DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Earth Sciences
ERTH/GEOG 4530 & ERTH 5530
Environmental Remote Sensing (Winter 2019)

Instructor(s):	Dr. Christopher Greene (csgreene@dal.ca)
Office Hours:	Tuesdays from 1:30 to 3:30 in LSC-2045 (BIO-EARTH Wing)
Lectures:	Monday-Wednesday-Friday from 12:35 pm to 1:25 pm Milligan Room (LSC-8007 BIO-EARTH Wing)
Laboratories:	Wednesdays from 2:35 pm to 5:25 pm GIS Teaching Laboratory (LSC-2012 BIO-EARTH Wing)

Course Description

The goal of this course is to introduce students to the role of remote sensing as a technique provide environmental and geologic information. Particular emphasis will be placed on examining the potential and limitations of remote sensing methods and data in this context. The lectures discuss the fundamentals of remote sensing with an emphasis on multi-spectral satellite systems. In the lab, students use computerized techniques of digital image enhancement and thematic information extraction to process images derived from optical, radar, and hyperspectral remote-sensing systems. The integration of remote-sensing information with GIS (Geographic Information Systems) is stressed in both the labs and lectures.

Course Prerequisites

PREREQUISITES: GEOG 3500, ENVS 3500, ERTH 3500; ERTH 5600, or SCIE 3600

CROSS-LISTING: GEOG 4530, ERTH 5530

Course Objectives/Learning Outcomes

With successful completion of the course, students will be able to:

- Recognize and explain the basic principles of remote sensing (RS);
- Identify, compare, and contrast common remote sensing collection systems;
- Explain the difference between the correction and enhancement of remotely sensed data;
- Apply these procedures to extract thematic information from remotely sensed data; and
- Recognize, explain, and demonstrate how error in information extraction is calculated.

Materials

Recommended Textbook: Jensen, J. (2016). *Introductory Digital Image Processing: A Remote Sensing Perspective*. Pearson.

Other: A dedicated USB drive with a minimum of 16 gigabytes of storage formatted to the NTFS file management system. **Recommended is a USB 3.0 drive with 64 gigabytes** of storage formatted to the NTFS file management system.

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Course Assessment. Both undergraduate (Left) and Graduate (Right) requirements are provided.

Category	Component	Weight U-GRAD (% of Final Grade)	Weight GRAD (% of Final Grade)	Date
Applied*	Workshop Assessments	5	10	Throughout term (beginning of next lab section)
	Lab Project 1	12.5	-	Sunday, February 17th, 2019
	Lab Project 2	12.5	-	Sunday, March 18th, 2019
	Individual Project**	20	40	Tuesday, April 10th, 2019
Theoretical	In Class Exercises	5	5	Ad hoc, throughout term
	Test 1	15	15	January 28th, 2019
	Test 2	15	15	Friday, March 1st, 2019
	Test 3	15	15	Monday, April 9th, 2019
Total		100		

Students must pass both the theoretical component and the laboratory component to complete the course (see course policies)

**The individual project is somewhat different for the undergraduate students in ERTH/GEOG 4530 and the graduate students enrolled in ERTH5530. Please consult guidelines as they are posted to the Learning Management System.*

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

Grade	Range	Definition and Expectations
A+	90-100	**Excellent:** Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
A	85-89	
A-	80-84	
B+	77-79	**Good:** Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.
B	73-76	
B-	70-72	
C+	65-69	**Satisfactory:** Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
C	60-64	
C-	55-59	
D	50-54	**Marginal Pass:** Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a minimum grade of 'C' is required).
F	<50	**Inadequate:** Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature.

