

ESS 421 – Introduction to Geological Remote Sensing
Winter 2019 – Mon./Wed. 12:30-1:20 (Lecture – JHN 111);
Tues./Thurs. 9:30-11:20/12:30-2:20 (Lab – JHN 366)

Course Description: Earth and Space Sciences 421 is designed to introduce upper class undergraduate and graduate students to the physical principles underlying remote sensing as applied to the study of the land surface of the Earth, Moon, and terrestrial planets. Remote sensing at visible and near-infrared, thermal infrared, and radar wavelengths are covered, including reflectance and emittance spectroscopy. Applications to the investigation of vegetation, rock surfaces, and urban environments are covered. The class includes a computer lab applying processing techniques via software commonly used for remote sensing applications.

Instructor: Steven Walters, swalt826@uw.edu
TA: Michael Turzewski, zewski@uw.edu

Office Hours: After class/lab, when my office door is open (JHN 374), or by appointment

Class Website: Class materials will be posted on the course Canvas website, <https://canvas.uw.edu/courses/1255889>; labs will be also be turned in and posted there.

Text: The text is optional. The (STRONGLY) recommended text book is Lillesand, Kiefer, and Chipman, Remote Sensing and Image Interpretation, 7th Edition, 2015. The hardcopy book (i.e., paperback edition) does have a rather high purchase price; however, a MUCH less expensive e-book version is also available, at <http://www.wiley.com/WileyCDA/WileyTitle/productCd-EHEP003336.html>, or for rental at <https://www.vitalsource.com/referral?term=9781118919477>.

Although organized a bit differently, the Remote Sensing Tutorial also contains a wealth of free information on many subjects covered in remote sensing textbooks (<http://geoinfo.amu.edu.pl/wpk/rst/rst/Front/overview.html>).

Exams and Grading: There will be two exams, emphasizing the first and second halves of the course, respectively. Quizzes will be administered weekly with the exceptions of weeks 1, 2, 6, and 10. Final grades will be assigned based on the following weighting:

| | |
|------------------------|-----|
| Exam 1: | 25% |
| Exam 2: | 25% |
| Quizzes ⁺ : | 20% |
| Lab Write-ups: | 30% |

⁺The lowest quiz grade will be discounted.

Attendance and Make Up Policy: Attendance is not factored into the final grade; however, it is expected that students will attend all classes. Quizzes will cover the lectures and reading assignments, and will be given at the start of class; make-up quizzes are not allowed except under extenuating circumstances. Make-up exams will be given if documents proving illness or bereavement are provided. Lab write-ups are due prior to the start of the Thursday labs of the week

following the lab assignment, unless noted otherwise. Lab grades will be deducted by 5% for any lab turned in after the start of class and an additional 5% for each day beyond the due date.

Class Schedule (revised 2/12/2019)

| Date | Lecture Topic | Lab Topic (Begin on Tuesdays) | Lab Due/Quiz |
|-------------|---|---|--------------------------|
| 1/7 | Introduction | Lab 1: Datasets and intro to ENVI | |
| 1/9 | Imaging | | |
| 1/14 | Imaging and interpretation | Lab 2: Pixels and orthophotos | Lab 1 Due 1/15 |
| 1/16 | Radiative transfer | | Quiz 1 |
| 1/21 | No class | Lab 3: Radiative transfer | Lab 2 Due 1/22 |
| 1/23 | Atmospheric scattering | | Quiz 2 |
| 1/28 | Light and surfaces | Lab 4: Atmospheric effects on spectral data | Lab 3 Due 1/29 |
| 1/30 | Spectroscopy | | Quiz 3 |
| 2/4 | <i>Snow day</i> | | |
| 2/6 | Materials and spectra | Lab 5: VNIR/SWIR/TIR spectroscopy Death Valley | Lab 4 Due 2/7 |
| 2/11 | <i>Snow day</i> | | |
| 2/13 | Spectral imaging | Lab 5 (continued Thursday) | Quiz 4 |
| 2/18 | No class | Lab 5 (continued Tuesday) | |
| 2/20 | Exam 1 review | | |
| 2/21 | Exam 1 (during lab sessions) | | |
| 2/25 | Image classification | Lab 6: LiDAR & topographic data | Lab 5 Due 2/26 |
| 2/27 | LiDAR | | Quiz 5 |
| 3/4 | Thermal spectroscopy | Lab 7: Dillon, MT field site | Lab 6 Due 3/5 |
| 3/6 | Temperature | | Quiz 6 |
| 3/11 | Radar/Microwave | Lab 7 (continued); Extra credit lab – image classification | |
| 3/13 | Other remote techniques; Exam 2 review | | |
| 3/14 | Exam 2 (during lab sessions) | | Lab 7/EC lab Due 3/15 |

