

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**

**SAULT STE. MARIE, ONTARIO**



**COURSE OUTLINE**

**COURSE TITLE:** Introduction to Remote Sensing  
**CODE NO. :** GIS422 **SEMESTER:** 10F  
**PROGRAM:** Geographic Information Systems Applications Specialist  
**AUTHOR:** Heath Bishop  
**DATE:** May, 2010 **PREVIOUS OUTLINE DATED:** Aug., 2009  
**APPROVED:** "B. Punch"

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	<b>CHAIR</b>	<b>DATE</b>
<b>TOTAL CREDITS:</b>	4	
<b>PREREQUISITE(S):</b>	None	
<b>HOURS/WEEK:</b>	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 environments. Topics to be covered include: remote sensing physics, data sources, visual imagery, image enhancement and filtering, multispectral classification, data import and export and GIS integration. In the second portion of the course students will learn about 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

7. Perform Classification Accuracy Assessment

Potential Elements of the Performance:

- Determine statistical accuracy of classifications

8. Photogrammetric Processes

Potential Elements of the Performance:

- Understand the concepts of various photogrammetric processes

9. Perform Various Processes with PCI Geomatica

Potential Elements of the Performance:

- Work with hyperspectral data
- Automate processes within PCI Modeler
- Work proficiently with PCI Focus and Orthoengine
- Georeference Imagery

**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
    - Perform statistical accuracy assessments on classification 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

**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:**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.

**VI. COURSE OUTLINE ADDENDUM:**

The provisions contained in the addendum located on the portal form part of this course outline.