SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: Introduction to Remote Sensing

CODE NO. : GIS420 **SEMESTER:** F2005

PROGRAM: Geographic Information Systems Applications Specialist

AUTHOR: Kevin Weaver

DATE: June, 2005 **PREVIOUS OUTLINE DATED:** May, 2004

APPROVED:

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DEAN **DATE**

TOTAL CREDITS: 4

PREREQUISITE(S): None

HOURS/WEEK: 8 hours x 7 weeks

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
   - Describe hyperspectral imagers 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

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
- Contingency tables, Kappa statistics and planimetric accuracy

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Lillesand, L.M., R.W. Kiefer, and J.W. Chipman. 2004. Remote Sensing and Image Interpretation (fifth edition). John Wiley and Sons Inc.

V. EVALUATION PROCESS/GRADING SYSTEM:

Grading System:

Laboratories (3)	45%
Mid-Term	20%
Final Exam	35%
	100%

The following semester grades will be assigned to students:

Grade	**Definition**	*Grade Point Equivalent*
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:

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 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 postsecondary institutions.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Rights and Responsibilities*. Students who engage in "academic dishonesty" will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. 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.

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.

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

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.