GEOSCIENCES (GEO) 3840: PRINCIPLES & METHODS
FALL SEMESTER 2019

Meeting Time:	TO BE DETERMINED
Location	TO BE DETERMINED
Instructor:	Michael W Hernandez, Ph.D. Department of Geosciences
Phone #:	(801) 626-8186
Office:	TY 334
Communication:	**WSUOnline – Canvas messaging system (preferred)** mhernandez@weber.edu (alternate)
Office Hours:	TO BE DETERMINED OR by appointment

REQUIRED MATERIALS

Jensen, John R. (2015) Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Ed., Upper Saddle River, New Jersey: Pearson Prentice Hall. ISBN: 978-0134058160

ADDITIONAL MATERIAL

There will be additional readings assigned by the instructor throughout the semester.

COURSE DESCRIPTION & OBJECTIVES

- This is an advanced geospatial course that introduces and analyzes important concepts, issues, and methods related to a variety of multispectral and other types of remotely sensed imagery (e.g., satellite and airborne platforms). The major objectives are to provide students with both a foundation in understanding different types of imagery and how to process imagery used to address geospatial problems and issues. After successful completion of this course, you will have the knowledge needed to understand different types / applications of imagery and the skills needed to process the image data and assess the accuracy of the results.

- *The specific objectives of the course are:*
    1) Provide students with a strong foundation in the theoretical concepts of various remotely sensed imagery used to study earth surface phenomena.
    2) Introduce students to the fundamentals of digital image processing through hands-on assignments that apply essential techniques commonly used to manipulate and interpret remotely sensed imagery.
    3) Teach students to evaluate which remote sensing workflows (e.g., image preprocessing, image analysis, image classification, and accuracy assessment methods) should be applied to imagery based on their understanding of the data types and quality.
    4) Evaluate student learning through completion of a final project. Students will demonstrate the digital image processing skills learned in the course by designing and executing a remote sensing workflow that addresses a real-world application.

5) Evaluate student communication skills through presentation of their final project results in both a professional 10-minute talk and an online forum (e.g., ESRI Story Map).

STUDENT LEARNING OUTCOMES (SLOS)
By the end of the course, students are expected to:

1. Understand the fundamental physics concepts related to remotely sensed images (e.g., electromagnetic spectrum, scattering, blackbody effect, etc.).
2. Understand the characteristics of multispectral and hyperspectral imagery in terms of spatial / spectral / radiometric / temporal resolutions.
3. Understand, apply, and analyze the optimal image data for a geospatial application based on sensor characteristics in SLO 2.
4. Understand the general characteristics and differences between passive and active remote sensing systems (e.g., passive multispectral versus active LiDAR).
5. Understand the essential field and in situ ground reference methods that support image processing workflows.
6. Apply, analyze, and evaluate multiple digital image processing techniques (a workflow) and ground reference data collection methods that prepare / analyze / evaluate images used to solve a geospatial problem (e.g., image acquisition, image correction/calibration/mosaicking, image classification, change detection, accuracy assessment, etc.).
7. Apply multiple concepts and software operations learned in SLOs 1 – 6 to solve a geospatial problem.

PREREQUISITE OR COREQUISITE:
- GEO 3710: Introduction to Geographic Information Systems (GIS)

LAB FEES
- $50
- The fees in this course are used to purchase expendables such as printer paper and color printer cartridges used for student printing in the lab. The remaining funds are pooled with funds from other courses to help pay for nonexpendable items such as annual software license fees (e.g., ESRI ArcGIS, ENVI, Trimble, etc.) and replacement of computer workstations / other equipment.

COURSE POLICIES

Methods of Evaluation: Grades are based on overall performance, measured by the scores earned from **exams, lab exercises, and a final project** assigned during the semester. This course will use the standard +/- grade scale in accordance with university policy. Final grades will be awarded using the following percentage scale that is based on the total number of points earned divided by the total number of available points.

A	93.0+%	B-	79.0-81.9%	D+	66.0-68.9%
A-	89.0-92.9%	C+	76.0-78.9%	D	63.0-65.9%
B+	86.0-88.9%	C	72.0-75.9%	D-	60.0-62.9%
B	82.0-85.9%	C-	69.0-71.9%	E	<60.0%

1 Exam (20% of grade)
10 Labs (40% of grade)
1 Final Project (40%)

Methods of Instruction: Instruction may include, but not limited to, the following methods:

- Lecture / Discussion
- Learning Modules (online)
- Audio-Visual Material (e.g., online videos)
- Collaborative Learning
- Computer Assisted Instruction
- Lab Exercises

COURSE OUTLINE

Week	Date	UNITS	SLOs (number)	Labs Due
1		UNIT 1: Foundations of Remote Sensing		
		No Lab		
2		Foundations of Remote Sensing (cont'd)		
		Lab 1:		---
3		UNIT 2: Imagery Systems		
		Lab 2:		Lab 1
4		Imagery Systems (cont'd)		
		Lab 3:		Lab 2
5		UNIT 3: Introduction to Remote Sensing Field Data & Methods		
		Lab 4:		Lab 3
6		UNIT 4: Digital Image Processing and Analysis		
		Lab 5:		Lab 4
7		Digital Image Processing and Analysis (cont'd)		
		Lab 6:		Lab 5
8		Digital Image Processing and Analysis (cont'd)		
		Lab 7:		Lab 6
9		Digital Image Processing and Analysis (cont'd)		
		Lab 8:		Lab 7
10		Digital Image Processing and Analysis (cont'd)		
		Lab 9:		Lab 8

11		UNIT 5: Accuracy Assessment		
		Lab 10:		Lab 9
12		UNIT 6: Final Project		
		Lab: Final Project		Lab 10
13		Final Project (cont'd)		
		Lab: Final Project		---
14		Final Project (cont'd)		
		Lab: Final Project		---
15		Final Project (cont'd) **EXAM**		Final Project
		Lab: Final Project		

Course development and/or revisions based on work supported by the National Science Foundation under Grant DUE ATE 1304888 awarded to Weber State University (PI: Michael W. Hernandez Ph.D.; Co-PI: Eric Ewert, Ph.D.). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Some content used in this course is based upon work supported by the National Science Foundation under Grant DUE ATE 1304591. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.