SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	Introduction to Remote Sensing		
CODE NO. :	GIS422	**SEMESTER:**	16F
PROGRAM:	Geographic Information Systems Applications Specialist		
AUTHOR:	Heath Bishop		
DATE:	June, 2016	**PREVIOUS OUTLINE DATED:**	May, 2015
APPROVED:	Colin Kirkwood		June/16
	DEAN		**DATE**
TOTAL CREDITS:	5		
PREREQUISITE(S):	None		
HOURS/WEEK:	5		

I. COURSE DESCRIPTION:

The use of remotely sensed data is becoming increasingly prominent in today's society. Through accessing satellite imagery and aerial photography, the student will gain a theoretical background in remote sensing and practical abilities in the PCI Geomatica and ArcGIS software environments. Topics to be covered include: remote sensing physics, data sources, visual imagery, image enhancement and filtering, multispectral classification, data import and export, change over time analysis and GIS integration, georeferencing and mosaicking 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
   - Explain the appearance of features on remote sensing images
   - Locate Earth-surface features using different band combinations

2. Describe remote sensing applications and sensors

   Potential Elements of the Performance:
   - Describe the Landsat program, focusing on Landsat 7 and 8
   - Describe high, medium and low resolution satellite sensors
   - Explain the 'multi' concept and how it impacts different satellites

3. Perform Visual Image Interpretation

   Potential Elements of the Performance:
   - Describe interpretation methods
   - Become familiar with Google Earth Pro and how it can be used as an aid in visual interpretation

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
   - PerformFeature extraction
   - Determine statistical accuracy of classifications

7. Perform Georeferencing and Mosaicing

   Potential Elements of the Performance:
   - Describe RMS and Residual Error
   - Describe GCPs and their collection methods
   - Work with mosaic cutlines and colour balancing

8. Interpret LIDAR Data

   Potential Elements of the Performance:
   - Describe, load, manage and interpret LIDAR data
   - Interpret LIDAR returns and create Bare Earth models

9. Perform Various Change over time Analyses

   Potential Elements of the Performance:
   - Apply visual change over time analysis
   - Demonstrate digital change over time analysis

10. Use PCI Modeler for Automation Purposes

    Potential Elements of the Performance:
    - Perform image processing through automation
    - Explore the use of batch processing in automation

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. 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

3. Visual Image Interpretation

- Identify various types of physical features from a remote sensing perspective
- Use Google Earth Pro as an aid in image interpretation

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. Georeferencing and Mosaicing

    - Collect GCPs
    - Rectification
    - Mosaic Images

8. LIDAR

    - LIDAR Returns
    - Accuracy
    - Physics of LIDAR
    - Bare earth model creation

9. Change over time analysis

    - Visual change over time and incorporation into GIS software
    - Digital change over time analysis

10. PCI Modeler
    - Perform automated processing
    - Perform automated processes in batch mode

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

None

V. EVALUATION PROCESS/GRADING SYSTEM:

Assignments	50%
Mid-Term	25%
Final Exam	25%
	100%

Note: Students must achieve an average mark of at least 50% on the Exam components AND achieve at least 50% on all of the assignments in order to pass the course.

Note: All assignments are due at the beginning of class on the scheduled due date, or may be subject to a 10% penalty. Each subsequent day that the assignment is not handed in by 9:30am is an additional 10% deduction.

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.

If a faculty member determines that a student is at risk of not being academically successful, the faculty member may confidentially provide that student's name to Student Services in an effort to help with the student's success. Students wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

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.

Course Outline:
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.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located in D2L and on the portal form part of this course outline.