

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: Introduction to Remote Sensing
CODE NO. : GIS 4200 **SEMESTER:** F2002
PROGRAM: Geographic Information Systems Applications Specialist
AUTHOR: Dennis Paradine
DATE: April, 2002 **PREVIOUS OUTLINE DATED:** June 2001

APPROVED:

	_____	_____
	DEAN	DATE
TOTAL CREDITS:	4	

PREREQUISITE(S):

LENGTH OF COURSE: **TOTAL CREDIT HOURS:** 60

Copyright ©1998 The Sault College of Applied Arts & Technology
Reproduction of this document by any means, in whole or in part, without prior written permission of Sault College of Applied Arts & Technology is prohibited.
For additional information, please contact, Dean
School of Engineering, Technology and Trades
(705) 759-2554, Ext. 642

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 software environment. Topics to be covered include: remote sensing physics, data sources, visual image, image enhancement and filtering; georeferencing; multispectral classification; data import and export and GIS integration.

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, SPOT, Radarsat and IRS programs
- Describe meteorological, continental and ocean monitoring satellites

Course Name

Code No.

- Describe hyperspectral imagers, aerial videography and photography systems

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. Assess the accuracy of image classifications

Potential Elements of the Performance:

- Collect ground reference data for accuracy assessment
- Create and explain contingency tables, kappa statistics and planimetric accuracy tables

8. Explain the foundations of radar remote sensing

Potential Elements of the Performance:

- Describe active and passive microwave sensors
- Describe radar signals and interactions with the earth's surface
- Explain radar image analysis methods

III. TOPICS:

1. Optical Remote Sensing (10 hours)
 - 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 (5 hours)
 - 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 (3 hours)
 - Optical and radar remote sensing applications
 - The Landsat, SPOT, IRS and Radarsat programs
 - Meteorological, continental and ocean imaging satellites
 - Hyperspectral scanners and airborne lasers
 - Scanned aerial photographs and aerial videography
 - Thermal remote sensing

4. Filtering and Enhancing Remotely-Sensed Images (3 hours)
 - Filtering imagery
 - Enhancing imagery

5. Performing Statistical Analysis on Remote Sensing Imagery (8 hours)
 - Image histograms
 - Scatterplots
 - Low-level classifications
 - Band mathematics
 - Image transformations

6. Performing Image Classifications (12 hours)
 - Regions of interest
 - Supervised classification

Course Name

Code No.

- Unsupervised classification
 - Post-classification processing
 - GIS transfer
7. Accuracy Assessment (6 hours)
- Collecting accuracy assessment ground reference data
 - Contingency tables, Kappa statistics and planimetric accuracy
8. Radar Remote Sensing (3 hours)
- Active and passive microwave sensors
 - Radar signal interaction with earth surface features
 - The nature of radar signals
 - Radar data analysis

Laboratory #1. Viewing and presenting remote sensing imagery

Laboratory #2. Image transformations and statistics

Laboratory #3. Image classification and GIS export

Practical and Theory Test #1. Theory to Date and Introductory ENVI

Practical and Theory Test #2 – Topics covered during the whole term

Course Name

Code No.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Lillesand, L.M. and R.W. Kiefer. 1999. Remote Sensing and Image Interpretation (fourth edition). John Wiley and Sons.

V. EVALUATION PROCESS/GRADING SYSTEM:**Grading System:**

Laboratories (3)	45%
Tests (2)	55%
	100%

The following semester grades will be assigned to students in post-secondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 – 100%	4.00
A	80 – 89%	3.75
B	70 – 79%	3.00
C	60 – 69%	2.00
R (Repeat)	59% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field placement or non-graded subject areas.	
X	A temporary grade. This is used in limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see <i>Policies & Procedures Manual - Deferred Grades and Make-up</i>).	
NR	Grade not reported to Registrar's office. This is used to facilitate transcript preparation when, for extenuating circumstances, it has been impossible for the faculty member to report grades.	

VI. SPECIAL NOTES:

Course Name

Code No.

Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

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 post-secondary institutions.

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.

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

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.