ABS 486/ABS 598: Introduction to Remote Sensing

Lecture - Poly | T Th | 3:00 PM - 4:15 PM | PERALTA bldg., room 122
Lab - Poly | T | 6:00 PM - 8:45 PM | PERALTA bldg., room 122
ASU Sync

Course and Faculty Information

Course Description: Principles of Remote Sensing utilized in natural resource management. Use of computers for spatial inventory and analysis of natural resources.

Credits: 4

Prerequisites: minimum 45 hours

Instructor: Dr. Fábio Albuquerque

Contact Info: Wanner Hall #301E - Fabio.Albuquerque@asu.edu - (480) 727-5920.

Office Hours: By appointment.

College Contact: This course is offered by the College of Integrative Sciences and Arts (CISA). For more information about the college, visit our website: https://cisa.asu.edu. If you have questions about this course, please speak with your instructor. If your instructor is unable to address your questions, please send your inquiry to cisa@asu.edu.

Course Learning Outcomes

Remote sensing has revolutionized our understanding of the Globe as an integrated system, giving us a growing capacity to predict changes in weather and climate and allowing observations of changes in land cover and land use. Remote sensing is an essential source of environmental information that can support a deeper understanding of trends and clarifying management strategies in a wide range of ecological applications. This course is intended to provide participants with an introductory working knowledge of remote sensing for biodiversity and wildlife management. This course will focus on the application of satellite and aerial/drone remote sensing in environmental science and management. With this necessary background, course participants will use remote sensing data to make spatial decisions. The concepts of biodiversity and wildlife management will be presented parallel to the remote sensing information. Image processing instruction and exercises begin with an analysis of digital imagery and proceed through the three broad classes of processing techniques; preprocessing enhancement, and information extraction.

Course Objectives

The desired outcomes of this course are for you to:

- Understand the concepts of Remote Sensing of the Environment.

- Demonstrate an ability to interpret and analyze the digital image to convey your message.
- Demonstrate an ability to present the results of your work.
- Demonstrate an ability to explain your decisions orally and in writing.

ASU Sync

This course is scheduled as an in-person (face-to-face) course. You will attend some class sessions in-person and be remote for other sessions to ensure we keep the room occupancy below 50%.

For the remote option, this course uses Sync. ASU Sync is a technology-enhanced approach designed to meet the dynamic needs of the class. During Sync classes, students learn remotely through live class lectures, discussions, study groups, and/or tutoring. You can find out more information about ASU Sync for students here: https://provost.asu.edu/sync/students.

To access live sessions of this class, go to MyASU and click the Attend via Sync button next to this class on your schedule. The "Attend via Sync" button in the students' MyASU schedule will direct to the instructor's Personal Meeting ID (for more information, visit the Zoom Faculty Guide).

To ensure in-person participation stays below 50% room occupancy, the class will be split into groups. Students will be assigned a day to attend the class in-person and placed on a rotation schedule. This means you will rotate between in-person and ASU Sync (Zoom) attendance.

If you cannot physically be on campus due to travel restrictions or personal health concerns, you will be able to attend your classes via ASU Sync during the fall semester. If you will not be on-campus for the fall semester, you are expected to contact your professors to make accommodations.

Face Coverings

Everyone is required to wear a face cover while in ASU buildings and community spaces, regardless of distance. Face covers help prevent pre-symptomatic and asymptomatic individuals from inadvertently spreading COVID-19 to others. They are meant to protect others in case you are sick. Students will be required to wear a face cover in the classroom. For more information about face coverings, please visit the FAQ page.

Textbooks, Required Readings and Materials

Textbooks are optional. If you wish to acquire a decent reference book to help you in this course and the future, take a look at the following:
Recommended Text:

- Campbell, J. C., and Wynne, R. H. Introduction to Remote Sensing, 5th ed. The Guilford Press. New York 622p.
- Wegmann M., Leutner, B., Dech, S. (eds) 2016. Remote sensing and GIS for Ecologists. Pelagic Publishing, UK. 331pp.

Additional Sources:

- Lillesand, T. M. and Kiefer, R. W. 2008. Remote Sensing and Image Interpretation. John Wiley & Sons. New York. 721p.
- Horning N, Robinson J.A., Sterling E. J., Turner W, Spector S. Remote Sensing for ecology and conservation. Oxford Biology 467pp

This syllabus and other course materials (e.g., databases, Image data) will be available through the Canvas website, where class announcements will be posted on the website as well.
Journal Articles and other readings: Copies available electronically via Canvas or Dropbox.

