ORIGINAL COURSE IMPLEMENTATION DATE:	January 2008
REVISED COURSE IMPLEMENTATION DATE:	January 2019
COURSE TO BE REVIEWED: (six years after UEC approval)	September 2024

Course outline form version: 09/15/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: GEOG 453	**Number of Credits:** 4 Course credit policy (105)
Course Full Title: Remote Sensing of the Environment **Course Short Title (if title exceeds 30 characters):**	
Faculty: Faculty of Social Sciences	**Department (or program if no department):** Geography and the Environment

Calendar Description:

Remote sensing is the art and science of studying Earth features from a distance. Students will learn the principles of remote sensing science and the characteristics of imagery collected from aircraft and satellite sensors. Students will use remote sensing to interpret and map geologic, hydrologic, vegetative, and urban features.

Prerequisites (or NONE):	GEOG 353.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Equivalent Courses (cannot be taken for additional credit)

Former course code/number:

Cross-listed with:

Equivalent course(s):

Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit

Transfer credit already exists: ☐ Yes ☒ No

Transfer credit requested (OReg to submit to BCCAT):
☒ Yes ☐ No (if yes, fill in transfer credit form)

Resubmit revised outline for articulation: ☐ Yes ☒ No

To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 90

Typical structure of instructional hours:

Lecture hours	20
Seminars/tutorials/workshops	
Laboratory hours	55
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	15
Other contact hours:	
Total	**90**

Special Topics

Will the course be offered with different topics?
☐ Yes ☒ No

If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit

Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 25

Expected frequency of course offerings (every semester, annually, every other year, etc.): once every other year

Department / Program Head or Director: Steven Marsh	**Date approved:**	May 2018
Faculty Council approval	**Date approved:**	May 11, 2018
Campus-Wide Consultation (CWC)	**Date of posting:**	n/a
Dean/Associate VP: Dr. Jacqueline Nolte	**Date approved:**	May 11, 2018
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	September 28, 2018

Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Describe how electromagnetic energy interacts with earth features.
2. Articulate the difference between active and passive remote sensing systems.
3. Distinguish major earth surface features using remote sensing.
4. Critically examine the role of scale and resolution in different types of imagery.
5. Evaluate the increasing role remotely sensed imagery plays in society and the importance of this imagery in geographic information science.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods (guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion)

The course will be offered in a lecture/lab format with an online learning component.

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☒

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials (if more space is required, download Supplemental Texts and Resource Materials form)

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Lilles and T, Kiefer, RW and Chipman J	Remote Sensing and Image Interpretation, 7 Edition	☐	Wiley	2015
2.	Campbell JB and Wynne RH	Introduction to Remote Sensing, Fifth Edition	☐	The Guilford Press	2011
3.	Jensen, J.R.	Remote Sensing of the Environment: An Earth Resource Perspective	☐	Prentice Hall: Upper Saddle River, NJ	2007

Required Additional Supplies and Materials (software, hardware, tools, specialized clothing, etc.)

None

Typical Evaluation Methods and Weighting

Quizzes/tests:	35%	Assignments:	20%	Lab work:	45%	Total:	100%

Typical Course Content and Topics

1. *Remote Sensing of the Environment.* Introduction to the art and science of remote sensing of environmental phenomena. *Lab 1: Working with remotely sensed imagery in ArcGIS.*
2. *History of Aerial Photography.* A survey of the history of remote sensing from aerial platforms, including balloons, kites, pigeons, and aircraft. *Lab 2: Comparison of landscapes in digital aerial photographs from different dates.*
3. *Principles of electromagnetic (EM) energy and surface-EM energy interactions.* The electromagnetic spectrum is introduced, including concepts of energy transfer, scatter, atmospheric windows, and radiance recorded by a sensor. *Lab 3: Measurement and Analysis of Target Reflectance from different types of leaves.*
4. *Multispectral Remote Sensing.* The use of past and present multispectral sensors for studying and monitoring the Earth are explored with a focus on the importance of spatial, spectral, and temporal resolution. *Lab 4: Spectral, spatial, and temporal resolution analysis of satellite imagery.*
5. *Elements of Image Interpretation.* Elements of visual remote sensing image interpretation such as color, tone, shape, pattern, and texture are investigated using a variety of image contexts and examples. *Lab 5: Fundamental image interpretation techniques of panchromatic rural and urban imagery.*
6. *Thermal Infrared Remote Sensing.* Regions of the electromagnetic spectrum in which thermal infrared remote sensing occurs are studied in conjunction with thermal characteristics of land features. Special considerations of thermal sensors are discussed. *Lab 6: thermal infrared image interpretation of night and daytime imagery.*
7. *Active and Passive Microwave Remote Sensing.* Active imaging radar systems are compared to sensors that record passive microwave emissions. Interpretation of radar imagery acquired at different wavelengths over different land cover features is examined. *Lab 7: Analysis and Interpretation of Radar Imagery over vegetated and urban areas.*
8. *Lidar Remote Sensing.* Creation of elevation models using conventional photogrammetric methods are compared to those created using Lidar. *Lab 8: Analysis of Lidar data across a floodplain.*
9. *Remote Sensing of Vegetation.* Electromagnetic radiation interaction with different types of vegetation is investigated, with a focus on the importance of spectral resolution. *Lab 9: Use of Remote Sensing to differentiate crop types.*
10. *Remote Sensing Soils, Minerals, Geomorphology.* Spectral characteristics of different soil and rock types are studied. Elements of image interpretation are used to interpret drainage patterns, horizontal and folded landforms, alluvial fans and other landforms. *Lab 10*: *Remote sensing of a desert landscape.*
11. *Remote Sensing of Water.* Spectral reflectance, scattering and absorption features of clear and turbid water are studied. *Lab 11: Monitoring of stream and lake water quality using remote sensing.*
12. *Remote Sensing the Urban Landscape.* The spatial and spectral resolution of image data for sensing urban features are contrasted to those used for natural surfaces. Strategies to interpret urban features are explored. *Lab 12: Identification of urban features on remotely sensed imagery.*