GEOG 2215 – EARTH OBSERVATION AND ANALYSIS (W22)

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Course Description:

Earth Observation and Analysis course will introduce fundamentals of Photogrammetry, including vertical and oblique photography, photo scale, mission planning, photo interpretation and stereo vision. Students become familiar with the basic image interpretation principles 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 using Remotely Piloted Aircraft Systems (RPAS) images.

Learning Outcomes:

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;
- describe the general procedure of aerial photography/RPAS mission planning;
- hands-on experience with ArcGIS Pro software; and
- successfully apply different image processing techniques for data extraction using aerial images.

Learning Resources:

- **Recommended (Chapter 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

Grading:

Lab exercises	45%	
Quizzes	5%	
Midterm exam	25%	(Feb 16th, 2022)
Final exam	25%	(TBA)

Course Expectations/Student Responsibilities:

1. **Attendance** is expected for each lecture and lab unless communicated with the instructor ahead of time.
2. **Late Assignments** receive a deduction of 10% per day unless an extension is agreed to with the instructor prior to the due date.
3. **Participation** is expected in all class discussions, group work and collaborative efforts.
4. **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 Lakehead University calendar, then you will be given the opportunity of an essay-based makeup exam that is significantly longer and more difficult.

Course Schedule:

Week starting from	**Monday (lecture) (11.30 to 12.30)**	**Wednesday (lecture) (11.30 to 12.30)**	**Lab exercise (Thursday 08.30 to 10.30)**
10	Introduction to the course; Introduction to GIS	***Review – Introduction to GIS***	Installing ArcGIS Pro and getting ready to work with the software
17	Introduction to ArcGIS Pro	Introduction to Photogrammetry (history)	**Lab 1**: Introduction to ArcGIS Pro
24	Four types of aerial photos (Panchromatic, B&W IR, Color IR, True colour)	Transition from analogue to digital photography (photographic films, multispectral images)	**Lab 2**: Explore air photo archives, identify different features and change over time
31	Digital photography (scale and GSD), different types of cameras (pixel size, CCD, flying height and DSD)	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)	**Lab 3:** Compare different types of photographs and digital cameras
Feb. 7	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
14	Midterm test review	***Midterm test***	**Lab 5:** Image interpretation (create a map)
21	***Study break***		
28	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. 7	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
14	Ortho photos, characteristics and applications	Ortho photos, characteristics and applications	**Lab 6 cont.:** Create ortho mosaic, DEM and DSM, terrain display
21	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
28	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 4	Final exam review	**Lab 8 cont.:** creating 3D products and maps	**Lab 8 cont.:** creating 3D products and maps

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