GEOG 2215 – INTRODUCTION TO EARTH OBSERVATION AND ANALYSIS (W21)

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Course Description:

Introduction to Earth Observation and Analysis course will introduce fundamentals of aerial 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. The state-of-the-art remote sensing techniques such as stereo image acquisition, Remotely Piloted Aircraft Systems (RPAS) and LiDAR remote sensing will also be explored within this course.

Learning Outcomes:

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

- understand the basic principles of photogrammetry/remote sensing;
- describe the general procedure of aerial photography/RPAS mission planning;
- identify photo interpretation techniques including stereo viewing and their applications;
- understand the basic principles of LiDAR; and
- successfully apply different image processing techniques for data extraction using aerial images and LiDAR point clouds.

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 24th, 2021)
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. After class assignments are graded and returned, late assignments receive a zero grade **but must be satisfactorily completed to receive credit in the course.**
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) (10.30 to 11.30)	Lab exercise (Monday 12.30 to 2.30)	Wednesday (lecture) (10.30 to 11.30)
11	Introduction to the course; Introduction to GIS	***Review – Introduction to GIS***	
18	Introduction to ArcGIS Pro	**Lab 1**: Introduction to ArcGIS Pro	Introduction to Photogrammetry (history)
25	Four types of aerial photos (Panchromatic, B&W IR, Color IR, True color)	**Lab 2**: Explore air photo archives, identify different features and change over time	Transition from analogue to digital photography (photographic films, multispectral images)
Feb 1	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	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)
8	Geometry of aerial photography (photo block, forward overlap, sidelap)	**Lab 4**: Photo characteristics, calculate scale and relief displacement, and display multispectral images on screen	Visual image interpretation and map making
15	***Study Break***		
22	Midterm test review	**Lab 5:** Image interpretation (create a map)	***Midterm test***
Mar. 1	Image orientation (block adjustment)	**Lab 6:** Create ortho mapping workspace; interior orientation and block adjustment in ArcGIS Pro	Image orientation – improve accuracy using Ground Control Points
8	Stereo vision and stereo photo measurements (photo base, parallax, height)	**Lab 6 cont.:** Add GCP and improve the accuracy, create a stereo pair Demonstrate stereo vision and 3D digitizing	Surface modelling using overlap photos – DEM, DSM
15	Ortho photos, characteristics and applications	**Lab 6 cont.:** Create ortho mosaic, DEM and DSM, terrain display	Review photogrammetric workflow and reflect on lab 6
22	Introduction to RPAS and mission planning (no flight lines, photos, overlaps)	**Lab 7**: Developing a flight plan (ground coverage, no. flight lines, photos, overlap) using MissionPlanner	3D products and 3D visualization from RPAS imagery
29	Introduction to RPAS (Regulations)	**Lab 8**: Follow ArcGIS Pro Ortho mapping workflow and create 3D products *(repeat the same workflow as Lab 6 with new dataset- student project)*	Introduction to LiDAR Remote Sensing
April 5	***Easter Monday (no classes)***		LiDAR applications and software packages
12	Final exam review	**Lab 9**: Visualize LiDAR point clouds	

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