


GEOG 2230B – Remote Sensing Course Outline: Section 001 Winter 2021



Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the [Digital Student Experience](#) website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: <https://www.uwo.ca/health/>.

1. Technical Requirements



Stable internet connection



Laptop or computer



Working microphone



Working webcam



Zoom application installed



You will also need external storage units (a USB key or an external hard drive) for backing up lab data.

Lectures and lab sessions are synchronous via Zoom and you will need a computer or laptop, stable internet connection, a microphone and webcam to participate in those sessions.

Recommended technical specifications: <https://registrar.uwo.ca/academics/timetables.html>

Western Zoom webpage, including privacy information: <https://wts.uwo.ca/zoom/index.html>.

2. Course Information



Delivery Mode	Dates	Time
Online synchronous lectures session 001	Tuesday	2:30-4:30 pm
online synchronous lab session 002	Wednesday	12:30-2:30 pm
online synchronous lab session 003	Thursday	12:30-2:30 pm

*Details about design and delivery of the course are listed below

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
January 11	February 13-21	April 12	April 13	April 14-30

* January 19, 2021: Last day to add a second-term half course

** March 15, 2021: Last day to drop a second-term half course



Course Instructor	Contact Information	Office Hours
Dr. Jinfei Wang	Email address: jfwang@uwo.ca	Wednesdays 4:30-5:30 pm

Teaching Assistant(s)	Contact Information	Office Hours
Wed. lab: Robin Kwik	rkwik@uwo.ca	Tuesdays 12:00-2:00 pm
Thur. lab: TBA	Email address	TBA
Lab support: Kathy Tang	ktang28@uwo.ca	



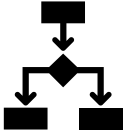
Drop in office hours will be held remotely using Zoom. You can find the Zoom links in OWL.

3. Calendar Description

Introduction to the principles, techniques, and geographic applications of remote sensing systems. Computer processing of remote sensing digital data. Interface of remote sensing data with geographic information systems.

2 lecture hours, 2 laboratory hours; 0.5 course

Prerequisite(s): 1.0 from [Geography 1100](#), [Geography 1200A/B](#), [Geography 1300A/B](#), [Geography 1400F/G](#), [Geography 1500F/G](#), [Geography 2131A/B](#), [Geography 2132A/B](#), [Geography 2133A/B](#), [Geography 2142A/B](#), [Geography 2152F/G](#), [Geography 2153A/B](#), [Environmental Science 1021F/G](#); or registration in a module in Science or in Engineering, in the Major in Physical Geography, in the Certificate in Geographic Information Science, or in the Commercial Aviation Management program in MOS.



Prerequisite checking is the student's responsibility

Senate Regulations state, "unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites."

4. Textbook

Primary Textbook:

Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., 2015, "Remote Sensing and Image Interpretation", 7th Edition, John Wiley & Sons. (ISBN : 978-1-118-34328-9 (print); 978-1-118-91947-7 (e-book)).



Other recommended Readings:

Jensen, J.R., 2016, "Introductory Digital Image Processing – A Remote Sensing Perspective", 4rd Edition, Prentice Hall. (ISBN-10: 0-13-405816-X; ISBN-13: 978-0-13-405816-0)

Richards, A. J. 2013, "Remote Sensing Digital Image Analysis", 5th edition, Springer. (ISBN: 978-3-642-30061-5 (Print); 978-3-642-30062-2 (Online)).

Jensen, J.R., 2007. "Remote sensing of the Environment – An Earth Resource Perspective", 2nd edition, Prentice Hall. (ISBN 978-0-13-188960-7)

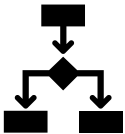
5. Course Format

Mode	Dates	Time	Frequency
Virtual synchronous lectures	Tuesday	2:30-4:30 pm	weekly
Virtual synchronous lab session 002	Wednesday	12:30-2:30 pm	weekly
Virtual synchronous lab session 003	Thursday	12:30-2:30 pm	weekly

Attendance and participation: Each student is required to attend all Zoom lectures, in order to understand the course material and the theoretical parts of the labs.

Students are responsible for material covered in the lectures as well as the assigned chapters/sections in the text.

Lab assignments: You must attend all labs. You should observe all the due dates/times for assignments. Plagiarism or copying is unacceptable. If there are two identical answers to a lab. Or parts of the lab., both students will be given a mark of 0 for that lab. The penalty of a late assignment is 2^n percent of the maximum mark for the assignment, where n = number of days late. (i.e., If you are late one day, 2% off; two days, 4% off; three days, 8% off; four days, 16% off; five days, 32% off; six days, 64% off; seven days, 100% off).



