

Course Instructor	George Bevan	Email: bevan@queensu.ca
Office	Mac-Corry D130/MS Teams	
Contact Time	Asynchronous Delivery (all course materials available through OnQ and MS Teams). Office hours will be available throughout the week (TBA)	
Format	Asynchronous	
Class Assessment	Participation in MS Teams (5%), Six Short, Multiple-Choice Quizzes (30%), Seven Lab Assignments (65%)	

COURSE OVERVIEW

This course proposes to give a rigorous introduction to the theory and practice of Digital Photogrammetry, a technique that has witnessed a tremendous rise in popularity with the rise of high resolution digital cameras and fast, multi-core computers in the early 2000s. While the underlying mathematics will not be treated in detail (no specific mathematical background is required), considerable attention will be paid to photogrammetry as a quantitative technique in geography, geomorphology, cartography, archaeology, architecture, geology, civil engineering and related fields where accurate 3D measurement is of great importance. Proper planning of photogrammetric projects will be emphasized, along with a focus on a priori estimates of accuracy of photogrammetric measurement. The use of Unmanned Aerial Vehicles to collect 3D data will be emphasized, along with basic mapping operations.

LEARNING OUTCOMES

- 1) to operate modern digital photogrammetry software
- 2) to analyze 3D data-sets in software to produce meaningful sets of measurements
- 3) to present effectively photogrammetry data, and the fundamental concepts of photogrammetry, in the form of oral presentations and written reports

COURSE TOPICS

History of Photography, History of Photogrammetry, Camera Fundamentals (Exposure, ISO, Shutter Speed and Aperture), Statistics (Models and Residuals), Root Mean Square Error, Principles of Photogrammetry, Stereoplotting, Network Bundle Adjustment/Least Squares, Exterior Orientation, Interior Orientation, Camera Calibration, Fan-geometry, Absolute Orientation, Ground Control Points and Surveying, Coordinate Systems, Aerial Photography, Orthophoto Generation, UAVS, Aerial Project Planning, Image File Formats, Spatial Resolution and the Modulation Transfer Function, Diffraction Limits on Optical Systems, Stereo Matching Algorithms, Meshing, Observations and Redundancy, Advanced Terrestrial Camera Networks, Photogrammetry Applications

COURSE READINGS

Wolf, P.R. and B. DeWitt, and B. Wilkinson, *Elements of Photogrammetry with Application in GIS*, 4th edition (McGraw-Hill, 2014) (available online through Queen's Library) OPTIONAL

It is strongly recommended students that have a hard-drive with at least 250GB free to store course data. Students will also be asked to buy a pair of anaglyph 3D glasses (these can be acquired on Amazon or through Walmart for ~\$15, e.g. <https://www.walmart.ca/en/ip/Uxcell-a10111700ux0001-Metal-Arms-Anaglyph-3D-Eyeglasses/PRD3FPKJMLI3711>)