UF|UNIVERSITY of FLORIDA

**Image Processing For Remote Sensing
SUR 5386 – Spring 2014**

School of Forest Resources and Conservation
Gulf Coast Research and Education Center
Plant City Education center

_____

Image Processing For Remote Sensing
SUR 5386 – Spring 2014

DESCRIPTION:

This course extends remote sensing concepts and data analysis towards digital image processing topics with natural resources applications. Topics such as radiometric and atmospheric corrections, image formation, image enhancement, and classification are presented. Special emphasis is given to hyperspectral and LiDAR data collection/analysis and machine learning algorithms for image classification. This course depends heavily on distance education tools. Should you have any complaints with your experience in this course please visit http://www.distance.ufl.edu/student-complaints to submit a complaint.

Instructor:	Dr. Amr Abd-Elrahman (Phone: 813.757.2283, Email: aamr@ufl.edu)
Office Location:	Plant City Education Center (Room 112)
Office Hours:	Tuesday 3:00-5:00p Via Adobe Connect* & by appointment
Class Hours:	Polycom** – Thurs. 3:00 pm-5:30 pm
Website:	https://lss.at.ufl.edu (Sakai)

*Adobe Connect is a software program used to conduct virtual meetings. See "Using Adobe Connect Software" section in this syllabus.
** Polycom is a video conferencing class room environment.

COURSE OUTCOMES:

At the conclusion of this course, the student will be able to:

- Comprehend the basic and applied principles of remote sensing
- Investigate and select best remote sensing data sources for certain application
- Identify image distortions and apply appropriate radiometric and geometric image correction techniques.
- Understand and evaluate image spatial and spectral transforms and their effect on image quality and data integrity
- Apply stochastic and deterministic image classification techniques including those based on machine vision algorithms
- Analyze high-dimensional remote sensing imagery (hyperspectral imagery and texture transforms)
- Understand the principles of LiDAR data collection and analysis for natural resources applications

COURSE RESOURCES

TEXT BOOKS:
Required:
John Jensen (2005). *Introductory Digital Image processing: A Remote Sensing Perspective* (3rd edition.). Prentice Hall - ISBN: 0-13-145361-0
Recommended:
Robert Schowengerdt (2007). *Remote Sensing: Models and Methods for Image processing* (3rd edition). Elsevier. ISBN: 0-12-369407-8
ADDITIONAL MATERIALS:
- Research article handouts
- Links to websites covering different topics
SOFTWARE:
- Homework assignments will be performed using ENVI 4.8/5.0 mainly.

![UF UNIVERSITY of FLORIDA]

**Image Processing For Remote Sensing
SUR 5386 – Spring 2014**

School of Forest Resources and Conservation
Gulf Coast Research and Education Center
Plant City Education center

_____
_____

GRADING:

Grading Item	Grade Percentage	Description
Assignments	**35%**	Lab assignments will be performed as homework
Attendance and Participation	**15%**	This is a discussion-based course. Participation is crucial
Final Exam	**15%**	A final exam will be offered at the last day of classes
Final Project	**35%**	An individual final project is due at the last week of classes.

GRADING SCHEME:

Please note that we are adopting the new grading scale encouraged by UF. For more information about the new grading system, please visit http://www.isis.ufl.edu/minusgrades.html

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Corresponding Course Score	95-100	90-94	85-89	80-84	75-79	70-74	65-69	60-64	55-59	50-54	45-49	0-44
Grade Points	4	3.67	3.33	3	2.67	2.33	2	1.67	1.33	1	0.67	0

USING ADOBE CONNECT SOFTWARE:

GIS sessions (for the distance section) and office hour meetings (per request) will be conducted using **Adobe Connect** web conferencing software. The software is accessed by clicking a link posted by the instructor through e-Learning. The instructor will schedule the sessions and post the link to you earlier in the semester. You should click on the link each time you need to join the GIS or office hour sessions.

The following link explains how to participate in Adobe Connect meetings/sessions. Adobe Connect only requires an internet connection, a web browser, and Adobe Flash Player version 10.1 or higher. Adobe Connect supports nearly any operating system including Windows, Macintosh, Linux and Solaris, as well as the most widely used browsers including Internet Explorer, Firefox, Safari, and Chrome. A microphone is also needed to communicate with the instructors and the students attending the session.