Required for all computer labs: One or two USB memory key, or a portable hard drive for storing data and results. I suggest that you double backup your work on two USBs, in case one USB has problems.

Each student will participate in a group presentation about remote sensing data (2 students per group). You will choose from a list of topics, conduct research and prepare a power point presentation.

All course material will be posted to OWL: <http://owl.uwo.ca>. Any changes will be indicated on the OWL site and discussed with the class.

Google Chrome or Mozilla Firefox are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#). [Using the right browser is important, especially when using different features integrated with OWL]

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

6. Course Content and Schedule

Course Content and readings:

Introduction to Remote Sensing

Readings: *Lillesand and Kiefer, (7th Ed.): Chapter 1, pp. 1-58.*
(*Lillesand and Kiefer, (6th Ed.): Chapter 1, pp. 1-51.*)

- Remote sensing
- Electromagnetic radiation (EM wave, Stefan-Boltzmann Law, Wien's Displacement Law)
- Data acquisition (energy source, the atmosphere, energy interactions at the Earth's surface, the sensor)
- Data analysis (data interpretation, information products, applications).
- Field measurements - ASD spectrometer

Aerial analog / digital images and Photogrammetry

Readings: *Lillesand and Kiefer, (7th Ed.): Chapter 2, pp. 85-145 3, pp.146-217.*
(*Lillesand and Kiefer, (6th Ed.): Chapter 3, pp.123-188.*)

- Introduction
- Stereoscopy with aerial photographs
- Photo scale
- Relief displacement
- Image parallax
- Height measurement
- Structure from Motion and UAV data collection

Digital Image Processing - Image Enhancement

Readings: *Lillesand and Kiefer, (7th Ed.): Chapter 7, pp.485-537.*
(*Lillesand and Kiefer, (6th Ed.): Chapter 7, pp.482-545.*)

- Digital image concept
- Contrast manipulation (linear stretch, histogram equalization)
- Spatial feature manipulation (low pass filters, high pass filters)
- Multi-image manipulation (false colour composites, Principle Components Analysis)

Digital Image Processing - Image Classification

Readings: *Lillesand and Kiefer, (7th Ed.): Chapter 7, 537-608.*
(*Lillesand and Kiefer, (6th Ed.): Chapter 7, 545-610.*)

- Supervised classification (minimum-distance-to-means classifier, parallelepiped classifier, maximum likelihood classifier)
- Unsupervised classification (k-means clustering)
- Accuracy assessment

Remote sensing image interpretation and applications

Readings: *Lillesand and Kiefer, (7th Ed.): Chapter 1, pp.59-84; Chapter 8, pp. 609-698.*
(*Lillesand and Kiefer, (6th Ed.): Chapter 4, pp. 189-323.*)

- Land use/land cover mapping

- Agricultural applicatinon
- Forestry application
- Water resource application
- Urban application
- Terrain analysis; Geologic/Geomorphic application

Remote sensing case studies

Remote Sensing Data (Student Presentations)

Readings: *Lillesand and Kiefer, (7th Ed.): Chapters 4, pp. 218-282; Chapter 5, 283-382; and Chapter 6, 385-484 .*
(Lillesand and Kiefer, (6th Ed.): Chapters 6 and 8, pp. 392-481; 626-726.)

Additional readings (search by students)

- Landsat satellites; SPOT satellites; ASTER, IRS, etc.
- Fine resolution land satellites (IKONOS-2, Quickbird, etc.)
- Hyperspectral satellite systems (MODIS, CHRIS/PROBA, Hyperion, etc.)
- Radar satellites (ERS-1, ENVISAT, RadarSat, etc...)
- Meterological satellites (NOAA AVHRR, etc)
- and more ...

Tentative Schedule:

Week	Dates	Topic	Labs assigned	Lab due
1	Jan 11 – 17	Introduction to the course/ 1. Introduction to remote sensing	No lab	
2	Jan 18 – 24	1. Introduction to remote sensing	Lab #1	
3	Jan 25 – 31	2. Aerial photographs and photogrammetry	Lab #2	Lab #1 due
4	Feb 1 – 7	2. Aerial photographs and photogrammetry	Lab #3 Software installation	
5	Feb 8 – 14	3. Digital image processing – image enhancement	Lab #3	Lab#2 due
6	Feb 15 – 21	Reading Week	N/A	
7	Feb 22 – 28	4. Digital image processing – image classification	Lab #4	Lab #3 due
8	Mar 1 – 7	4. Digital image processing – image classification	Lab #5	Lab#4 due
9	Mar 8 – 14	4. Digital image processing – image classification	Lab #5	
10	Mar 15 – 21	5. Remote sensing image interpretation and applications 6. Remote sensing case studies	Lab #6	Lab #5 due
11	Mar 22 – 28	Student presentations		Lab#6 due
12	Mar 29 – Apr 4	Student presentations		
13	Apr 5 – 11	Student presentations	Presentations if needed	
14	Apr 12-18			Term paper due April 16



