

UNIVERSITY OF MANITOBA
CHR FACULTY OF EARTH, ENVIRONMENT, AND RESOURCES
DEPARTMENT OF ENVIRONMENT AND GEOGRAPHY

GEOG 4200/7480 ADVANCED METHODS IN REMOTE SENSING
COURSE OUTLINE: FALL 2016

GENERAL INFORMATION

Dr. John Iacozza

Phone: (204) 474-8483

Office hours: Tuesday and Thursday 8:30-9:30 am, or by appointment.

Course website: umlearn.ca

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COURSE DESCRIPTION

This course is designed for students who have already acquired a fundamental understanding of remote sensing concepts, techniques and applications. The goal of this course is twofold: 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. Specifically, this course will tackle three major areas of remote sensing: an overview of the remote sensing process (review of introductory remote sensing), an in-depth review of the major techniques in digital image processing; and an introduction to the LIDAR and hyperspectral remote sensing systems. 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 principle 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.

My goal for this course is to make sure every student receives an excellent final grade and each student live up to their full potential.

LEARNING OBJECTIVES

- Review basic terminology related to remote sensing
- Review optical and microwave remote sensing instruments
- Examine radiometric and geometric correction procedures
- Examine image processing techniques including classification
- Describe Lidar and hyperspectral remote sensing systems and methods to analyze imagery data

TEXTBOOK

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

EVALUATION

GEOG 4200

Journal article presentation:	10%
Journal article report:	5%
Lab assignments (4):	60%
Participation:	10%
Final test:	15%

GEOG 7480

Journal article presentation (2):	20%
Journal article report (2):	10%
Lab assignments (4):	60%
Participation:	10%

FINAL GRADE ALLOCATION

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

STUDENT RESPONSIBILITIES

- A high level of student cooperation and participation, involving asking and answering questions during the lectures.
- **Cell phones and portable music players must be turned off during lectures. Students are also required to remove earphones. NO TEXTING DURING CLASS.** Students may use laptops/tablets to take course notes in class. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline “gaming” during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it.
- Students are required to attend all lectures and take notes. Students are expected to be punctual for classes. Not all material presented in the lectures is covered in the text. *If you miss a lecture, make arrangements to get notes from a fellow student, not from instructor!* Lecture slides will not be provided on UMLearn (the learning management tool). Failure to attend lectures will result in a poor class participation grade.
- The individual student is required to read the assigned chapters of the textbook *prior to class*. Not all the textbook will be covered in the lectures but may be covered on the quiz or exam.
- Students are required to complete the necessary assignments individually and on time, unless otherwise stated. Students may consult with other students, however it is expected that all assignments will be submitted in the student’s own words. Failure to do so will result in a penalty (see section of course outline on Academic Integrity)
- The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit:
http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf
- Please note that all communication between myself and you as a student must comply with the electronic communication with student policy
(http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

VOLUNTARY WITHDRAWAL DATE

The voluntary withdrawal date is the last date for withdrawing from this course without academic penalty. The voluntary withdrawal date for this course is November 18, 2016. Evaluative feedback for first two assignments will be provided prior to this date.

COURSE POLICIES

Audio/Video Recording: John Iacozza and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission by John Iacozza. Course materials (both paper and digital) are for the participant's private study and research.

Feedback: formative (i.e. comments) and summative (i.e. grade) feedback will be provided to the student within two weeks of the assignment due date (or as soon as possible). This feedback will be provided through online UMLearn

Questions/Concerns: If you are having a problem and want to discuss something, please feel free to see me before/after class, during my office hours or make an appointment at a more convenient time. I can be reached through phone or email (preferred method).

Emails: Ensure that the course name and number are included in the subject line for all emails. Please make sure emails are written in a professional manner, including complete sentences and do not use text language (I am not fluent in shorthand). Please address the email to John or Dr. Iacozza (not Buddy or any similar terms). Emails must be sent from University of Manitoba email accounts; emails from other accounts (such as gmail) will not be responded to. Emails will typically be responded to during regular office hours. You should not expect a response on weekends or in the evenings (i.e. after 4 pm).

Academic Integrity: Academic dishonesty (plagiarism, cheating) is a very serious matter in any academic institution and is dealt with severely at the University of Manitoba.

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room (e.g., crib notes, pagers or cell phones). Exam cheating can also include exam personation (see below). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty, including a grade of zero on the assignment/exam, a final grade of F in the course or expulsion from the University (based on severity of offense).

