GEOPHYSICS 4336: REMOTE SENSING

University of Texas at El Paso **Department of Geological Sciences**
Spring Semester 2014

Instructor:
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Class Website:

http://www.geo.utep.edu/pub/hurtado/remotesensing

Check the class website often for updates and announcements. The website is a key part of the class and will be the venue for a lot of important class business.

Class Meetings:

Lectures: Mon. & Wed. 12:30 pm – 11:20 pm, Geology 320
Lab/Lecture: Wed. 1:30 pm – 4:20 pm, Geology 409
Office Hours: Tues. 12 pm – 4 pm (or by appointment), Geology 301a (JMH)

Text:

John R. Jensen, 2005, *Introductory Digital Image Processing: A Remote Sensing Perspective* (3rd edition): Pearson/Prentice Hall, 526 pp.; ISBN 0131453610.
Note: This text is also used for the follow-on course, Digital Image Processing (GEOP 5336)

In addition to the required text (above), handouts and supplemental materials from a variety of sources will also be provided throughout the semester. A small collection of additional textbooks you can use as reference will also be available in Geology 320 – these books are my personal property and are NOT to be removed from that room, except for making photocopies.

In addition, the web will be critical resource during the semester. Here are some useful links we will also be using to supplement the textbook and other materials:

- The Remote Sensing Tutorial: http://www.fas.org/irp/imint/docs/rst/.
- The Remote Sensing Core Curriculum: http://www.r-s-c-c.org/
- ENVI: http://www.exelisvis.com/ProductsServices/ENVI/ENVI.aspx
- Spectroscopy of Rocks and Minerals, and Principles of Spectroscopy (Clark, 1999): http://speclab.cr.usgs.gov/PAPERS.refl-mrs/refl4.html

Grading:

~15 laboratory/homework/field trip* assignments or quizzes (70%); 1 project/presentation (10%); 1 final examination (10%); lecture and lab participation (10%).

*Note: There is one field trip tentatively scheduled for Saturday, April 5 (see schedule)

Work will be assigned and due in lab. Note that most assignments will be turned in electronically (or as otherwise instructed). Storage space, data, and software for all assignments will be made available to you on the Geology department computer system. Therefore, you will all need accounts to access the UTEP open-lab PCs in Geology 409. Contact me or the system administrator, Carlos Montana (montana@geo.utep.edu), if you do not have access already.

Policies:

Show up, show up on time, and show up prepared! Do each reading assignment before attending class, and come to class meetings with questions about what you read and about material from the previous class meeting. Attendance and class participation in both lecture and lab are required. **I reserve the right to drop you from the course if you have excessive absences.** Please **contact Dr. Hurtado about any concerns, schedule conflicts, missed work, etc. ASAP and, whenever possible, in advance.** Valid excuses include illness, absence with the instructor's prior approval, official University business, etc., but **all require documentation**. Unless other arrangements with the instructor are made, **late work will lose 50% of its value for each day it is late, and work will not be accepted more than one week late**. In general, **make-up exams and assignments will not be given**.

If you are a military student with the potential of being called to military service and /or training during the course of the semester, you are encouraged to contact as soon as possible.

If you think you may have a disability or if you are experiencing learning difficulties, please contact the Disabled Student Services Office (DSSO) at (915) 747-5148. They're located in Union East room 106 or you can reach them by e-mail at dss@utep.edu. The student is responsible for presenting to the instructor any DSS accommodation letters and instructions.

While **collaboration on assignments is encouraged**, the intent is to foster problem-solving skills and mastery of the subject matter, not just a quick way to get "answers". **All work is expected to be your own!** The University guidelines for acceptable student conduct are very specific and will be strictly followed. Please read the guidelines (see http://studentaffairs.utep.edu/dos), and contact the Dean of Students or Professor Hurtado if you have any concerns.

