University of Victoria

**Faculty of Social Sciences**
**Department of Geography**

# Geography 322 A01
# DIGITAL REMOTE SENSING
# SPRING 2017

**Instructor:** Dr. Randy Scharien
**Office:** David Turpin Building B122
**Office Hours:** Monday 13:30-15:30 or by appointment
**E-mail:** randy@uvic.ca

**Lab Instructor:** Terri Evans (tevans@uvic.ca)

## Course Description

The objective of this course will be to introduce you to the idea of collecting, processing and using passive microwave, active microwave, and LiDAR remotely sensed data as standalone and complementary remote sensing data sources to optical data.

The course builds on GEOG228 by focusing on the unique aspects of the microwave region of the electromagnetic spectrum. Microwaves have wavelengths around 1 cm to 1 m, approximately 100,000 times longer than optical wavelengths, so that interactions with the earth's surface, and approaches for landscape information extraction, require unique treatments.

We will also explore LiDAR data for the evaluation of natural environments. The lectures will introduce to the potential of these data and a specific processing and analysis philosophy, while the lab assignment will let you process and analyze LiDAR data.

There will be four laboratory assignments that will explore innovative approaches for using microwave and LiDAR remotely senses data. Emphasis is placed on innovative applications made possible by recent advances in these technologies.

## Class Meetings

Monday/Thursday 09:00-09:50 DSB C108

## Lab Times

B01 Tuesday 14:30-16:30
B02 Thursday 11:30-13:30

**Lab Website**

http://labs.geog.uvic.ca/geog322/
user: geog322
pw: fusion

**Text and Readings**

There is no required text for this course and assigned readings will be posted on CourseSpaces. The following are recommended as reference material.

1. Richards, J.A., (2009). Remote Sensing with Imaging Radar. Springer, Heidelberg, Germany.

*A resource book which does an excellent job of providing a rigorous treatment of microwave imaging but in a manner suited to earth scientists rather than practitioners of theoretical electromagnetism. Focus is on radar but the book includes a chapter on passive microwave remote sensing.*

2. Woodhouse, I.H. (2006). Introduction to Microwave Remote Sensing. Taylor and Francis, Boca Raton, Florida.

*A very readable primer in active and passive microwave remote sensing. Contains overviews of several application domains.*

3. Ulaby, F.T, R.K. Moore, and A.K. Fung (1986). Microwave Remote Sensing: Active and Passive, Volume 3 Volume Scattering and Emission Theory, Advanced Systems and Applications. Addison-Wesley, Reading, Mass.

*Third part of a three volume set considered by many to be the benchmark books that provided the first comprehensive treatment of microwave remote sensing. Part three is suggested due to its focus on many different application domains.*

For laboratory assignments you will be expected to make additional use of remote sensing journal articles, other material in the university libraries, and web-based information in support of your work.

**Course Components**

CLASS MEETINGS

Each class meeting will typically comprise an overview lecture on a topic given by the instructor, followed by an interactive and student led discussion of the material. The overview lectures will build from the assigned readings posted on CourseSpaces. You are required to come prepared for each lecture. This means you should have read and considered the assigned readings.

LABS

There are 4 lab assignments (see course schedule below). The labs are an essential part of the course and you are expected to have basic computer skills such as file maintenance, word processing, and conducting spreadsheet operations (e.g. Microsoft Excel). **Attendance is required**. All labs will be held in the Geomatics Lab A251/253. Each lab will explore unique aspects of microwave remote sensing from systems and applications perspectives. The labs will provide you with practice using remote sensing software for the analysis of microwave remote sensing data, including the Sentinel-1 Toolbox (https://sentinel.esa.int/web/sentinel/toolboxes/sentinel-1). I strongly encourage you to spend time at the beginning of the course accessing the software and working through the tutorials provided with it, in order to gain proficiency with this package.

Analysis and presentation of data, as well as preparation of synthesis reports, are valuable skills that will be developed as part of lab assignments.