Course Access

Your ASU courses can be accessed by both my.asu.edu and asu.instructure.com; bookmark both in the event that one site is down.

Computer Access Requirements

ASU Sync classes can be live streamed anywhere with the proper technology. We encourage you to use a PC or Apple laptop or desktop equipped with a built-in or standalone webcam. You will need an internet connection that can effectively stream live broadcasts. It is recommended that your internet download speed is at least 5.0 mbps. You can use this tool to test your current connection.

We do not recommend the use of iPads or Chromebooks for ASU Sync because these devices do not work for class exams that may be proctored remotely.

If you are not able to personally finance the equipment that you need to attend class via ASU Sync, ASU has a laptop and WiFi hotspot checkout program available through ASU Library.

Who is eligible?

- Any currently enrolled ASU student is eligible to checkout a laptop or WiFi hotspot. The current availability of laptops can be found here.

Borrowing and returning laptop rules

- Rentals are limited to one laptop per student.
- Laptops are available for checkout at the following libraries on all four campuses: (Please check online for current library hours)
    - Downtown Phoenix campus Library
    - Polytechnic campus Library
    - Tempe: Hayden and Noble Libraries
    - West campus: Fletcher Library
- Return laptops to any ASU Library Information Desk (not at the drop box or other location)
- Refer to ASU Library Computer Use Policy and ASU Computer, Internet, and Electronic Communications Policy.
- Borrowers are responsible for loss, damage, and theft of the laptop while in their possession. Borrowers should verify the condition of the laptop at the time of check-out and upon check-in.

Additional Requirements

This course requires the following technologies:

- Web browsers (Chrome, Mozilla Firefox, or Safari)
- Adobe Acrobat Reader (free)
- Adobe Flash Player (free)
- Webcam, microphone, headset/earbuds, and speaker
- Microsoft Office (Microsoft 365 is free for all currently-enrolled ASU students)
- Reliable broadband internet connection (DSL or cable) to stream videos.

Note: A smartphone, iPad, Chromebook, etc. will not be sufficient for completing your work in an online environment. Although you will be able to access course content with mobile devices, you must use a computer for all assignments, quizzes, and virtual labs completed in Canvas.

Student Success

To be successful:

- check the course daily
- read announcements
- read and respond to course email messages as needed
- complete assignments by the due dates specified
- communicate regularly with your instructor and peers
- create a study and/or assignment schedule to stay on track
- access ASU Online Student Resources or CISA Academic Resources

Grading

Grades and deadlines may be revised at the discretion of the instructor.

Lab assignments: 500 points
Assignments will include essays and problem sets. Homework is designed to either 1) get you to think more about the concepts we have been working in class or 2) build competency with specific analytical approaches.

- Homework responses must be PDF documents, single-spaced, 12- point Times Roman font (this font), 1" margins. Please discuss the questions and possible answers with other students, but do not share your exam answers. I use software to detect plagiarized responses, which earn a score of zero.
- Name your file YourLastName.pdf and send it as an attachment in Canvas.
- Homework is due within one week. For example, if the homework was assigned on March 10, then the homework due date is March 17.
- The instructor will define the due date for the in-class assignment.

Please consider the homework due date to be a request rather than a demand. I understand that you are working professionals and have other responsibilities while you are taking this course. But you will do me (and you) a favor if you send me the homework on time. Please do not leave everything for the last few days.

Term Paper: 200 points
A term paper providing an in-depth examination of some aspects of Remote Sensing technology in natural resources will be due Thursday, April 20. This paper should be at least 7 to 9 typed pages in length and have a minimum of 12 citations. Papers should include the following sections: abstract, introduction, material and methods, results and discussion, and conclusion.

Remote sensing Project: 300 points
A significant component of this class will be preparing, analyzing, and interpreting data. To do this, you will work as part of a team, and each team will be responsible for preparing an oral presentation. Projects require the application and synthesis of skills from multiple lectures/labs, and they will take >3 weeks to complete.

Your grade will be determined based on the following grading schema:

A	**Percentage**
A+	100-97%
A	<97-94%
A-	<94-90%
B+	<90-87%
B	<87-84%
B-	<84-80%

C+	<80-77%
C	<77-70%
D	<70-60%
E	<60%
EU	<60%
EN	0%

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Grades on assignments will be available within one week of the due date in the Gradebook.

Late or Missed Assignments

Notify the instructor **BEFORE** an assignment is due if an urgent situation arises and you are unable to submit the assignment on time.

Follow the appropriate University policies to request an accommodation for religious practices, or to request accommodation for missed assignments due to University-sanctioned activities or active military service.

