Geography 587
Remote Sensing of Environment
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Office Hrs. M 1:30-2:30 & W 9:00-10:00 or by appt.

Course Syllabus

Objective: To introduce theoretical, technical and applied aspects of remote sensing as a tool for monitoring and managing earth resources.

Scope: Emphasis on: electromagnetic radiation transfer; data collection with aerial photographic and satellite sensor systems; and visual interpretation of air photos and satellite imagery.

Text: Jensen, J.R., 2007. Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Edition, Prentice Hall (New Jersey).

Exams and Graded Assignments:	**% of grade**
Midterms 1 & 2	30% (15% each)
Lab Practical 1 & 2	25% (12.5% each)
Lab exercises	20%
Final exam	25%

Note: Grades for lecture and lab components are combined into a single, final course grade.

Lectures: Emphasis on theoretical and technical aspects of image acquisition and interpretation. Each lecture will be accompanied by an outline covering the general content of the lecture, as well as relevant graphs, references and readings.

Lecture Topics and Readings: The following is a provisional outline and estimated schedule for the topics to be covered each week of the semester. To make the lectures and lab sessions of maximum benefit it is useful to complete the assigned reading prior to class.

Week	**Topic**	**Readings in text**
1	Course introduction	
	Introduction of remote sensing (RS)	Chs 1 & 3
2	History of remote sensing (RS)	Ch 1
	Elements of image interpretation	Ch 5
	Resolution attributes of remote sensors	Ch 1
3	EMR - properties and sources	Ch 2
	EMR - atmospheric interactions	Ch 2
4	EMR - target interactions	Ch 2 & 15
5	Air-photo geometry and stereo viewing	Chs 4 & 6
6	Mensuration and photogrammetry	Ch 6, Ch 12 (for lab)
	Midterm #1 (7 Oct)	
7	Remote sensing platforms	
	Frame imaging systems (aerial photographic and digital cameras)	Ch 4 & 7, Ch 11 (for lab)
8	Films and filters (B&W, color)	Ch 4
9	Introduction to digital image processing	
	Land satellite systems	Ch 7
10	Land satellite images and interpretation	
11	Data acquisition and planning	Ch 4, Ch 14 (for lab)
	Land use/land cover and urban applications	Ch 12
12	**Midterm #2 (18 Nov)**	

13	(No Class or Lab Wednesday 8/25) Renewable resources applications Chs 11 & 12	
14	Geological applications	Ch 14
	Coastal applications	Ch 11
15-16	**Final Exam, (Date TBD)**	

Labs: Lab work is very important in enabling students to obtain "hands on experience," the only way that image interpretation skills can be developed. Labs will emphasize practical and hands-on aspects of remote sensing principles and image interpretation. Processing and display of digital images will introduced.

Lab Schedule

WEEK	LAB TITLE
1	No lab
2	Math, units and quantities
3	General image interpretation
4	Electromagnetic radiation principles
5	Spectral signature concepts
6	Urban features and development
7	Stereoscopic viewing and photogrammetry
8	Vegetation, agriculture and soils
9	Digital image processing and satellite image interpretation
10	Lab Practical #1
11	Lithology, geomorphic agents and geologic hazards
12	Land-use/land-cover mapping
13	Thanksgiving, No Lab
14	Image acquisition and mission planning
15	Lab Practical #2
16	Final Exam Week, No Lab

POLICY AND PROCEDURES

(1) Class Attendance and Participation

Roll will not be taken after the first week or so of class; attendance is expected but not required.

(2) Textbook and Other Class Materials

Textbook: Jensen, J.R., 2007. Remote Sensing of the Environment: An Earth Resource Perspective, 2nd edition, Prentice Hall (New Jersey), is required for the course. Readings from the text are used to supplement the lecture, in terms of more detailed explanations and in providing examples and illustrations.

(3) Exams and Grades

The two mid-term exams and half the final exam will be based only on the lecture, lab, and reading material covered since the last exam (or for the first mid-term, since the start of the course). A greater emphasis will be placed on materials covered in the lectures and labs. The exam format will be variable, consisting of multiple choice, true/false, matching, image interpretation, and problem solving.

