

TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
ADVENTURER TRAILBLAZER DEFENDER VISIONARY
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY

Syllabus

GEOG 4200/7480: Advanced Methods in Remote Sensing
(Winter 2023)

Clayton H. Riddell Faculty of
Environment, Earth, and Resources



UNIVERSITY
OF MANITOBA

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Traditional Territories Acknowledgement: *The University of Manitoba campuses are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.*

COURSE DETAILS

Course Title & Number:	GEOG 4200/7480 Advanced Methods in Remote Sensing
Number of Credit Hours:	3
Class Times & Days of Week:	2:30PM – 5:25PM, Thursdays
Location for classes/labs/tutorials:	Classes: Online using UMLearn Laboratories: Remote Access
Pre-Requisites:	GEOG 3200 or permission of Department Head

Instructor Contact Information

Instructor(s) Name & Preferred Form of Address:	Prof. Dustin Isleifson, Ph.D., P.Eng. Dr. Isleifson, Professor, Dr. I.
Pronouns:	He/him/his
Office Location:	EITC E3-513
Office Hours or Availability:	By appointment
Office Phone No.	204-474-6553 [My preferred form of communication is by email]
Email:	Dustin.Isleifson@umanitoba.ca Please ensure that you include the course number (GEOG 4200 or GEOG 7480) in the subject line of your email. I will typically return emails within two regular business days (and usually quicker than that). <i>Note:</i> All email communication must conform to the Communicating with Students university policy.
Contact:	Please email me to ask questions about the course or to request office hours or consultation times.

Course Description

U of M Course Calendar Description

Provides instruction in the current theory and application of remote sensing technology to Earth system Science. Emphasis will be placed on the processing and interpretation of remote sensing imagery and the integration of remote sensing data with other spatial data. Lab required. Prerequisite: GEOG 3200 (C), or permission of department head.

General Course Description

Advanced Methods in Remote Sensing is a 4th year course (GEOG 4200) that is held in conjunction with a graduate level section (GEOG 7480). The course is designed for students who have already acquired a fundamental understanding of remote sensing concepts, techniques, and applications. Laboratory assignments and project work serve to develop student remote sensing software and report writing skills, as well as presentation and communication skills.

Course Goals

The goal of this course is to introduce students with a basic knowledge of remote sensing image analysis to advanced topics in digital remote sensing to support environmental and cultural applications. The course emphasizes a hands-on learning environment, with in-depth insights into theoretical and conceptual underpinnings in satellite remote sensing. A major component of this course consists of computer-based lab assignments that largely practice the principles and methods introduced in the lectures. Ultimately, the course will empower students to delve more deeply into advanced issues in remote sensing and to customize and develop image processing tools for their particular area of interest.

Course Learning Objectives

1. Demonstrate knowledge and understanding of remote sensing concepts/theory by solving problems in laboratory assignments and timed examinations.
2. Describe optical and microwave remote sensing instruments through laboratory assignments and examinations.
3. Perform radiometric and geometric correction procedures through laboratory assignments.
4. Perform image classification on remote sensing imagery.
5. Describe and explain recent developments in remote sensing technologies and their applications.

Textbook, Readings, and Course Materials

Required textbook – Lillesand T.M., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. (7th Ed.) John Wiley and Sons.

Supplementary readings – Alternate textbooks and readings may be recommended by the professor.

Using Copyrighted Material

Please respect copyright laws. In this course, we will use content that is copyrighted. I will ensure that the content I use will appropriately be acknowledged. Any materials that I am providing to you through UMLearn or in the lectures is for your personal work and study and should not be distributed without my express permission. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Course Technology

You will need to use a personal computer (or equivalent) to access the UMLearn website. You will require a PDF viewer, such as Adobe Acrobat Reader, to view course materials. The laboratories will use remote sensing software and you will receive instruction on its use in the laboratory manuals.

No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Students may use laptops/tablets to take course notes in class.

Expectations: I Expect You To

- I will treat you with respect and would appreciate the same courtesy in return. See [Respectful Work and Learning Environment Policy](#).
- Students are required to attend all lectures and take notes. Not all material presented in the lectures is covered in the text. Lecture notes and slides will be provided on UMLearn (the learning management tool).
- Students are required to read the assigned chapters of the textbook prior to class. All of the sections of the textbook will not be covered in the lectures, but may be covered on the assignments or exam.
- Students are required to complete the necessary assignments individually and on time, unless otherwise stated. Students may consult with each other; however, all assignments must be submitted in the student's own words.
- Students should use their University of Manitoba email account for all communication with the instructor.
- It is the responsibility of each student to contact the instructor in a timely manner if they are uncertain about their standing in the course and about their potential for receiving a failing grade. Students should also familiarize themselves with the University's General Academic Regulations, dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- Video or audio recordings of the lectures are not permitted, unless you have my express permission.
- During lectures, you may take pictures of the screen or board for your personal reference, if you wish.