Late work will be accepted but penalized (i.e., 10% deduction) per day after the due date. No late work will be accepted after the Friday following the posted due date.

Attendance Policy

Class attendance (either in-person or remotely) is required in the course, and attendance is taken every class session. If you are unable to attend class for any reason, please contact me as soon as possible.

Communicating with your Instructor and Classmates

Classroom Community

To build a course climate that is comfortable for all, it is important that students (1) display respect for all members of the class – including the instructor and students; (2) pay attention to and participate in all interactive student partner/instructor sessions and activities; and (3) observe the rules of appropriate online behavior (also known as *netiquette*). This term is defined by the instructor and includes keeping course discussion posts and oral communication with other

students (or the instructor) focused on the assigned topics. Students must maintain a cordial atmosphere and use tact in expressing differences of opinion. In addition, they must avoid racist, sexist, homophobic, or other negative language that may unnecessarily exclude course members. This is not an exhaustive list of behaviors; rather, it represents examples of the types of things that can have a dramatic impact on the course environment. Your final grade may be reduced each time you engage in the types of negative behaviors indicated above.

Community Forum

This course uses a Canvas discussion topic called "Community Forum" for general questions and comments about the course. Check the syllabus, announcements, and existing posts to ensure it's not redundant prior to posting a question or comment. You are encouraged to respond to the questions of your classmates.

Email questions of a personal nature to your instructor. You can expect a response within 48h.

Chat

The Chat tool in Canvas allows students and teachers to interact in real time. Use Chat only for informal course-related conversations unless your instructor informs you otherwise. Chat is not ideal for questions about assignments; instructors are not required to monitor it and conversations may be buried or lost.

Email

ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly.

All instructor correspondence will be sent to your ASU email account.

Course Outline

Tentative Lecture Schedule

Week	Topic
1	Concepts and Foundations of the Remote Sensing
2	Electromagnetic Radiation
3	Aerial photography
4	Digital imagery Image resolution

5	Image interpretation **Project preparation**
6	Land Observation Satellites
7	Active Sensors Thermal Imagery
8	LiDar LiDAR measurements
9	Unsupervised classification Supervised classification
10	Image accuracy Hyperspectral Remote Sensing
11	Plant science
12	Unmanned aerial systems for remote sensing
13	Marine and coastal environments Remote Sensing and Wildlife management
14	Remote sensing in biodiversity monitoring **Term paper**
15	RS Project preparation RS Project presentation

- The course schedule may be revised at the discretion of the instructor.

Tentative laboratory schedule:

Week	Topic
1	Introduction to RS software I
2	Introduction to RS software II
3	Basic of image data
4	Where to obtain spatial data
5	Composite imagery
6	Deriving temperature from Landsat imagery
7	Spectral signatures
8	Pre-processing remote sensing data
9	Image classification I
10	Image classification II
11	Normalized difference vegetation index – NDVI I
12	Normalized difference vegetation index – NDVI II
13	Building orthomosaics – Drones I
14	Building orthomosaics - Drones II

- The course schedule may be revised at the discretion of the instructor.

Assignment Details

Assignments may be revised at the discretion of the instructor. A list of assignments is displayed bellow.

1. Introduction to remote sensing. Total number of points: 70.
2. Hyperspectral remote sensing. Total number of points: 100.
3. Image classification. Total number of points: 100.
4. Lab assignments. Total number of points: 100.
5. Final assignment. Write a short essay about the use of remote sensing in natural resources. This homework is worth 130 points.

Submitting Assignments

For your own protection, you should keep a copy of everything you hand in, and you should keep your graded assignments at least until grades are finalized at the end of the semester in the event you wish to contest any grades.

All assignments, unless otherwise announced by the instructor, MUST be submitted to the designated area of Canvas. Do not submit an assignment via email.

Assignment due dates follow Arizona Standard time. Click the following link to access the Time Converter to ensure your account for the difference in time zones. Note: Arizona does not observe daylight savings time.

Course Time Commitment

Coursework includes all learning activities including reading, watching videos, studying, and completing assignments. Arizona Board of Regents (ABOR) requires 45 hours of coursework per credit for college-level courses, which translates to:

· 1 credit hour = 45 total hours
· 2 credit hours = 90 total hours
· 3 credit hours = 135 total hours
· 4 credit hours = 180 total hours
· 5 credit hours = 225 total hours

ASU courses range in length from 6 weeks to 15 weeks. Below is a breakdown of the 135-hour required time commitment for a three-credit course divided among weeks for courses of various lengths.