The final exam will be cumulative. It will also contain a major essay question, for which you will be given the general question ahead of time and will have several weeks to prepare. It will involve an application scenario that will enable you to comprehensively tie together details you have learned in the course.

There will be two lab practical exams, one at mid-semester and the other just before the end of the course. The lab exams will mostly cover material learned in the labs, but could include hands on image interpretation of concepts discussed in the lecture. The lab exams will occur during the lab period.

Missing exams will not be made up, (and therefore, will count as zero points), unless the instructor is notified prior to the exam and the student receives prior approval to make up the exam. If a sudden illness or emergency occurs, make every attempt to call the instructor before the exam. Illness or emergency excuses must be verified by a note from a responsible person.

Make-up exams are discouraged and no student should count on the option of a make-up exam. Consecutive exams or vacation travel during final exams week is not a sufficient reason for arranging make-up exams. If a make-up exam is required and agreed to by the instructor, the student must take the exam after it is administered to the rest of the class. The make-up exams will be different form and generally be more extensive than the regular exam.

Cheating on an exam constitutes a violation of university rules and students caught cheating will automatically receive a zero grade for the exam and will be reported to the University for possible disciplinary action. Two incidences of cheating will result in expulsion from the class.

The final class grade will be based on the cumulative point total for all exams and lab exercises. Note that there is just one grade for the four units (i.e., lectures and labs are combined). Final grade decisions will be based on a flexible curve, taking into consideration distributions from the instructor's past Geography 587 classes. The instructor reserves the option to raise a grade by one half to a whole grade based on consistent improvement in exam performance.

(4) Weekly Labs

Remote sensing problem solving and image interpretation labs are an integral part of the course. Lab exercises will consist of some take-home exercises, but predominantly hands on visual image interpretation labs completed in the lab. Calculation labs will be performed by individuals (i.e. no partners). Interpretation labs will be performed by teams of two or more students and one lab write up per team will be due. All Labs are due by the beginning of the following lab period. Late labs will be penalized by 10% of the original point total for each day they are late (i.e., after 10 days handing in the lab will not get you any points). Labs will be handed out and described at the beginning of each lab period.

Acronyms (a very partial listing)

On-line glossary: http://www.ldeo.columbia.edu/res/fac/rsvlab/glossary.html

Satellites and Sensors

Landsat:	Land satellite (Formerly ERTS: Earth resources technology satellite)
RBV	Return beam video camera
MSS	Multi-spectral scanner
TM	Thematic Mapper
ETM+	Enhanced Thematic Mapper Plus
SPOT:	Systeme Pour l'Obsevation de la Terre
XS	Multi-spectral mode
Pan	Panchromatic mode
AVHRR	Advanced very high resolution radiometer
TIROS	Television infrared observational satellite
GOES	Geosynchronous observational environmental satellite
DMSP	Defense meteorological satellite program
ERS-1	European remote sensing satellite #1
JERS-1	Japanese earth remote sensing satellite #1
RADAR	Radio detection and ranging
RADARSAT	Canadian radar satellite
SIR	Shuttle imaging radar
ERBS	Earth radiation budget satellite
TOMS	Total ozone mapping spectrometer
SeaWiFS	Sea-viewing wide field of view sensor
EOS:	Earth Observing system (a small sample of EOS sensors)
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
MODIS	Moderate resolution imaging spectroradiometer
EOSP	Earth observing scanning polarimeter
ETM	Enhanced thematic mapper
LIS	Lightning imaging sensor
MISR	Multi-angle imaging spectrometer
MOPITT	Measurements of pollution in the troposphere
SeaWinds	Scatterometer
ADAR	Airborne data acquistion and registration system
AVIRIS	Airborne visible and infrared imaging spectrometer
SAR	Synthetic aperture radar
IFSAR	Interferometric synthetic aperture radar

Agencies and projects

BLM	Bureau of Land Management
CIESIN	Consortium for International Earth Science Information Network
EOS	NASA's Earth Observing System
EPA	Environmental Protection Agency
EROS	Earth Resources Observations Systems
ESA	European Space Agency
GSFC	NASA Goddard Space Flight Center
JPL	NASA Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration

Pathfinder	NASA program to provide high quality global change data sets
TOPEX	Ocean topography experiment
USDA	United States Department of Agriculture
USGS	United States Geological Survey