

**SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON**



COURSE OUTLINE

Course Title: Introduction to ENVI Software

Code No.: GIS 405-4

Semester: I

Program: Geographic Information Systems (GIS Specialist)

Author: Stig Andersen/Harvey Robbins

Date: Dec. 1998

Previous Outline Date: New

Approved:

K. DeRosario

Dean

Dec 15/98

Date

Total Credits:

Prerequisite(s):

Length of Course:

Total Credit Hours:

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For additional information, please contact Kitty DeRosario, Dean, School of Trades
& Technology, (705) 759-2554, Ext. 642.

I. COURSE DESCRIPTION:

This course introduces the basic concepts of remote sensing utilizing approaches introduced in GIS-400 (Introduction to IDRISI) and advanced in combination with an introduction to the ENVI (Environment for Visualizing Images) software. This course includes a study of the following topics using ENVI and IDRISI software: introduction to multispectral classification, image geo-referencing and registration, mosaicking, vector overlay and GIS integration, and map composition. The course provides a combination of theoretical understanding and extensive practical exercises utilizing (vendor supplied) IDRISI and ENVI tutorials.

In addition, the course will focus on methods for data acquisition and data interchange, demonstrated with practical examples utilizing ENVI, IDRISI, ESRI ArcView, and ESRI Arc/Info.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

(Generic Skills Learning Outcomes placement on the course outline will be determined and communicated at a later date.)

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

1) Review Course Outline and Perform Basic ENVI (and IDRISI) Exercises

Potential Elements of the Performance:

- Read over course outline with instructor
- Work within ENVI environment: file formats, windows and displays, ENVI menus
- Perform basic ENVI functions
- Perform basic IDRISI functions

2) Access and Explore Data Sources, Using ESRI (ArcView and Arc/Info), IDRISI and ENVI

Potential Elements of the Performance:

- Identify digital cartographic databases
- Develop methods for data interchange

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE (Continued)

3) Explore Remotely-Sensed Imagery and Image Processing Techniques, Using ENVI (and IDRISI).

Potential Elements of the Performance:

- Explore ways to enhance images
- Explain the logic behind image classification
- Describe supervised and unsupervised multispectral classification methods
- Explain the logic behind principal components analysis
- Complete examples of both supervised and unsupervised classifications

4) Explore techniques for Image Georeferencing and Registration, Using ENVI (and IDRISI)

Potential elements of the performance:

- Develop methods for georeferencing unregistered images
- Develop methods for changing reference systems
- Develop methods for image-to-image registration
- Develop methods for image-to-map registration

5) Explore ENVI's Image Mosaicking Capabilities.

Potential elements of the performance:

- Explore general topics: preparing images, histogram matching and feathering
- Develop methods for creating a pixel-based mosaic

6.) Explore ENVI's Vector Overlay and GIS Analysis Capabilities.

Potential elements of the performance:

- Review IDRISI GIS analysis functions
- Explore vector overlay and GIS concepts in ENVI
- Explore stand-alone vector overlay and GIS analysis capabilities in ENVI
- Explore combined raster/vector processing using ENVI

- 7.) Explore Map Composition Capabilities, Comparing/Contrasting ENVI, IDRISI and ESRI ArcView.

Potential elements of the performance:

- Review IDRISI map composition capabilities
- Review ESRI ArcView map composition capabilities
- Explore ENVI image display and map layout functions

- 8.) Review and Summarize Course and Identify Future Directions.

Potential elements of the performance:

- Review introduction to basic ENVI (and IDRISI) functions and capabilities
- Introduction to hyperspectral data and analysis, and advanced topics in GIS 410-4
- Write final exam

III. TOPICS:

1. Introduction

3 hrs.

- review course outline; establish consensus with respect to grading testing and assignments
- review of IDRISI functions and continuation from course, GIS 400
- identify linkages and subject matter progression from GIS 405, to GIS 410
- ENVI preview

2. ENVI Basics

6 hrs.