**Specific announcements regarding lab due dates and times will be made by the lab instructor Terri Evans.**

EXAMS

There is a mid-term exam and a final exam in this course. Each exam will cover lecture material independently from the other. Further details will be provided during class.

**Grading Scheme**

| | |
|---|---|
| Midterm Exam | 20% |
| Final Exam | 30% |
| Lab 1 | 10% |
| Lab 2 | 10% |
| Lab 3 | 15% |
| Lab 4 | 15% |

**Course Schedule**

| Week | Date | Topic | Lab (Monday) |
|---|---|---|---|
| 1 | Jan 05 | Course intro and structure | No lab |
| 2 | Jan 09 | Radiation primer – optical and microwave | Lab 1 |
| | Jan 12 | Passive microwave remote sensing (cont.) | |
| 3 | Jan 16 | Passive microwave remote sensing (cont.) | Lab 1 |
| | Jan 19 | Passive microwave remote sensing (cont.) | |
| 4 | Jan 23 | Introduction to RADAR | Lab 2 |
| | Jan 26 | RADAR Scatterometers | |
| 5 | Jan 30 | Synthetic Aperture RADAR | Lab 2 |
| | Feb 02 | Synthetic Aperture RADAR (cont.) | |
| 6 | Feb 06 | Synthetic Aperture RADAR (cont.) | Lab 3 |
| | Feb 09 | Review | |
| 7 | Feb 13 | ***Reading Break*** | No lab |

| | | | |
|---|---|---|---|
| | Feb 16 | ***Reading Break*** | No lab |
| 8 | Feb 20 | Mid term exam | Lab 3 |
| | Feb 23 | Guest Lecture #1 | |
| 9 | Feb 27 | RADAR Interferometry | Lab 3 |
| | Mar 02 | Guest Lecture #2 | |
| 10 | Mar 06 | LiDAR | Lab 4 |
| | Mar 09 | LiDAR (cont.) | |
| 11 | Mar 13 | LiDAR (cont.) | Lab 4 |
| | Mar 16 | LiDAR (cont.) | |
| 12 | Mar 20 | Object-based image analysis (OBIA) | Lab 4 |
| | Mar 23 | Object-based image analysis (OBIA) | |
| 13 | Mar 27 | Altimetry | No lab |
| | Mar 30 | Altimetry (cont.) | |
| 14 | Apr 03 | Last class – review | No lab |

## Late Assignment Policy

**Late lab assignments are subject to significant penalties: 10% for each 24 hour period following the due date and time.** Exceptions are not permitted except for circumstances involving medical or compassionate reasons. Written verification as proof may be requested at the discretion of the instructor.

## Course Experience Survey (CES)

I value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to http://ces.uvic.ca. You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. I will remind you nearer the time, but please be thinking about this important activity, especially the following three questions, during the course.

1. What strengths did your **instructor** demonstrate that helped you learn in this course?
2. Please provide specific suggestions as to how the **instructor** could have helped you learn more effectively.
3. Please provide specific suggestions as to how this **course** could be improved.

## Grade Scale

| A+ | A | A- | B+ | B | B- | C+ | C | D | F |
|---|---|---|---|---|---|---|---|---|---|
| 90-100% | 85-89% | 80-84% | 77-79% | 73-76% | 70-72% | 65-69% | 60-64% | 50-59% | 0-49% |

**Academic Integrity**

Academic integrity requires commitment to the values of honesty, trust, fairness, respect and responsibility. It is expected that students, faculty members and staff at the University of Victoria, as members of an intellectual community, will adhere to these ethical values in all activities related to learning, teaching, research and service. Any action that contravenes this standard, including misrepresentation, falsification or deception, undermines the intention and worth of scholarly work and violates the fundamental academic rights of members of our community. Students are advised to consult the university's Policy on Academic Integrity in the University Calendar. The instructor reserves the right to use plagiarism detection software programs to detect plagiarism in term papers.

*The University of Victoria is committed to promoting, providing and protecting a positive and safe learning and working environment for all its members.*