Kiefer, R.W., and Chipman, J.W., 2015. Remote Sensing and Image Interpretation, 6th Edition (New Jersey: Wiley), ISBN 978-1-118-34328-9

ebook for renting: <https://www.wiley.com/en-ca/Remote+Sensing+and+Image+Interpretation%2C+7th+Edition-p-9781118919477>

- Reading materials from the course website

## Course Schedule/Outline

<b>Week starting from</b>	<b>Monday (lecture) (12.30 pm to 1.30 pm)</b>	<b>Wednesday (lecture) (12.30 pm to 1.30 pm)</b>	<b>Lab exercise (Tuesday 08.30 am to 10.30 am)</b>
Jan. 09	Introduction to the course; Introduction to GIS	Review – Introduction to GIS and ArcGIS Pro	ArcGIS Online accounts and getting ready to work with the ArcGIS Pro software
16	Introduction to Photogrammetry (history)	Four types of aerial photos (Panchromatic, B&W IR, Color IR, True colour)	Lab 1: Introduction to ArcGIS Pro
23	Transition from analogue to digital photography (photographic films, multispectral images)	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)	Lab 2: Explore air photo archives, identify different features and change over time
30	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)	Digital photography (scale and GSD), different types of cameras (pixel size, CCD, flying height and DSD)	Lab 3: Compare different types of photographs and digital cameras
Feb. 6	Geometry of aerial photography (photo block, forward overlap, side lap)	Visual image interpretation and map making	Lab 4: Photo characteristics, calculate scale and relief displacement, and display multispectral images on screen
13	Midterm test review	Midterm test	Lab 5: Image interpretation (create a map)
20	<b>Study break</b>		
27	Image orientation (block adjustment)	Image orientation – improve accuracy using Ground Control Points	Lab 6: Create ortho mapping workspace; interior orientation and block adjustment in ArcGIS Pro
Mar. 6	Stereo vision and stereo photo measurements (photo base, parallax, height)	Surface modelling using overlap photos – DEM, DSM	Lab 6 cont.: Add GCP and improve the accuracy, create a stereo pair Demonstrate stereo vision and 3D digitizing
13	Ortho photos, characteristics and applications	DEM/DSM visualization and applications	Lab 6 cont.: Create ortho mosaic, DEM and DSM, terrain display
20	Introduction to RPAS and mission planning (no. of flight lines, photos, overlaps)	3D products and 3D visualization from RPAS imagery	Lab 7: Developing a flight plan (ground coverage, no. of flight lines & images, overlap) using MissionPlanner
27	Introduction to RPAS (Regulations)	RPAS image acquisition	Lab 8: Follow ArcGIS Pro Ortho mapping workflow and create 3D products (repeat the same workflow as Lab 6 with new dataset- student project)
Apr 3	Final exam review	Lab 8 cont.: creating 3D products and maps	Lab 8 cont.: creating 3D products and maps

## Assignments and Evaluations

Item	Date(s)	Value
Lab Assignment(s)	Every Tuesday before 8.30 am	45%
Quizzes	TBA	5%
Mid-Term Test	Feb. 15, 2023	25%
Final Examination	TBA	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,
- Exams (a) absences from illness, compassionate reasons or representing the university off-campus, supported by written documentation, will be accepted as sufficient evidence to allow a rewrite of a missed test.  
(b) If you miss an exam for any reason other than those deemed acceptable in the Lakehead University calendar, then you will be given the opportunity of an essay-based makeup exam that is significantly longer and more difficult.

## 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))