Reading Assignments

(LKC = Lillesand, Kiefer and Chipman, 7th edition; sections & pg. #'s, in addition to overall content, vary for earlier editions)

| Date | Lecture Topic | Reading |
|------|---|---|
| 1/7 | Introduction | LKC 1.1, 1.5, 1.6, 1.8, 1.9, 1.11 |
| 1/9 | Imaging | LKC 2.1-3, 2.5, 2.7, 3.1-3, 3.6-3.8, p. 199-207 |
| 1/14 | Imaging and interpretation | LKC 8.1, 8.2, 8.3-16 (skim), 7.4 |
| 1/16 | Radiative transfer | LKC 1.2, Appendix A, http://en.wikipedia.org/wiki/Greenhouse_effect |
| 1/21 | No class | |
| 1/23 | Atmospheric Scattering | LKC 1.3, 1.4, http://hyperphysics.phy-astr.gsu.edu/hbase/atmos/blusky.html |
| 1/28 | Light and Surfaces | http://en.wikipedia.org/wiki/Fresnel_equations http://en.wikipedia.org/wiki/Beer-Lambert_law http://en.wikipedia.org/wiki/Snell's_law |
| 1/30 | Spectroscopy | http://speclab.cr.usgs.gov/PAPERS.refl-mrs/refl4.html ; Siegal_Gillespie.pdf (on Canvas website) |
| 2/4 | <i>Snow day</i> | |
| 2/6 | Materials and spectra; Satellites and sensors | Salisbury_Major_spectral_features_of_minerals.pdf (on Canvas website); LKC 5.1-20 |
| 2/11 | <i>Snow day</i> | |
| 2/13 | Spectral imaging | LKC 4.1-5, 4.13 |
| 2/18 | No class | |
| 2/20 | Exam 1 review | |
| 2/21 | Exam 1 | |
| 2/25 | Image classification | LKC 7.1-3, 7.5-14 |
| 2/27 | LiDAR | LKC 6.23-24 |
| 3/4 | Thermal Spectroscopy | LKC 4.8-13, http://geoinfo.amu.edu.pl/wpk/rst/rst/Sect9/Sect9_1.html |
| 3/6 | Temperature | |
| 3/11 | Radar/Microwave | LKC 6.1-22 |
| 3/13 | Other remote techniques | http://en.wikipedia.org/wiki/Gravity_Recovery_and_Climate_Experiment http://en.wikipedia.org/wiki/Gamma_ray_spectrometer |
| 3/14 | Exam 2 | |

Policies on Access and Accommodation:

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or <https://depts.washington.edu/uwdrs/>. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Ethics Policy – Expectations for you in ESS 421:

Labs: Collaborative work on lab exercises is encouraged, but you are responsible for writing up your own results.

Homework: Any homework assigned should be completed by yourself and is not intended to be group work unless otherwise specified.

Quizzes, Midterm, Final: No outside help is allowed and all work should be entirely your own.

Cheating is not tolerated and it is likely to hurt your grade. You have the right to appeal any accusation of cheating to the College of the Environment where it will be independently reviewed.

Official University Policies

Student Conduct

All UW students agree to abide by, and familiarize themselves with, the Student Conduct Code when enrolling at the University of Washington. All students in ESS courses are expected to abide by the Student Conduct Code (also known as WAC 478-121).

The possession, use, or distribution of controlled substances, firearms, and dangerous weapons will not be tolerated. Physical abuse, sexual harassment, or harassment of any kind, for any reason, will not be tolerated.

Violations will be immediately reported to the Community Standards and Student Conduct, and possibly the UW Police Department. The Student Conduct Code can be viewed at:

<http://apps.leg.wa.gov/WAC/default.aspx?cite=478-121>.

If you have questions or concerns regarding an alleged violation of the Student Conduct Code please contact your instructor, ESS Student Services (206-616-8511 or essadv@uw.edu), or Community Standards and Student Conduct (206-685-6194 or cssc@uw.edu).

Misconduct

At the University level, passing anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution is considered academic misconduct.

Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-121). We expect that you will know and follow the UW's policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to UW regulations. For more information, see the College of the Environment Academic Misconduct Policy and the UW Community Standards and Student Conduct website: <https://environment.uw.edu/intranet/academics/academic-integrity/academic-misconduct/>.