ESM 186 Environmental Remote Sensing and ESM 186 Lab
Syllabus Winter 2012

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Classroom: 1137 PES
The door code for 1137 PES
Lecture: Tuesday, Thursday 10:00-11:20 am
Lab: Tuesday, Thursday 3:10-6:00 pm (open lab for breaks)
Smart Site listserv: ers186@smartsite.ucdavis.edu

THIS COURSE IS 5 CREDIT UNITS
3 units credit for the lecture course.
A 2 unit lab credit is 6 hrs per week. You can come in independently if you need more time to complete the lab assignments in your unscheduled time but we expect everyone can finish within the scheduled class time.

Grading: Graded homework Sets (4) 20%, Midterms (2) 25% each, Comprehensive Final 30%.

Text: Jensen, John R. 2007. Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed. Upper Saddle River, N.J., Prentice Hall.

You are responsible for assigned reading material, even if it is not covered in class.
Exams cover concepts and lectures delivered in lab AND reading assignments.

The first section of the course describes principles of spectroscopy related to plants, soil, mineralogy and water

Lecture #	Date	Primary Topic(s)	Reading Assignment
Lecture 1	January 10	Introduction Wavelength, frequency, energy Reflectance, Transmission, Absorption Survey of environmental digital remote sensing Plant functions (photosynthesis, respiration, transpiration) *Lab: introduction to image processing	Chapter 1, 2
Lecture 2	January 12	*In situ* (field/lab) reflectance measurements; How/what to measure; endmembers, calibration targets Measurement protocols; instrument characteristics Platforms: portable, vehicle mounted, trams, ultralight and unpiloted airborne vehicles *Lab: Introduction to field spectrometers and GPS	Chapter 15
Lecture 3	January 17	Spectroscopy of Leaves and Plants Optical Properties of leaves and canopies Index of Refraction Specular and diffuse reflectance Target and path radiance Bidirectional Reflectance Distribution Function	Chapter 11, 2
Lecture 4	January 19	Spectroscopy of Canopies Leaf area index, leaf angle distribution Landscape components, structure Digital Multispectral (MSS, Landsat, SPOT) Orbital configurations *Georegistration and Mosaicking	Chapter 11, 2, 7
Lecture 5	January 24	Spectroscopy of Water Spectral properties of phases of water (vapor, liquid, solid) Specular, Lambertian (diffuse) reflectance	Chapter 12, 9
Lecture 6	January 26	Spectroscopy of Minerals Mineralogy, Optical and Thermal signatures Kinetic heat, temperature Temperature relationships: Stefan-Boltzmann Law, Emittance, Wien's Law, Kirchoff's Law	Chapter 14, 2, 8
1st Midterm	January 31	*Lab: Data Reduction: Spectral Indexes	

Lecture 8	February 2	Spectroscopy of soils Soil moisture, mineralogy Organic matter, soil quality and fertility Texture, roughness *Lab: Data Reduction: Principal Components	Chapter 14, 2, 7

The second section of the course provides examples of major types of environmental remote sensing applications

Lecture 9	February 7	Land Cover Classification &Mapping Spatial patterns and scales (Local: plant, patch, stand) Fragmentation, corridors, and spatial landscape features Regional land cover, cover type, Global systematic land cover mapping missions: Global: growth form mapping; AVHRR, MODIS global mapping *Lab = supervised/unsupervised classification	Chapter 11, 7
Lecture 10	February 9	Geomorphology Land forms, topography Faults, geologic features Earthquake monitoring, volcanic eruptions Tsunamis	Chapter 14, 9
Lecture 11	February 14	Hydrology and water systems Rivers, lakes, and ocean color Water color, turbidity, sea surface temperature, Precipitation, ice, snow Ocean satellites: SeaWIFS Surface hydrology, drainage Evapotranspiration	Chapter 12, 7, 8, 9
Lecture 12	February 16	Change detection: Seasonal, annual, interannual Landscape components, Mixture analysis Phenological patterns; intra-annual to Century-scale patterns Invasive species/species mapping Multitemporal data (MODIS, Landsat, SPOT) Bidirectional Reflectance Distribution Function (BRDF)	
Lecture 13	February 21	Weather monitoring GOES, POES Geostationary orbits Scattering and absorption in atmosphere Aerosols and clouds ***lab = change detection;** Change Detection Handout	Chapter 12, handout

Lecture 14	February 23	Weather Monitoring Chapter 12, handout Severe storms, Weather disaster prediction Radiation and energy budget Thermal sensors Stefan-Boltzmann Law, Emittance, Wien's Law, Kirchoff's Law
Lecture 15	February 28	Climate Change Handout Greenhouse gases and energy budget Biogeochemical cycles (carbon, water, nitrogen + others) *Map Composition Lab
Lecture 16	March 1	**Take Home Midterm (2nd Midterm) Released** Urban Chapter 13, 10 Heat islands Impervious surfaces and hydrology High spatial resolution satellites Landscape mixtures subpixel mixing pan sharpening
Lecture 17	March 6	**Midterm due before start of class** **Disaster Response and Monitoring** Chapter 8, 11 Wildfire detection and mapping; risk assessment Fire extent mapping, fire temperature (and emissions), Volcanic eruptions Temperature Measurements *Lab Wildfire Exercise
Lecture 18	March 8	LiDAR Principles Chapter 10 *Lab: Spectral mixing analysis
Lecture 19	March 13	Radar principles Chapter 9 Radar satellites Radar interferometry SRTM *Lab = LiDAR
Lecture 20	March 15	Comparison of lidar, radar, and optical methods Complete any unfinished topics Review

In addition to the text, several web based Information Resources:
http://rst.gsfc.nasa.gov/
http://ccrs.nrcan.gc.ca/index_e.php
http://www.gisdevelopment.net/tutorials/tuman008.htm
http://www.profc.udec.cl/~gabriel/tutoriales/rsnote/contents.htm
http://noaasis.noaa.gov/NOAASIS/ml/education.html
http://www.geog.ubc.ca/vgd/remote.sensing/tutorials/tutorials.html