To plagiarize is to take ideas or words of another person and pass them off as one's own. In short, it is stealing something intangible rather than an object. Plagiarism applies to any written work, in traditional or electronic format, as well as orally or verbally presented work. Obviously it is not necessary to state the source of well-known or easily verifiable facts, but students are expected to appropriately acknowledge the sources of ideas and expressions they use in their written work, whether quoted directly or paraphrased. This applies to diagrams, statistical tables and the like, as well as to written material, and materials or information from Internet sources. Students must use either APA or Chicago styles to properly reference work. Students will be penalized 20% if another style or footnotes are used in the assignment. Information on the acceptable styles is available through the UM Libraries at: <http://libguides.lib.umanitoba.ca/c.php?g=298394>

To provide adequate and correct documentation is not only an indication of academic honesty but is also a courtesy which enables the reader to consult these sources with ease. Failure to provide appropriate citations constitutes plagiarism. It will also be considered plagiarism and/or cheating if a student submits a term paper written in whole or in part by someone other than him/herself, or copies the answer or answers of another student in any test, examination, or take-home assignment.

Working with other students on assignments, laboratory work, take-home tests, or on-line tests, when this is not permitted by the instructor, can constitute Inappropriate Collaboration and may be subject to penalty under the Student Discipline By-Law.

An assignment which is prepared and submitted for one course should not be used for a different course. This is called “duplicate submission” and represents a form of cheating because course requirements are expected to be fulfilled through original work for each course.

Please familiarize yourself with the University policy on academic dishonesty found on the following website: http://www.umanitoba.ca/student/resource/student_advocacy/cheating_plagiarism_fraud.html. When in doubt about any practice, ask your professor or instructor.

Examinations Personations is when a student who arranges for another individual to undertake or write any nature of examination for and on his/her behalf, as well as the individual who undertakes or writes the examination, will be subject to discipline under the university’s Student Discipline Bylaw, which could lead to suspension or expulsion from the university. In addition, the Canadian Criminal Code treats the personation of a candidate at a competitive or qualifying examination held at a university as an offence punishable by summary conviction. Section 362 of the code provides:

Personation at Examination

362. Everyone who falsely, with intent to gain advantage for him/herself or some other person, personates a candidate at a competitive or qualifying examination held under the authority of law or in connection with a university, college or school or who knowingly avails him/herself of the results of such personation is guilty of an offence punishable on summary conviction. 1953-54,c.51, s.347.

Both the personator and the individual who avails him/herself of the personation could be found guilty. Summary conviction could result in a fine being levied or up to two years of imprisonment.

A complete copy of the Final Examination Procedures is available at:

http://umanitoba.ca/admin/governance/governing_documents/academic/final_examinations_procedures.html

Students are encouraged to review the University policy on Responsibilities of Academic Staff with Regards to Students (ROASS): umanitoba.ca/admin/governance/governing_documents/students/278.html

TESTING

The final exam will consist of short answer questions. These questions will be based on lectures, assigned readings and class discussion. No extraneous devices (i.e. dictionaries, cell phones, notes, textbooks, etc.) will be allowed for the final exam. You will need to bring a writing utensil (i.e. pencil/pen) and a form of identification (Student ID card preferred). 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.

ASSIGNMENTS

Four assignments will be distributed through the term. The assignments will focus on the practical application of the remote sensing analysis techniques. The first assignment will focus on the formulation of a research problem. The student is encouraged to select a topic of interest with a focus on a physical or human geographic issue. The second and third assignments will focus on a data collection method and actual collection that can be used to examine the geographic problem in the first assignment. The final assignment requires the student to produce a document that will highlight the dissemination of the results for the geographic problem.

Assignments must be submitted as a **SINGLE WORD DOCUMENT** and electronically through UMLearn (formally D2L). The course website is available for registered students at: umlearn.ca. Your login name and password are the same as your UMnetID. Documents **MUST** be labelled with the student name, student number and assignment number. Emailed assignments **WILL NOT** be accepted at any time for any reason and therefore will not be graded. If you are not familiar with UMLearn, please ask your instructor. Assignment grades will

only be posted on UMLearn and not through email. Grading rubrics and instructions will be provided on each assignment.

Assignments must be handed in on time – by 2:30 pm on due date. **Late assignments will be given a grade of 0** unless the student has obtained Instructor approval in advance of the deadline.

Reasons for granting an extension (assignment or quizzes): a death in your immediate family, an illness in either yourself or in a dependent (requires written note from a doctor dated on the assignment due date), and required to travel for work. The Instructor will not accept a note dated **AFTER** the due date.

Reasons for not granting an extension: having another assignment due at a similar time/day, being away from the university for a personal reason (i.e. holiday or personal vacation), being too busy with other course work (i.e. having a midterm that same day or week), not attending the lectures due to personal or compassionate reasons (or other reasons), car broke down and could not submit assignment on time, computer is not working properly and you lost the assignment, or any other reason deemed inappropriate by the instructor. This is not an exhaustive list. Please don't ask for an extension if any of these or similar reasons apply. If you know that you will be away, you **MUST** submit the assignment before the due date.