Class Communication:

All communication must comply with the Electronic Communication with Student Policy:

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html.

Academic Integrity:

Students are expected to conduct themselves in accordance with the highest ethical standards of the profession and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty. Visit the [Academic Calendar](#), [Student Advocacy](#), and [Academic Integrity](#) web pages for more information and support.

Student Accessibility Services:

The University of Manitoba is committed to providing an accessible academic community. [Students Accessibility Services \(SAS\)](#) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services
520 University Centre
Phone: (204) 474-7423
Email: Student_accessibility@umanitoba.ca

Expectations: You Can Expect Me To

- I will be using UMLearn for announcements, course content, WebEx, assignments, and examinations
- I will be using a mixture of online methods to deliver the course content to you. This will include:
 - Lecture-style delivery during the class times (synchronous delivery)
 - Prerecorded presentations or video material (asynchronous delivery)
- I will be using active learning strategies to involve you in the learning process
- I will be available after the class to discuss questions or comments on the lecture
 - If you would like a detailed discussion, please book a time for consultation
- You can expect to receive feedback on your laboratory assignments within one week of the due date. Marked laboratory assignments will be handed back to students by the start of the subsequent laboratory session.
- I will post my lecture notes and slides for your reference
- I might respond to your emails outside of “regular” office hours

CLASS SCHEDULE AND COURSE EVALUATION

This schedule is a guideline for students. It is subject to change at the discretion of the instructor, in response to student learning needs. Such changes will be subject to [Section 2.8 of ROASS](#).

In the event that a class must be canceled due to instructor medical or compassionate reasons, I will endeavour to make the information known as soon as possible, either through UMLearn announcement or the Departmental Office.

Major Topics	Subtopics	Lecture Number	Date
1. Introduction to Remote Sensing	Course Introduction	1	January 12, 2023
	Data Acquisition Systems	2	
2. Hyperspectral Remote Sensing	Overview	3	January 19, 2023
3. Optical Remote Sensing	Overview and discussion	4	
4. Digital Image Analysis	Overview - Image Processing	5	January 26, 2023
	Image Classification	6	February 2, 2023
	Change Detection	7	
5. LiDAR Remote Sensing	Overview	8	February 9, 2023
	Application	9	
6. Microwave Remote Sensing	Overview	10	February 16, 2023
	Physical and EM Properties of Materials	11	
Winter Term Break	--	--	February 23, 2023
6.1 Passive Microwave	Overview	12	March 2, 2023
	Application	13	
6.2 Active Microwave Remote Sensing	Overview	14	March 9, 2023
	Synthetic Aperture Radar and Altimetry	15	
	Polarimetry	16	March 23, 2023
	Oceanic Remote Sensing	17	
7. Advanced Topics	TBD	18	March 30, 2023
8. Student Seminars	Student Seminars	--	
	Student Seminars	--	April 6, 2023
Review	Review Lecture	--	April 13, 2023

Lab Expectations

All laboratory reports are due one week after the laboratory session. Please hand in your laboratory report electronically using UMLearn.

Lab Schedule

Laboratory	Assignment Handed Out	Lab Content
Lab #1	January 26, 2023	Software overview. ENVI Imagery
Lab #2	February 16, 2023	Image Processing in ENVI
Lab #3	March 2, 2023	Change Detection
Lab #4	March 16, 2023	Image Classification

Grading

The final course grade is determined by the student's performance on laboratory assignments, a project, and a final examination. Students must complete all project and laboratory assignments in order to be eligible to receive a passing grade.

GEOG 4200

Component	Value (%)
Laboratory Assignments	60%
Journal Article Presentation	10%
Journal Article Report	5%
Final Exam	25%

GEOG 7480

Component	Value (%)
Laboratory Assignments	60%
Seminar Presentation	10%
Seminar Report	15%
Final Exam	15%

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Letter Grade	Mark
A+	90% or above
A	80% - 89%
B+	75% - 79%
B	70% - 74%
C+	65% - 69%
C	60% - 64%
D	50% - 59%
F	49% or below

Voluntary Withdrawal

Voluntary withdrawal deadline is March 22, 2023.