Expectations:

The goal of this course is for the student to attain a firm understanding of the physics and basic principles of remote sensing. The emphasis in this course will be on basic concepts, and there will be mathematical treatments electromagnetism, statistical physics, physical chemistry, optics, orbital

mechanics, and photogrammetry, among other topics. Other topics will include the spectral characteristics of biological and geological materials, sensor system design, image acquisition and processing, and applications of remote sensing to the Earth and planetary sciences. Students will be given access to state-of-the-art computer facilities, instruction on how to use the popular image processing software ENVI, and exposure to a variety of remotely sensed datasets including aerial photographs, satellite-based optical imagery (e.g. Landsat, SPOT, ASTER, IKONOS, etc.), LIDAR, and RADAR. Note that this course is intended to prepare the student for Geophysics 5336 (Digital Image Processing).

For graduate students: Graduate students will be held to a higher standard than undergraduates. This can include, but is not limited to, the expectation of more in-depth/detailed/higher-quality laboratory work, required oral/written presentations, and supplementary homework/exam questions. Details will be given as the semester progresses.

Course Outline:

Note that the details of our schedule are likely to change as the semester progresses. Please be flexible, and let Professor Hurtado know if you have any concerns or suggestions. A preliminary, detailed schedule attached.

Note: we are not meeting the first week of the semester (Jan. 20, 22) – our first meeting is Jan 27.

Note: we may not have lecture (we <u>will</u> meet for lab) on the following dates (details/confirmation TBA): Mar. 17, 19 (JMH at conference); Apr. 14, 16 (JMH in the field)

Week	**Dates (M, W)**	**Lecture Topics**	**Assignments (assigned and due on W)**
Week 2	Jan. 27, 29	Introduction: Definition, History, and Overview	*Lab 1: ENVI tutorials on general ENVI functionality*
Week 3	Feb. 3, 5	Electromagnetic Radiation: Spectra, Maxwell's Equations, and Optics; Nomenclature, Generation, and Detection	*Lab 2: ENVI tutorials on map composition, GIS/vectors, etc., and image fusion*
Week 4	Feb. 10, 12	Electromagnetic Radiation: Interaction with Matter and Surfaces	*Lab 3: ENVI tutorials on image registration, georeferencing, orthorectification, and mosaicking*
Week 5	Feb. 17, 19	VNIR Remote Sensing: Source Characteristics, EM-Surface Interactions, and Material Spectra	*Problem Set 1*
Week 6	Feb. 24, 26	TIR Remote Sensing: Emissivity vs. Temperature and Spectra	*Lab 4: ENVI tutorials on image calibration, atmospheric correction, and multispectral image processing*
Week 7	Mar. 3, 5	VNIR & TIR Remote Sensing: Applications and Examples	*Lab 5: ENVI tutorials on classification* ***Spring Break (Mar. 10-14)***
Week 8	*Mar. 17, 19*	VNIR & TIR Remote Sensing: Applications and Examples	*Problem Set 2*
Week 9	Mar. 24, 26	Sensors and Satellites: Optics & Sensor Design; Spacecraft Design; Orbital Mechanics	*Lab 6: ENVI tutorials on basic hyperspectral analysis*
Week 10	Mar. 31, Apr. 2	Air Photos, Photogrammetry, and Photointerpretation	*Lab 7: ENVI tutorials on advanced hyperspectral analysis* ***Field Trip (Sat., Apr. 5)***
Week 11	Apr. 7, 9	Air Photos, Photogrammetry, and Photointerpretation	*Lab 8: Field Trip Project/Report*
Week 12	*Apr. 14, 16*	Microwave Remote Sensing: EM-Surface Interactions and RADAR	*Lab 9: ENVI tutorials on hyperspectral case studies (geology, coastal environments, vegetation)*
Week 13	Apr. 21, 23	Microwave Remote Sensing: SAR; LIDAR	*Lab 10: ENVI tutorials on change detection*
Week 14	Apr. 28, 30	Hydrospheric, Atmospheric, and Planetary Surface Remote Sensing Examples	*Lab 11: Photointerpretation and Photogrammetry*
Week 15	May 5, 7	Hydrospheric, Atmospheric, and Planetary Surface Remote Sensing Examples	***Project Presentations: Wed., May 7 during lecture and lab***
		Final Exam and Papers: Due Wed., Fri., May 16	