- ENVI file formats
- ENVI windows and displays
- menus in ENVI windows
- basic ENVI functions
- compare/contrast ENVI/IDRISI functions

3. Data Acquisition and Interchange 8 hrs.

- identify digital cartographic databases and satellite images data sources
- develop protocols for data interchange, considering:
 - Arc/Info>>IDRISI data transfer procedures
 - ArvView>>IDRISI data transfer procedures
 - Arc/Info>>ENVI data transfer procedures
 - ArvView>>ENVI data transfer procedures
- develop procedures for importing selected satellite image data

Assignment #1. Complete an exercise demonstrating data interchange protocols

4. Multispectral Classification, Using ENVI (and IDRISI). 8 hrs.

- examining images, and methods for image enhancement
- supervised classification
- principal component analysis
- unsupervised classification

Assignment #2. Complete an exercise demonstrating supervised and/or unsupervised classification

5. Image Georeferencing and Registration, Using ENVI (and IDRISI) 6 hrs.

- georeferencing unregistered images, using (IDRISI module) RESAMPLE
- changing reference systems, using (IDRISI module) PROJECT
- image-to-image registration, using ENVI
- image-to-map registration, using ENVI

Assignment #3. Complete an exercise demonstrating the georeferencing of an unregistered image

6. Creating Image Mosaics, Using ENVI (and IDRISI) 4 hrs.

- general topics
- creating a pixel-based mosaic, using ENVI
- creating a mosaic using (IDRISI) concatenation module

Assignment #4. Complete an exercise to create a mosaic from a series of images

7. Vector Overlay and GIS Analysis Capabilities, Using ENVI. 4 hrs.

- vector overlay and GIS concepts in ENVI
- stand-alone vector overlay and GIS analysis capabilities in ENVI
- combined raster/vector processing using ENVI

8. Map Composition, Using ENVI 4 hrs.

- map composition in ENVI
- image display and map layout, using ENVI
- comparison/contrasting of ENVI, IDRISI and ESRI ArcView map composition capabilities

Assignment #5. Complete an exercise demonstrating map composition capabilities using ENVI, IDRISI and/or ESRI ArcView

9. Course Review and Summary. 2 hrs.

- review
- introduction to hyperspectral data and analysis, and advanced topics in GIS 410-4

FINAL EXAM

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Anon. ENVI (The Environment for Visualizing Images) User's Guide, Version 3.0.
Lafayette, Better Solutions Consulting Limited Liability Company. 614 p.

Anon. ENVI (The Environment for Visualizing Images) Tutorials, Version 3.0.
Lafayette, Better Solutions Consulting Limited Liability Company. 370 p.

Eastman, J.R. 1997. IDRISI for Windows, Student Manual System Basics, Version 2.0.
Worcester, Clark Labs for Cartographic Technology and Geographic Analysis. n.p.

ADDITIONAL RESOURCE MATERIAL

Eastman, J.R. 1997. IDRISI for Windows, Advanced Student Manual: Special Topics, Version 2.0. Worcester, Clark Labs for Cartographic Technology and Geographic Analysis. n.p.

V. EVALUATION PROCESS/GRADING SYSTEM

Practical Assignments	50%
Quizzes and Participation	15%
Final (take home) Examination	<u>35%</u>
<u>TOTAL</u>	100%

GRADING:	A+	= 90 - 100%	= 4.00	Grade Point Equivalent
	A	= 80 - 89	= 3.75	
	B	= 70 - 79	= 3.00	
	C	= 60 - 69	= 2.00	
	R (repeat)	= 59 or below	= 0.00	

VI. SPECIAL NOTES:

- Special Needs
If you are a student with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 493, 717, 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.
- Disclaimer for Meeting the Needs of the Learners
- Substitute Course Information is available at the Registrar's Office.
- Any Other Special Notes appropriate to your course.

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: