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

GEOG 3200 INTRODUCTION REMOTE SENSING
COURSE OUTLINE: FALL 2018

GENERAL INFORMATION

Dr. John Iacozza
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Office hours: Monday and Wednesday at 8:30 – 9:20 am, or by appointment.

DESCRIPTION

Remote sensing is defined as any technique used to obtain an observation or measurement from a distance. Numerous techniques fit this definition, ranging from aerial photographs to satellite based systems. This course will provide an introduction to these remote sensing systems, as well as the general theory and principles of electromagnetic interaction. Applications including geological, geomorphological, climatological and environmental monitoring will also be discussed throughout this course. Upon completion, students will be able to advise on the various types of remote sensing data that are available and on various processing procedures for extracting information from remote sensing data (through developed computer laboratory assignments).

TEACHING PHILOSOPHY

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.

If you failed at something it means you have tried…and you can try again!

COURSE OBJECTIVES

- Describe the remote sensing process, including the various steps from energy source to product
- Calculate the properties of electromagnetic radiation, including frequency, wavelength and scattering/reflection.
- Discuss how aerial photographic systems work, including basic operation and components
- Interpret aerial photographs using visual clues, and calculate basic photogrammetry measurements from aerial photographs
- Differentiate numerous satellite based remote sensing systems, including optical, microwave and LiDAR platforms, as well as specific satellites such as RadarSAT, LandSAT and Envisat.
- Explain the properties and distortions of various types of remote sensing systems
- Conduct basic digital imagery analysis, such as radiometric and geometric corrections, using industry standard software.
- Calculate basic properties of microwave imagery, including various types of resolution.

TEXTBOOK

REQUIRED: Lillesand T.M., R.W. Kiefer and J. Chipman. 2015. *Remote Sensing and Image Interpretation*. (7th Ed.) John Wiley and Sons. ISBN: 978-1-118-34328-9

PREREQUISITES

A grade of "C" or better in GEOG 1200 or GEOG 1201 (or 053.120) or GEOG 1290 or GEOG 1291 (or 053.129) and three credit hours in PHYS 1020 or PHYS 1021 (or 016.102), PHYS 1030 or PHYS 1031 (or 016.103), MATH 1300 or MATH 1301 (or 136.130), MATH 1500 or MATH 1501 (or 136.150), or written consent of the department.

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

EVALUATION

Midterm exam:	15%	Lab assignments:	50%
Final exam:	25%	Class participation:	10%

TENTATIVE DATES (please note that the dates may change)

ASSIGNMENT	*DATE*
Assignment #1	September 21, 2018
Assignment #2	October 5, 2018
Assignment #3	October 26, 2018
Assignment #4	November 23, 2018
Assignment #5	December 7, 2018

TEST	*DATE*
Midterm	October 19, 2018
Final Exam	Scheduled through SRO

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)

MIDTERM AND FINAL EXAM

The midterm and final exam will consist of multiple choice and/or 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 in the examination room. You will need to bring a writing utensil (i.e. pencil/pen) and a form of identification for the final exam (Student ID card preferred). If you miss the midterm exam, you are required to let me know ASAP and provide proper documentation for your absence. 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 test/exam is at the discretion of the Instructor/department office, in consultation with the student.

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 19, 2018. Evaluative feedback will be provided prior to this date.

ASSIGNMENTS

Because remote sensing is a tool not only for analysis but also communication, students will be required to prepare graphical and written materials, much as would be expected in a professional setting with the same quality. Computer-based assignments will focus on the practical application of remote sensing principles discussed in class to real-world data. Five assignments will be distributed through the term. The assignments will focus on a specific unit of the course.

Assignments must be submitted as a **SINGLE WORD DOCUMENT** and electronically through UMLearn (formally D2L). Submission of assignment in any other format (including PDF or pages) will be given a grade of 0, unless the Teaching Assistant (TA) grants permission prior to the deadline. Documents **MUST** be labelled with the student name and assignment number. Answers to questions must be provided in complete sentences. 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 be posted online.

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 TA approval in advance of the deadline.

Reasons for granting an extension (assignment or midterm): a death in your immediate family, an illness in either yourself or in a dependent (requires written note from a doctor dated **BEFORE** the assignment is due), 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 or midterm on the same 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.

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 written permission by John Iacozza. Course materials (both paper and digital) are for the participant's private study and research.

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.

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 online through 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).

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.

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. A grade of 0 will be given for any assignment that is suspected as academic dishonesty. If persistent or a major offense, further action will be taken including an F in the course and other university punishment.

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

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

COURSE/READING SCHEDULE

LECTURE TOPIC	*READINGS*
Unit 1: Introduction and History	pp. 1-4; 30-49 pp. 86-88

Learning Objectives:

- define what is meant by 'remote sensing' in the context of image acquisition and interpretation,
- describe the broad components and characteristics of the remote sensing process,
- explain the various types of resolution and data levels as applied to remote sensing products,
- interpret the steps involved in the application of remote sensing products into research, and
- discuss the technological and theoretical advances over the past 1000 years as pertaining to remote sensing.

Unit 2: Electromagnetic Energy	pp. 4-30

Learning Objectives:

- describe the concept and major divisions of the EM spectrum,
- calculate the properties of EM energy using physical laws,
- examine the outcome of solar energy as it passes through the atmosphere and interacts with the surface,
- discuss the atmosphere and geometric influences on the spectral response of surface features as related to remote sensing products

Unit 3: Aerial Photography and Photogrammetry	pp. 85; 89-140; 146-217; pp. 59-78

Learning Objectives:

- discuss the characteristics of aerial photographic systems, including cameras, film and filters,
- examine photographic basics associated with exposure, geometric factors, and spatial resolution,
- explain the different generic types of aerial photographs and the factors and elements associated with vertical photographs,
- calculate basic photogrammetric properties that can be estimated from aerial photographs, and
- identify features in an aerial photograph based on the image interpretation factors.

Unit 4: Optical Remote Sensing	pp. 218-242; pp. 283-38

Learning Objectives:

- explain the characteristics of satellite-based remote sensing,
- describe the properties of optical remote sensors including LandSat, SPOT and EOS satellites,
- describe high resolution satellite remote sensing systems, and
- discuss optical remote sensors designed for ocean monitoring and meteorology.

LECTURE TOPIC	*READINGS*
Unit 5: Microwave Remote Sensing	pp. 385-425; pp. 441-464; pp. 466-471

Learning Objectives:

- differentiate between microwave and optical remote sensing systems, and the various types of passive and active microwave systems,
- calculate the basic geometric properties of microwave systems, including resolution and distortion,
- describe the geometric and image characteristics of generic radar and radiometer systems,
- interpret radar images based on factors including the surface roughness, incidence angles and scattering, and
- discuss the orbital and sensor characteristics of specific active and passive satellite microwave systems.

Unit 6: Other Systems	pp. 471-484; pp. 271-282; pp. 243-269

Learning Objectives:

- describe the basic operational structure of hyperspectral, Lidar and thermal remote sensors,
- explain the thermal radiation properties as applied to remote sensing, and
- discuss the remote sensing of the planetary boundary layer (PBL) and the different systems used to measure variables near the surface.

Unit 7: Introductory Image Processing	pp. 485-512

Learning Objectives:

- list the seven categories of digital image processing techniques in remote sensing,
- explain radiometric and geometric image rectification and restoration techniques,
- apply correction techniques to a remote sensing image,
- discuss the various contrast manipulation tools that can be used to enhance an image, and
- describe the methods available to enhance a spatial feature in an image.

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/1tJ0bB4. 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 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