Course Content

Week	Lecture Topics	Reading	Lab Period	Assessment Due
Week 1 **Jan. 7-11**	Introduction	Chapter 1	WS1 – RS Imagery in ArcMap	
Week 2 **Jan. 14-18**	Data Collection	Chapter 2	WS2 – RS Imagery in PCI Geomatica	
Week 3 **Jan. 21-25**	Image Quality	Chapter 4, 8	WS3 – Image Quality	
Week 4 **Jan. 30 - Feb. 1**	Classification I (Munro Day, Feb. 2)	Chapter 9 (partial)	WS4 –Classification of Raw Imagery	**Test 1** (Monday, Jan. 28)
Week 5 **Feb. 4-10**	Error Analysis, Accuracy Assessment	Chapter 13	WS5 – Error Analysis	
Week 6 **Feb. 11-15**	Electromagnetic Radiation, Correction	Chapter 6	Working Week	**Lab Proj. 1** (Sunday, Feb. 17)
Week 7 **Feb. 18-22**	**Reading Week (No Classes or Labs)**			
Week 8 **Feb. 25-Mar. 1**	*Buffer Week for Snow Days**			**Test 2** (Friday, March 1)
Week 9 **Mar. 4-8**	Geometric Correction	Chapter 7	WS6 – Geometric Correction	
Week 10 **Mar. 11-15**	Image Enhancement	Chapter 8	WS7 – Band Ratios, PCA, Tasselled Cap	
Week 11 **Mar. 18-22**	Classification II	Chapter 9 (partial)	Working Week	**Lab Proj. 2** (Sunday, March 17)
Week 12 **Mar. 25-29**	Change Detection (Good Friday, March 26)	Chapter 12	WS8 – Change Detection	
Week 13 **April 1-5**	Artificial Intelligence Wrap-Up	Chapter 10	WS9 – Advanced Classification	
Week 14 **April 8**	**Test 3** (Monday, April 8)		Working Week	**Individual Project** (Tuesday, April 9)

* If no cancellations, material is moved up by one week. If cancellations, time will be used to catch up on material. If no snow days + no material overrun, additional content will be added to the end of the schedule.

Course Policies

Course Completion

To successfully complete the course, <u>students must receive 50% of the total possible points or higher for both the theoretical and applied portions of the course</u>. Not meeting this minimum threshold will result in a grade of F for the course, even if greater than 50% is achieved overall.

Course Variations

The course will be taught as close to the listed schedule as possible, however some deviation from this schedule may be required as the term progresses.

Course Culture

We aim to cultivate a culture of mutual respect and collective curiosity. We ask that all students arrive to class on time, turn off their cell phones, and do not engage with materials that are outside of the course during class time. Please also be courteous of your neighbours by not distracting them during class time.

Learning Management System (LMS)

Important information is posted to the LMS on a weekly basis. It is your responsibility to check the LMS and their email on a regular basis to ensure you are not missing any important materials, updates, announcements, etc.

Materials posted to the Learning Management System are for personal use only. Posting class materials to course sharing sites could be considered both a copyright issue as well as a breach of academic integrity. If any course materials do appear on any of these sites, instructional materials such as lecture slides will no longer be provided.

Email

Due to the volume of emails received during the semester, I am unable to guarantee immediate responses to email enquiries. On average expect a one business day turnaround for responses to emailed questions.

Missed classes

All the information related to the logistical and administrative components of this course will be communicated in the lectures. If you miss any part of a lecture, it is your responsibility to contact a fellow student and catch up on what you missed, regardless of whether the absence was justified or not.

If you are aware that you will be missing more than a single class, please inform the instructor in advance of the planned absence.

Missed In-Class Tests

Makeup tests are not provided under normal circumstances. If an in-class test is missed and accommodations are granted by the instructor, the primary option for replacement value will be to complete a short paper, externally sourced, on a topic assigned by the instructor to earn replacement value.

Electronics in the Classroom

Laptop computers, tablet devices are permitted for taking notes during lectures and interacting with class room exercises (e.g., Poll Everywhere™ or Socrative™). To minimize distraction to other students, use for non-classroom related activities such as social media is not acceptable during the class section.

Mobile devices such as cellphones are to be set to 'silent mode' during the lecture period. Receiving calls, text conversations, etc. are distracting to other students and the instructor and are not acceptable during class time. Please step outside if you need to receive or make an important call, text, etc.

Submission of Work

To reduce the carbon footprint related to class delivery, most work will be submitted and graded electronically in the Brightspace LMS to reduce paper use. All written work will be subject to evaluation using a plagiarism detection service (see Academic Integrity Policy for further detail).

All students are responsible for ensuring the product they submit to the LMS is the one they intended to submit. There has been an emerging trend of "I submitted the wrong draft" as a justification for high similarity in originality detection, or as an effort to buy time to avoid late penalties from submitting after the scheduled due date. If a resubmission is permitted, that submission will be subject to a grade penalty unless there is timely notification from the student to the instructor that the wrong draft was submitted.

Unless otherwise noted, independent work is to be submitted. General discussion and peer tutoring is acceptable and encouraged; however, assessments with highly similar structure and flow of ideas is not acceptable and could be submitted to the faculty academic integrity officer for review.

Faculty of Science Course Syllabus (Section B)
ENVS / ERTH / GEOG 4530 & ERTH 5530
Environmental Remote Sensing (Winter 2019)

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Missed or Late Academic Requirements due to Student Absence (policy)
https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html