7. Online Participation and Engagement



- Students are expected to participate and engage with content as much as possible
- Students are expected to attend all lectures and labs and can interact with the instructor and the TAs during the online sessions
- Students can also participate by interacting in the forums with their peers and TAs/instructors.

8. Communication



- Students should check the OWL site at least before lectures and labs.
- Students should email their instructor(s) and teaching assistant(s) using OWL “messages”
- For any other communication, the centrally administered **e-mail account** provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner. You can read about the privacy and security of the UWO email accounts [here](#).
- Emails will be monitored frequently; students will receive a response in 48-72 hours
- This course will use the OWL forum for discussions
- Students should post course-related content on the discussion forum so that everyone can access answers to questions
- The discussion forums will be monitored by instructors or teaching assistants

9. Evaluation

Below is the evaluation breakdown for the course. Any deviations will be communicated.

Assessment	Format	Weighting	Due Date
Attendance and participation	Random attendance check	5%	Ongoing
Written and computer lab assignments	Written and computer labs	60%	See schedule table
Class presentation	Zoom presentation	10%	TBA
Final report	Written report	25%	In final exam period

Students are responsible for material covered in the lectures as well as the assigned chapters/sections in the text.

Lab assignments:

- Lab 1 Fundamentals of Remote Sensing (8%)
- Lab 2 Photogrammetry and 3D reconstruction (10%)
- Lab 3 Digital image processing – Image enhancement (10%)
- Lab 4 Digital image classification concepts (7%)
- Lab 5 Image classification I – Training data collection (15 %)
- Lab 6 Image classification II – Classification and accuracy assessment (10%)



Information about late or missed evaluations:

Late assignments without illness self-reports will be subject to a late penalty. The penalty of a late assignment is 2^n percent of the maximum mark for the assignment, where n = number of days late. (i.e., If you are late one day, 2% off; two days, 4% off; three days, 8% off; four days, 16% off; five days, 32% off; six days, 64% off; seven days, 100% off).

Late assignments with illness self-reports should be submitted within 24 hours of submission of the last illness self-report

An assignment cannot be submitted after it has been returned to the class.

Grades will not be adjusted on the basis of need. It is important to monitor your performance in the course. Remember: *You* are responsible for your grades in this course.

10. Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](#).

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see

[Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs](#)

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the [Western Multicultural Calendar](#).

11. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.



1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
2. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
3. Take notes as you go through the lesson material. Treat this course as you would a face-to-face course. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively.
4. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
5. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor(s) and or teaching assistant(s).
6. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

12. Use of Recordings

The remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

13. Statements concerning Online Etiquette

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- Please “arrive” to class on time
- Please use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- Ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- To minimize background noise, kindly mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- Please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable
- Unless invited by your instructor, do not share your screen in the meeting.

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- If you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question
- Remember to unmute your microphone and turn on your video camera before speaking
- Self-identify when speaking
- Remember to mute your mic and turn off your video camera after speaking (unless directed otherwise)

General considerations of “netiquette”:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
- Be professional and scholarly in all online postings. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

14.Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

15.Western’s Commitment to Accessibility

The Department of Geography strives at all times to provide accessibility to all faculty, staff, students and visitors in a way that respects the dignity and independence of people with disabilities.

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2147 for any specific question regarding an accommodation. [Information regarding accommodation of exams](#) is available on the Registrar's website.

More information about ["Accessibility at Western"](#) is available.

16. Mental Health

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit Western's [Health and Wellness website](#) for more information on mental health resources.

17. Support Services

[Western's Support Services](#)
[Student Development Centre](#)

18. Important Dates

January 11: Classes resume

January 19: Last day to add a second term half course

February 15: Family Day – Department Office Closed

February 13 to February 21: Spring Reading Week (No classes; Department Office open)

March 15: Last day to drop a first term half course without penalty

April 2: Good Friday

April 12: Classes end

April 13: Study day

April 14 to April 30: Examination Period