

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: Introduction to Remote Sensing
CODE NO. : GIS422 **SEMESTER:** 09F
PROGRAM: Geographic Information Systems Applications Specialist
AUTHOR: Heath Bishop
DATE: August, 2009 **PREVIOUS OUTLINE DATED:** June, 2008
APPROVED:

“B. Punch”

CHAIR

DATE

TOTAL CREDITS: 4

PREREQUISITE(S): None

HOURS/WEEK: 5

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I. COURSE DESCRIPTION:

Remote sensing can be defined as the interpretation of images taken at a distance from the object viewed. In this course, the student will gain a theoretical background in remote sensing and a practical ability in the ENVI and PCI Geomatica software environment. Topics to be covered include: remote sensing physics, data sources, visual imagery, image enhancement and filtering, georeferencing, multispectral classification, data import and export and GIS integration. In the second portion of the course students will learn atmospheric and radiometric correction, hyperspectral, high resolution, multi-scale and radar image analysis, georeferencing and mosaicing aerial photographs, orthorectification and LIDAR imagery.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Explain the foundations of optical remote sensing

Potential Elements of the Performance:

- Describe remote sensing energy sources and radiation principles
- Describe the colour mixing process
- Describe the electromagnetic spectrum
- Describe energy interactions with earth surface features
- Describe characteristics of ideal and real remote sensing systems
- Explain the appearance of features on remote sensing images
- Locate Earth-surface features on different band combinations

2. Perform interactive analyses within ENVI

Potential Elements of the Performance:

- Work within the ENVI environment (windows, displays, menus)
- Load and save imagery
- View different band combinations
- Locate and understand georeferencing information
- Zoom in and out of imagery and link image windows

3. Describe remote sensing applications

Potential Elements of the Performance:

- Describe optical, radar and thermal remote sensing applications
- Describe the Landsat programs
- Describe meteorological, continental and ocean monitoring satellites

4. Filter and enhance remote sensing imagery

Potential Elements of the Performance:

- Apply filters to remote sensing imagery
- Enhance remote sensing imagery

5. Review the statistical nature of remotely sensed imagery

Potential Elements of the Performance:

- Perform and analyze data views, image histograms, scatterplots and low-level classifications
- Apply band mathematics and image transformations (band ratios, vegetation indices and principle component analyses) to imagery

6. Perform image classifications

Potential Elements of the Performance:

- Collect regions of interest as classification training data
- Complete a supervised classification
- Complete an unsupervised classification
- Transfer classifications to a GIS environment

III. TOPICS:

1. Optical Remote Sensing

- Energy sources and radiation principles
- The electromagnetic spectrum
- Atmospheric and Earth-surface energy interactions
- The colour mixing process
- Ideal and real remote sensing systems
- Visual interpretation of remote sensing imagery
- Interpreting different band combinations

2. Introduction to ENVI

- ENVI file formats
- The ENVI environment (windows, displays, menus)
- Loading, saving and creating sub-sets of imagery
- Zooming in and out of imagery
- Linking image windows
- Image georeferencing data

3. Remote Sensing Applications

- Optical and radar remote sensing applications
- The Landsat, SPOT, IRS and Radarsat programs
- Meteorological, continental and ocean imaging satellites
- Hyperspectral scanners and airborne lasers
- Aerial photography
- Thermal remote sensing

4. Filtering and Enhancing Remotely-Sensed Images

- Filtering imagery
- Enhancing imagery

5. Performing Statistical Analysis on Remote Sensing Imagery

- Image histograms
- Scatterplots
- Low-level classifications
- Band mathematics
- Image transformations

6. Performing Image Classifications

- Regions of interest
- Supervised classification
- Unsupervised classification
- Post-classification processing
- GIS transfer

7. Accuracy Assessment

- Collecting accuracy assessment ground reference data

8. Photogrammetric Processes

- Triangulation
- Parallax
- Orthophotoscopes
- Stereopairs
- DEM extraction

9. PCI Geomatica

- PCI Focus
- PCI Orthoengine
- PCI Modeler
- PCI EASI
- Cartography in PCI
- File conversion in PCI

10. Hyperspectral Imagery

- Hyperspectral data theory
- Viewing Hyperspectral data
- Viewing Hyperspectral Thumbnails
- Spectral Signatures
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11. PCI Modeler

- Automation
- Merging and Splitting in Modeler
- Creating contours from multiple DEMs
- Pan-Sharpener in Modeler

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

None

V. EVALUATION PROCESS/GRADING SYSTEM:

Laboratories (6)	45%
Report	5%
Mid-Term	25%
Final Exam	<u>25%</u>
	100%

Note: Students must achieve a mark of at least 50% on the Test/Exam components to pass the course.

The following semester grades will be assigned to students:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:Course Outline Amendments:

The professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Retention of Course Outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Prior Learning Assessment:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question. Please refer to the Student Academic Calendar of Events for the deadline date by which application must be made for advance standing.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.

Substitute course information is available in the Registrar's office.

Disability Services:

If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Communication:

The College considers **WebCT/LMS** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the **Learning Management System** communication tool.

Plagiarism:

Students should refer to the definition of "academic dishonesty" in *Student Code of Conduct*. A professor/instructor may assign a sanction as defined below, or make recommendations to the Academic Chair for disposition of the matter. The professor/instructor may (i) issue a verbal reprimand, (ii) make an assignment of a lower grade with explanation, (iii) require additional academic assignments and issue a lower grade upon completion to the maximum grade "C", (iv) make an automatic assignment of a failing grade, (v) recommend to the Chair dismissal from the course with the assignment of a failing grade. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Student Portal:

The Sault College portal allows you to view all your student information in one place. **mysaultcollege** gives you personalized access to online resources seven days a week from your home or school computer. Single log-in access allows you to see your personal and financial information, timetable, grades, records of achievement, unofficial transcript, and outstanding obligations, in addition to announcements, news, academic calendar of events, class cancellations, your learning management system (LMS), and much more. Go to <https://my.saultcollege.ca>.

Electronic Devices in the Classroom:

Students who wish to use electronic devices in the classroom will seek permission of the faculty member before proceeding to record instruction. With the exception of issues related to accommodations of disability, the decision to approve or refuse the request is the responsibility of the faculty member. Recorded classroom instruction will be used only for personal use and will not be used for any other purpose. Recorded classroom instruction will be destroyed at the end of the course. To ensure this, the student is required to return all copies of recorded material to the faculty member by the last day of class in the semester. Where the use of an electronic device has been approved, the student agrees that materials recorded are for his/her use only, are not for distribution, and are the sole property of the College.

Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

Tuition Default:

Students who have defaulted on the payment of tuition (tuition has not been paid in full, payments were not deferred or payment plan not honoured) as of the first week of November will be removed from placement and clinical activities. This may result in loss of mandatory hours or incomplete course work. Sault College will not be responsible for incomplete hours or outcomes that are not achieved or any other academic requirement not met as of the result of tuition default. Students are encouraged to communicate with Financial Services with regard to the status of their tuition prior to this deadline to ensure that their financial status does not interfere with academic progress.