UF | UNIVERSITY of FLORIDA

**Image Processing For Remote Sensing
SUR 5386 – Spring 2014**

School of Forest Resources and Conservation
Gulf Coast Research and Education Center
Plant City Education center

LECTURES SCHEDULE:

Week & dates	Topic	Readings
Week 1	Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics	*Schwengerdt: Chapter 1: Jensen: Chapter 1*
Week 2	Optical Radiation Model: The wave/ particle models - energy/matter interaction	*Schwengerdt: Chapter 2 Jensen: Chapter 6 (pp. 175-194)*
Week 3	Digital Image Formation: point spread functions – sampling and quantization – implementation with Whiskbroom and Pushbroom sensors.	*Schwengerdt: Chapter 3*
Week 4	Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix	*Schwengerdt: Chapter 4*
Week 5	Radiometric Correction: Sensor calibration - atmospheric Correction techniques and models – model-based and empirical corrections	*Schwengerdt: Chapter 7 (pp 309-350) Jensen: Chapter 6 (pp. 194-222)*
Week 6	Image Enhancement and Spectral Transforms: contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms	*Schwengerdt: Chapter 5 Jensen: Chapter 8*
Week 7	Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform – wavelet transforms	*Schwengerdt: Chapter 6*
Week 8	Geometric Correction: sensor geometry and empirical models for geometric corrections	*Schwengerdt: Chapter 7 (pp.285-300) Jensen: Chapter 7*
Week 9	*SPRING BREAK*	
Week 10	Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification	*Schwengerdt: Chapter 8 (pp.285-300) Jensen: Chapter 9*
Week 11	Machine Learning: neural networks – expert systems –support vector machine	*Jensen: Chapter 10*
Week 12	Hyperspectral Image Preprocessing: atmospheric correction – dimensionality reduction - minimum noise fraction transformation – endmember determination – pixel purity index – orthogonal sub-space projection	*Jensen: Chapter 11 (pp. 431-450)*
Week 13	Hyperspectral Image Classification: spectral angle mapper – linear spectral un-mixing – spectroscopic library matching – Hyperspectral vegetation Indices	*Jensen: Chapter 11 (pp. 450 – 461)*
Week 14	LiDAR data acquisition- multiple returns vs. full wave form data– feature extraction from LiDAR data	*Misc. handouts*
Week 15	*Final Exam - Final Project Presentations and Discussion*	

NOTE - This syllabus is tentative, thus changes may occur. You are responsible for knowing the course content and follow up schedule, reading and lab changes as published in the course e-learning website.

UF UNIVERSITY of FLORIDA

Image Processing For Remote Sensing
SUR 5386 – Spring 2014

School of Forest Resources and Conservation
Gulf Coast Research and Education Center
Plant City Education center

ACADEMIC HONESTY POLICY:

In 1995 the UF student body enacted a new honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students. In adopting this honor code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the university community. Students who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action. The quality of a University of Florida education is dependent upon community acceptance and enforcement of the honor code. **The Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.** On all work submitted for credit by students at the university, the following pledge is either required or implied: "**On my honor, I have neither given nor received unauthorized aid in doing this assignment."** The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior. Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court. *(Source: 2007-2008 Undergraduate Catalog)* It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course.

SOFTWARE USE

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

ADDITIONAL GAINESVILLE CAMPUS RESOURCES:

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. Both the Counseling Center and Student Mental Health Services provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance. The Counseling Center is located at 301 Peabody Hall (next to Criser Hall). Student Mental Health Services is located on the
second floor of the Student Health Care Center in the Infirmary.
- *University Counseling Center*, 301 Peabody Hall, 392-1575,**www.counsel.ufl.edu**
- *Career Resource Center,* CR-100 JWRU, 392-1602, **www.crc.ufl.edu/**
- *Student Mental Health Services,* Rm. 245 Student Health Care Center, 392-1171,
www.shcc.ufl.edu/smhs/
   - Alcohol and Substance Abuse Program (ASAP)
   - Center for Sexual Assault / Abuse Recovery & Education (CARE)
   - Eating Disorders Program
   - Employee Assistance Program
   - Suicide Prevention Program

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES:

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. 0001 Reid Hall, 392-8565, **www.dso.ufl.edu/drc/**