Students who do not drop the course by the deadline will be assigned a final grade. Note that the withdrawal from a course will be recorded on official transcripts. Please refer to the [Registrar's Office](#) web page for more information.

ASSIGNMENT DESCRIPTIONS

The final course grade is determined by the student's performance on laboratory assignments, a project (journal article report and presentation for GEOG 4200 students and a seminar report and presentation for GEOG 7480 students), and a final examination. Rubrics on laboratory assignments and the course project will be provided.

Journal Article Report and Presentation (GEOG 4200)

Undergraduate students (GEOG 4200) are required to review one major research article. The article must be chosen from a major scholarly journal and should not have been reviewed by you in a different course. The article should focus on either the application of a specific remote sensing system to an environmental issue or a digital image processing technique. A summary report must be submitted to the instructor for evaluation. Each undergraduate student needs to create a presentation and lead the discussion for the

chosen article. The student must prepare a set of questions for that particular article. All students are expected to participate in the discussion. Further details will be provided in an assignment on UMLearn.

Seminar Report and Presentation (GEOG 7480)

Graduate students (GEOG 7480) are required to prepare a seminar report, consisting of a literature survey on the use of remote sensing (e.g., type of sensor or analytical technique) in the study of their thesis topic. It should provide a general background on the thesis topic and how a sensor type or analytical technique may be used to examine that topic. The literature survey must be submitted to the instructor for evaluation. Each graduate student needs to create a seminar presentation and lead a discussion. All students are expected to participate in the discussion. Further details will be provided in an assignment on UMLearn.

Final Examination

The final exam will consist of short answer questions. These questions will be based on lectures, assignments, assigned readings, and class discussion. If you miss the final exam due to illness or compassionate reasons, you must make arrangements with your own Faculty office for a deferred exam. Scheduling of the deferred exam is at the discretion of the Instructor/department office, in consultation with the student.

Referencing Style

Please use the IEEE referencing style in your reports. Information on this referencing style is available through the University of Manitoba libraries website. See the following link for more details:
<https://libguides.lib.umanitoba.ca/citingandwriting>

Assignment Feedback

Laboratories assignments primarily consist of computer simulations. A marking rubric will be provided on the laboratory assignments.

Assignment Extension and Late Submission Policy

Late laboratory and project submissions may be penalized at the rate 20% of the assessment value per day. In the event that you are unable to hand in the assignment due to a medical or compassionate reason, please contact the instructor to make arrangements.

UNIVERSITY SUPPORT OFFICES & POLICIES

Schedule "A"

A list of University governing documents pertaining to students can be found here:

http://umanitoba.ca/admin/governance/governing_documents/students/index.html

Academic Resources

Various academic resources are available to students including the Donald W. Craik Engineering Library, Science and Technology Library and various departmental help centres.

Health & Mental Health Resources

Students with Health and/or Mental Health issues may seek advice and/or help from Student Counselling

Center, Student Accessibility Services, and University Health Services.

<http://umanitoba.ca/student-supports/counselling-resources-students>

<http://umanitoba.ca/student/health/>

Live Well @ UofM

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

<http://umanitoba.ca/student/livewell/index.html>

Copyright and Intellectual Property Resources

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. Visit

<http://umanitoba.ca/copyright> for more information

University and Unit Policies are available online

Your rights and responsibilities

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The [Academic Calendar](http://umanitoba.ca/student/records/academiccalendar.html) <http://umanitoba.ca/student/records/academiccalendar.html> is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form <http://umanitoba.ca/registrar/>
- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support <http://umanitoba.ca/academicintegrity/> View the **Student Academic Misconduct** procedure for more information.
- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

Respectful Work and Learning Environment

http://umanitoba.ca/admin/governance/governing_documents/community/230.html

Student Discipline

http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

Violent or Threatening Behaviour

http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at:
http://umanitoba.ca/admin/governance/governing_documents/community/230.html
More information and resources can be found by reviewing the Sexual Assault site
<http://umanitoba.ca/student/sexual-assault/>
- For information about rights and responsibilities regarding **Intellectual Property** view the policy http://umanitoba.ca/admin/governance/media/Intellectual_Property_Policy_-_2013_10_01.pdf

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site

<http://umanitoba.ca/faculties/>

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations <http://umanitoba.ca/academic-advisors/>

Student Advocacy

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>

520 University Centre

204 474 7423

student_advocacy@umanitoba.ca