

GEOG 2230A Remote Sensing Course Outline: Section 001 Fall 2018

1. Course Information

1.1. Classroom Location:

Class Location and Time:

Lecture:	Tuesday	12:30-2:30	SSC 3028
Lab 003:	Wednesday	2:30-4:30	SSC 1059
Lab 002:	Thursday	12:30-2:30	SSC 1059

1.2. Contact Information:

Instructor: Dr. Jinfei Wang, Professor, Department of Geography

Office: SSC 2402

Office Hours: Tuesday 2:30-3:30 and Thursday 4:30-5:30, or by appointment

Phone: 661-2111 x85017

Email: jfwang@uwo.ca

1.3. TA Information:

Wednesday lab: Hwang Lee, MSc. student. Office: SSC 2434; Email: hlee738@uwo.ca

Office hours: Wednesday 1:30 pm – 2:30 pm; 4:30 pm - 5:30 pm, or by appointment

Thursday lab: Matthew Roffey, MSc. student. Office: SSC 2434; Email: mroffey@uwo.ca

Office Hours: Tuesday 3:30 – 4:30 pm; Thursday 2:30-3:30 pm, or by appointment

2. Calendar Description

2.1. Course 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 course from [Geography 1100](#), [1300A/B](#), [1400F/G](#), [1500F/G](#), [2131A/B](#), [2153A/B](#), [Environmental Science 1021F/G](#); , or registration in a module in Science or in Engineering, in the Major in Physical Geography, or in the Commercial Aviation Management program in MOS.

Adequate mathematical background is needed to be successful.

Prerequisite checking is the student's responsibility

2.2. Senate Regulations

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."

3. Textbook

Required Text:

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)).

Recommended Readings:

Jensen, J.R., 2015, "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)

4. Topics

1. 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

2. 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

3. 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)

4. 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

5. 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 application
- Forestry application
- Water resource application
- Urban application
- Terrain analysis; Geologic/Geomorphic application

6. Remote sensing case studies

7. 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...)
- Meteorological satellites (NOAA AVHRR, etc)
- and more ...

	Date of Monday	Lecture topics	Labs assigned	Lab due (at the beginning of the lab)
Week 1	Sept. 3	No lecture	No lab	
Week 2	Sept. 10	Introduction to the course/ 1. Introduction to remote sensing	Lab #1	
Week 3	Sept. 17	1. Introduction to remote sensing	Lab #0/ Lab #1	
Week 4	Sept. 24	2. Aerial photographs and photogrammetry (field camp week)	Lab #1	
Week 5	Oct. 1	2. Aerial photographs and photogrammetry	Lab#2	Lab#1 due
Week 6	Oct. 8	Fall Reading week	No lab	
Week 7	Oct. 15	3. Digital image processing– image enhancement	Lab #3	Lab#2 due
Week 8	Oct. 22	Midterm test - October 23	Lab #4	
Week 9	Oct. 29	4. Digital image processing – image classification	Lab #5	Lab #3 due
Week 10	Nov. 5	4. Digital image processing – image classification	Lab #6	Lab #4 due
Week 11	Nov. 12	5. Remote sensing image interpretation and applications	Lab #6	Lab #5 due
Week 12	Nov. 19	6. Remote sensing case studies		Lab#6 due
Week 13	Nov. 26	Student presentations		
Week 14	Dec. 3	Student presentations	Presentations (backup)	

5. Evaluation

Evaluation Components	Percentage of Course Grade	Assignment Schedule
Lab. Assignments (6 labs)	40%	-
Attendance and participation	5%	Ongoing
Class presentation	10%	TBA
Midterm test	15%	Tue., Oct. 23, 12:30pm-2:20pm, SSC 3028
Final Exam	30%	TBA

Lab assignments:

- Lab 0 Fundamentals of Remote Sensing (optional)
- Lab 1 Remote Sensing Field Work (7%)
- Lab 2 Anaglyph 3D and Photogrammetry (7%)
- Lab 3 Introduction to digital images (5%)
- Lab 4 Digital image processing using PCI Geomatica (7%)
- Lab 5 Image classification I using PCI Geomatica (7%)
- Lab 6 Image classification II using PCI Geomatica (7%)

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

1. Attendance and participation: Each student is required to attend all the lectures and labs. Attendance can be taken randomly during any lecture and lab session. Participation includes in class exercises (non-graded).
2. Exams: All students are required to take the close-book midterm test and final exam. During the tests, scientific calculators are permitted and no other electronic devices are allowed. There will be no make-up test for the midterm test. If you will miss the mid-term test under extreme circumstances, you must obtain permission from the Dean's office and provide sufficient documentation. When I receive the permission from the Dean's office, your final exam will account for 45%. If you miss the midterm with no good reason, you will receive no mark for the midterm. Make-up exams will be given for the final exam only under extreme circumstances. If you consider that you have grounds to write the final exam on an alternate date, you must follow the procedure established by the Dean's Office and complete the appropriate forms. You must obtain permission from the Dean's office and provide sufficient documentation, such as a Doctor's note. In addition, you must inform the instructor at least 2 days in advance before the final exam.
3. Lab assignments: You must attend all labs. You should observe all the due dates for assignments. Assignments are due during the lab hours of the assignment due dates. 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).
4. Missed assignment will receive no mark. In case of extreme circumstances and you need accommodation of less than 10% of the total grade, the instructor may allow extension provided that you submit proper documentation. If you need accommodation of more than 10% of the total grade, you must obtain permission from the Dean's office and provide sufficient documentation.
5. Required for Labs 4, 5 and 6: 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. Please note: do not insert your USB with the data from the Windows system to a Mac computer, since this may cause errors on your data.

6. 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.
7. The following is a suggestion as to what could be used to refer students to the policy on Accommodation for Medical Illness:
For Western's Policy on Accommodation for Medical Illness and a downloadable SMC please refer to the Academic Handbook.

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

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.

6. Make-up Examinations

Makeups will be granted with approved documentation only. All documentation for missed exams must be provided the Academic Counselling Office and Instructor within 48 hours of the scheduled exam. For missed exams, you must take your documentation to Academic Counselling within 48 hours of the exam. Otherwise, the instructor will assign a grade of zero. The format and content of make-ups may differ substantially from the scheduled test or examination.

7. Use of Electronic Devices

During the tests, scientific calculators are permitted and no other electronic devices are allowed.

8. 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>).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

9. 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.

10. Medical Issues

The University recognizes that a student's ability to meet his/her academic responsibilities may, on occasion, be impaired by medical illness. The Student Services website provides greater detail about the University's policy on [medical accommodation](#). This site provides links the necessary forms. In the event of illness, you should contact Academic Counselling as soon as possible. The Academic Counsellors will determine, in consultation with the student, whether or not accommodation should be requested. They will subsequently contact the instructors in the relevant courses about the accommodation. Once the instructor has made a decision about whether to grant an accommodation, the student should contact his/her instructors to determine a new due date for tests, assignments, and exams.

Students must see the [Academic Counsellor](#) and submit all required documentation in order to be approved for certain accommodation.

11. 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.

12. Support Services

[Student Support Services](#)

[Student Development Services](#)

13. Important Dates

September 6: Classes resume

September 14: Last day to add a full course or a second term half course

October 8: Thanksgiving Holiday – Department Office Closed

October 9-13: Fall Reading Week (No classes; Department Office open)

November 12: Last day to drop a first term half course without penalty

November 30: Last day to drop a full course without academic penalty

December 7: Classes end

December 8 and 9: Study days

December 10-21: Examination Period

December 21: Fall term ends.