JOURNAL ARTICLE REVIEW

Each student is required to review at least one major research article chosen by yourself (graduate students must review two articles). 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. You are **NOT** allowed to use any web materials to replace a journal article. Each participant needs to do a 15-minute presentation and lead discussion for one article. The leader is expected to prepare a set of questions (5 or so) for that particular article in one week before the actual discussion. These questions should be given to the instructor to be posted on the course site, and students should download the questions prior to class. The leader should prepare some slides to initiate the discussion based on the questions and major results from the journal article. The summary report (no more than 5 pages) is due one week after the discussion. Each discussion session could last up to 15 minutes depending upon the topic. All students are expected to participate in the discussion.

Remote Sensing Journals (further journals can be found in your text)

- Photogrammetric Engineering and Remote Sensing (American Society for Photogrammetry and Remote Sensing)
- International Journal of Remote Sensing (Taylor & Francis)
- Remote Sensing of Environment (Elsevier)
- IEEE Transactions of Geosciences and Remote Sensing
- IEEE Geoscience and Remote Sensing Letters
- ISPRS Journal of Photogrammetry and Remote Sensing
- International Journal of Applied Earth Observation and Geoinformation
- Canadian Journal of Remote Sensing (CRSS)
- GIScience and Remote Sensing

SPECIAL NEEDS

Students with disability-related needs or are experiencing difficulty should discuss issues with a councillor in one of the following Student Affairs offices as soon as possible. You can also discuss any issues with your instructor, who can direct you to appropriate institutional resources. Student accessibility services (SAS) can facilitate any necessary accommodations for the student. If applicable, please see the Instructor regarding the accommodations recommended by SAS.

- Student Accessibility Services: 155 University Center, 204-474-6213, 204-474-9790 (TTY)
- Learning Assistance Center: 201 Tier Building, 204-480-1481
- Student Counselling and Career Centre: 474 University Center, 204-474-8592

USING COPYRIGHTED MATERIAL

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

COURSE/ASSIGNMENT SCHEDULE

WEEK	TOPIC	READING	ASSIGNMENT
September 14	<ul style="list-style-type: none">• Course introduction• Review terms and remote sensing process	pp. 1-51	
September 21	Optical remote sensing Radiometric and geometric correction	pp. 218-243	
September 28	Image classification	pp. 537-583	
October 5	Microwave remote sensing	pp. 385-443; 462-471	Assignment 1 Due
October 12	Microwave remote sensing		
October 19	Hyperspectral remote sensing	pp. 271-282	
October 26	Lidar remote sensing	pp. 471-484	Assignment 2 Due
November 2	Advanced techniques I	pp. 582-608	
November 9	Advanced techniques I		
November 16	Advanced techniques II		Assignment 3 Due
November 23	Advanced techniques II		
November 30	Review		
December 7	Final test		Assignment 4 Due

UNIVERSITY POLICIES AND PROCEDURES

A list of academic supports available to Students:

Writing and Learning Support

The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor's feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at: <http://umanitoba.ca/student/academiclearning/>

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 201 Tier Building.

University of Manitoba Libraries (UML)

As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources, and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by subject: <http://bit.ly/WcEbA1> or name: <http://bit.ly/1tJObB4>. In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. For a listing of all libraries, please consult the following: <http://bit.ly/1sXe6RA>. When working remotely, students can also receive help online, via the Ask-a-Librarian chat found on the Libraries' homepage: www.umanitoba.ca/libraries.

Referral information for mental health resources and support:

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781. You may also find the following resources helpful:

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. Student Counselling Centre:

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

474 University Centre or S207 Medical Services

(204) 474-8592

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

Student Support Intake Assistant <http://umanitoba.ca/student/case-manager/index.html>

520 University Centre

(204) 474-7423

University Health Service

Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

University Health Service <http://umanitoba.ca/student/health/>

104 University Centre, Fort Garry Campus

(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness

Contact our Health and Wellness Educator if you are interested in information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

Health and Wellness Educator <http://umanitoba.ca/student/health-wellness/welcome.html>

Katie.Kutryk@umanitoba.ca

469 University Centre

(204) 295-9032

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

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.

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> 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.

Respectful Work and Learning Environment

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

Please refer to the document:

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

Student Discipline

Please refer to the document:

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

Violent or Threatening Behaviour

Please refer to the document:

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

Sexual Assault

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/>

Intellectual Property

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