

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES  
CARLETON UNIVERSITY

GEOM4003 – REMOTE SENSING OF THE ENVIRONMENT

**Instructor:** Dr. Andrew Davidson

Office Hours: Monday, 20.05 – 21.55, A200 LA (or by appointment).

Lectures: Monday, 18.05 – 19.55, A200 LA.

Labs: Monday, 20.05 – 21.55, A200 LA (Starting Week 3).

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**TA:** TBD

Email: TBD

Help: TBD

**Prerequisite:** Geomatics 3002

**Objectives:** To develop skills and understanding of quantitative methods of remote sensing image data acquisition and analysis. To explore the use of remotely sensed information in a variety of applications.

**Topics:** (a) Image enhancement for visual analysis: Visual understanding of multispectral imagery displayed in various colour-spectral band combinations is critical and necessary for effective integration with quantitative analysis. The course continues from GEOG 3002 in development of these capabilities by presenting various data processing techniques that enhance imagery for visual analysis. They include: (i) colour space transformation, (ii) multi-resolution data fusion, and (iii) principal components analysis.

(b) Information extraction from remotely sensed imagery: Much of what we know about the Earth's land cover and its changes through time in the past four decades is a result of remote sensing analysis. The most common and fundamental methodologies applied to gain such knowledge are presented. These include (i) Image classification for thematic land cover mapping, (ii) Temporal change detection and mapping, and (iii) Biophysical modeling.

(c) Improving data information: Imagery can be processed and transformed in a variety of ways to improve its information quality. The most common methods are presented. These include (i) Spectral transformations (vegetation and soil indices; principal components analysis), (ii) Spatial transformations (image texture algorithms), (iii) Data calibration, and (iv) the reduction of effects caused by the sensor system, atmosphere, sun angle/view angle, and topography.

(d) Radar remote sensing: Radar is particularly useful where the structural, roughness, or moisture properties of the land cover type are distinctive. It can be used to map such

land cover types or to estimate their biophysical properties. In this section of the course, the theory and applications of radar imaging are presented.

- Readings**
- 1) Lillesand, T., R. Kiefer, and J. Chipman. 2004. *Remote sensing and image interpretation*. 5th edition. John Wiley and Sons. Toronto.
  - 2) Jensen, J. R. 2005. *Introductory digital image processing: A remote sensing perspective*, 3rd Ed. Prentice Hall.
  - 3) Jensen, J.R. 2007. *Remote Sensing of the Environment: An Earth Resource Perspective*. 2nd edition. Prentice-Hall.

Although the lectures sometimes follow Jensen (2007), there is no defined course text (i.e. concepts taught in class are covered in many books). Copies of texts are placed on reserve at the Carleton University Library and will be available for in library loan under course listings for **GEOG3002**.

4) Lecture presentations will be made available online. URL will be given in class.

- Program:**
1. *Lectures*. Twelve (12) lectures will be given, as per the schedule.
  2. *Lab exercises*. Five (5) exercises will be assigned, as per the schedule.
  3. *Final examination*. A final examination will be scheduled in the Final Exam period.

<b>Evaluation:</b>	Lab reports	70%
	Final examination	30%
	<i>TOTAL</i>	<i>100%</i>

**Final Exam:** A two-hour short-answer examination will be scheduled in the Final Examination period. Exam will be a combination of multiple choice, short answer, and long answer (synthesis) questions. No aids except calculator required.

**Labs:** Five lab assignments that require continued learning and use of PCI Image Analysis software in Loeb A200/A237. They vary in size and the length of time given to complete them. **The penalty for late labs is 10% per day unless accompanied by appropriate documentation**, such as a medical certificate. **Late labs will not be accepted more than two (2) days after their deadline**. Each lab assignment will be marked out of a different value based on the degree of difficulty and time required to complete the assignment. The lab assignments are worth a total of 70% of your final course grade.

**Resources:** *Help with laboratory and lecture materials:*  
 There are a variety of ways to get help if you are having difficulties with any of the course materials. PASS (see below), informal study groups with other classmates, judicious use of the text, lab manual and a variety of websites listed on WebCT are valuable resources. The course instructor is there to facilitate your learning. Ask for help when you need it! The instructor will maintain office hours, where you can drop in for assistance. If you need help outside those times, arrange a meeting with them.

*Peer Assisted Study Sessions (PASS):*

Organized by the Centre for Student Academic Support, peer assisted study sessions are weekly study sessions led by trained students who have earned an A in this course in past years. PASS facilitators will work with small groups of students to review course content and develop course-appropriate learning strategies. Sessions are entirely voluntary and anonymous and are intended to offer a safe, friendly place to help students develop strategies to be successful. Whether your aim is to survive GEOG1010 or maintain that A average, the PASS facilitator can help you achieve your goal. For more information go to [www.carleton.ca/pass](http://www.carleton.ca/pass), email [pass@carleton.ca](mailto:pass@carleton.ca) or call (613) 520-2600 Ext. 1523. Further details about sessions will be provided during the lecture period.

*Academic conduct:*

The University Senate defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This can include:

- (a) reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source;
- (b) submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- (c) using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment; using another's data or research findings;
- (d) failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks;
- (e) handing in "substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.

Plagiarism is a serious offence which cannot be resolved directly with the course instructor. A rigorous investigation is conducted by the Office of the Faculty Dean, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial.

Students should consult the Student Conduct: Instructional Offenses and Offenses of Conduct – Discrimination and Harassment sections of the Undergraduate Calendar for details regarding policies on academic misconduct. For more information see: <https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy.pdf>.

*Requests for Academic Accommodations For Students with Disabilities:*

Students with disabilities needing academic accommodations are required to contact a coordinator at the Paul Menton Centre to complete the necessary letters of accommodation. The student must then make an appointment to discuss their needs with the instructor at least two weeks prior to the first class or ITV test. This is to ensure

sufficient time is available to make the necessary accommodation arrangements.

*For Religious Observance:*

Students requesting academic accommodation on the basis of religious observance should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory academic event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student.

Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Department of Equity and Inclusive Communities website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Department of Equity and Inclusive Communities Advisor in the Department of Equity and Inclusive Communities Department for assistance.

*For Pregnancy:*

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Department of Equity and Inclusive Communities to complete a letter of accommodation. The student must then make an appointment to discuss their needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required. Please visit: <https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>.

*Survivors of Sexual Violence*

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/equity/sexual-assault-support-services>.