Course Syllabus, ESS 490E / 590E, Spring 2017

Course Title: Field Methods in Remote Sensing (4 credits)
Class Time: MW, 3:30-5:20pm, JHN 366
SLNs: 14286 / 14311
Course Website: Canvas
Recommended Prereqs: Calculus; EM/Waves; Introductory Geology.

Instructors:	**Email:**	**Office:**	**Office Hours:**
David Schmidt	dasc@uw.edu	206 ATG	Tuesdays. 1-2 pm
Knut Christianson	knut@uw.edu	218 ATG	Thursdays. 10-11 am

Course Description: As sensors have reduced in size and cost over the past decade, portable instruments that remotely sense our environment have become common in science and industry. The data from these sensors are revolutionizing how science is done on the field scale. When coupled with new data analysis tools, these sensors allow us to capture natural and anthropogenic processes in unprecedented spatial and temporal detail. Topics to be covered in this course include:

- modern and historical techniques to remotely measure topography (of the Earth and buildings, bridges, dams, etc.) as used to study slope stability, glacier motion, ground deformation, and other geological and civil engineering features of interest;
- remote sensing basics, including the electromagnetic spectrum, wave propagation, radiation absorption and reflectance, scattering properties of the target surface, resolution vs. precision vs. accuracy;
- creation of digital elevation and surface models from radar, laser and optical data, differences between point clouds and raster images, change detection;
- field experiment design, hypothesis testing, instrument capability tradeoffs, collection of field data using several instruments;
- preparation of technical/scientific reports that document data collection, processing, and interpretation.

Learning Objectives: Through a series of field and laboratory exercises, students will:

- learn how to collect, process, and interpret data from several field-based sensors, such as terrestrial laser scanners (TLS), optical cameras, terrestrial radar interferometers, and ground-penetrating radars (GPR);
- understand the tradeoffs between using different sensors, and gain insight into how to optimally pair a sensor to an application;
- learn how to document and discuss a data set through the preparation of written scientific reports.

Reading Assignments: There is no textbook for this course. All assigned readings will be posted on the course website. Readings will include excerpts from relevant textbooks, manuals, and peer-reviewed articles relevant to laboratory datasets.

Course Format: Each class period will consist of a short lecture followed by a computer exercise. On some class days, the entire class period will be spent outside in order to see a particular sensor in action and to learn how data acquisition is performed. There will also be a local field trip, so that students can participate in experiment design and data collection.

Computer Laboratory Work: All data analysis will be performed on the software installed in the JHN 366. Students should bring a USB drive (65+ GB) to store all personal files and processed data products. Local machines will be wiped clean weekly.

Laboratory Notebooks: Student are required to have laboratory notebooks. Notes from the field are an essential component of a successful survey, as relevant details are often difficult to remember, and these records are needed for data processing and interpretation. Students should record information on the target to be scanned (the feature of interest) and metadata relevant to survey design, such as weather conditions, instrument scan settings, computer settings, and sketches of scan target and instrument setup. Notebooks will be graded as a component of the two written reports (detailed immediately below). Best practices for field notes will be reviewed prior to data collection.

Reports: Students will complete two written reports (~10 pages each) during the quarter, which will describe the data, analysis, and interpretation of a data set. The first report will cover TLS and optical data, while the second report will describe a GPR data set. The first report will also go through a round of revisions. Additional details about the reports will be provided at a later time. These reports will qualify for UW writing credit.

Late Work Policy: No late work will be accepted. If you have extenuating circumstances that prevent you from submitting your lab or report on time, please contact the instructors before the due date.

Academic Integrity: All the work submitted for this class is expected to be your own. You may collaborate with fellow students on assignments, such as when troubleshooting or thinking through a problem; but you are expected to individually prepare and submit your own work. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478□120). Students are expected to know and follow the university's policies on cheating and plagiarism. Cases of alleged misconduct or plagiarism will be forwarded to the Dean's office for evaluation, and if found responsible, will receive a zero on the assignment in question.

Access and Accommodations: It is our goal to create an equal learning environment for all students. Please communicate any disabilities or health issues with the instructors in advance. Students are also encouraged to contact Disability Resources for Students (DRS) for assessment and accommodation.

Final Grade Assignments: Final grade will be based on a curve with the components weighted as follows:

Lab/HW	30%
Exam 1	15%
Exam 2	15%
Report 1	20%
Report 2	20%

Course Schedule (Tentative):

	Monday	Wednesday	Notes
March 27/29	Lecture: Introduction & Remote Sensing Lab: Topography	Lecture: Topography and Change Detection Lab: DEMs & ENVI	
April 3/5	Lecture: Principles of LiDAR Lab: Image Registration in ENVI	Lecture: Experimental setup and field notes Lab: RiSCAN Software	
April 10/12/15	Lecture: Optical, SfM Lab: SfM exercise	On-campus TLS Scan and Optical	Tentative Field Trip on April 15
April 17/19	Lab: RiSCAN Processing	Lab: RiSCAN Processing	
April 24/26	Lab: SfM Processing	**Exam 1: TLS & Optical** Lab: Report Preparation	
May 1/3	**1st draft of Report 1 Due at 5pm.** No class in exchange for field trip.	Lecture: Interferometric Radar Lab: RAR Data Analysis	
May 8/10	On-campus Demo of GPRI	Lab: GPRI dataset and interpretation	
May 15/17	Lecture: Ground Penetrating Radar Lab: GPR data processing **Report 1 Revision Due**	Lecture: GPR Lab: GPR data interpretation	
May 22/24	On-campus GPR Survey	Lecture: Sensor Review Lab: Analysis of GPR data	
May 29/31	**Holiday**- no class	**Exam 2: Radar** Lab: Report Preparation	
June 8		**Report 2 Due: 5 pm**	