Course Length	Time on Coursework per Week for a 3-credit course	Total Time Requirement for a 3-credit Course

6 weeks	22.5 hours	135 hours
7.5 weeks	18 hours	135 hours
8 weeks	17 hours	135 hours
15 weeks	9 hours	135 hours

Drop and Add Dates/Withdrawals

If you are unable to take this course for any reason, be aware that there is a limited timeline to drop or add the course. Consult with your advisor and notify your instructor to add or drop this course. If you are considering a withdrawal, review the following ASU policies: Withdrawal from Classes, Withdrawing as a Financial Aid Recipient, Medical/Compassionate Withdrawal, and a Grade of Incomplete.

Grade Appeals

Students must first speak with the instructor of the class to discuss any disputed grades. If, after review, a resolution is not achieved, students may proceed with the appeal process. Student grade appeals must be processed in the regular semester immediately following the issuance of the grade in dispute (by commencement for fall or spring), regardless whether the student is enrolled at the university. Complete details are available in the CISA Grade Appeals policy.

Academic Integrity

Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see provost.asu.edu/academicintegrity.

If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, college, and/or dean. Academic dishonesty includes, but is not limited to, cheating on an academic evaluation or assignment, plagiarizing, academic deceit (such as fabricating data or information), or falsifying academic records. Turning in an assignment (all or in part) that you completed for a previous class is considered self-plagiarism and falls under these guidelines. Any infractions of self-plagiarism are subject to the same penalties as copying someone else's work without proper citations. Students who have taken this class previously and would like to use the work from previous assignments should contact the instructor for permission to do so.

If you have any questions about your work and the academic integrity policy, please discuss your assignment or concerns with your instructor, teaching assistant, or your college Academic Integrity Officer in advance of submitting an assignment. Student resources on Sun Devil Integrity and strategies for completing your work with integrity and avoiding plagiarism are

available here: ASU Student Resources for Academic Integrity or provost.asu.edu/academicintegrity for more information.

Harassment Prohibited

ASU policy prohibits harassment on the basis of race, sex, gender identity, age, religion, national origin, disability, sexual orientation, Vietnam era veteran status, and other protected veteran status. Violations of this policy may result in disciplinary action, including termination of employees or expulsion of students. Students are encouraged to report harassment to instructors and the Dean of Students Office.

Student Conduct

ASU and the College of Integrative Sciences and Arts expects and requires its students to act with honesty, integrity, and respect. Required behavior standards are listed in the Student Code of Conduct and Student Disciplinary Procedures, Computer, Internet, and Electronic Communications policy, ASU Student Academic Integrity Policy, and outlined by the Office of Student Rights & Responsibilities. Anyone in violation of these policies is subject to sanctions. Students are entitled to receive instruction free from interference by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per Instructor Withdrawal of a Student for Disruptive Classroom Behavior. The Office of Student Rights and Responsibilities accepts incident reports from students, faculty, staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Title IX

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Disability Accommodations

Qualified students with disabilities who will require disability accommodations in this class are encouraged to make their requests to the instructor at the beginning of the semester either during office hours or by appointment. Note: Prior to receiving disability accommodations, verification of eligibility from the Disability Resource Center (DRC) is required. Disability information is confidential.

Disability Resource Center (eoss.asu.edu/drc)
Email: DRC@asu.edu
DRC Phone: 480-965-1234
DRC FAX: 480-965-0441

Statement on Inclusion

Arizona State University is deeply committed to positioning itself as one of the great new universities by seeking to build excellence, enhance access, and have an impact on our community, state, nation, and the world. To do that requires our faculty and staff to reflect the intellectual, ethnic, and cultural diversity of our nation and world so that our students learn from the broadest perspectives, and we engage in the advancement of knowledge with the most inclusive understanding possible of the issues we are addressing through our scholarly activities. We recognize that race and gender historically have been markers of diversity in institutions of higher education. However, at ASU, we believe that diversity includes additional categories such as socioeconomic background, religion, sexual orientation, gender identity, age, disability, veteran status, nationality, and intellectual perspective.

Mental Health

As a student, like anyone else, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating, and/or lack of motivation. These emotional health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. ASU Counseling Services provides counseling and crisis services for students who are experiencing a mental health concern. Any student may call or walk-in to any ASU counseling center for a same-day or future appointment to discuss any personal concern. Here is the website: eoss.asu.edu/counseling. After office hours and 24/7 ASU's dedicated crisis line is available for crisis consultation by calling 480-921-1006.

Establishing a Safe Environment

Learning takes place best when a safe environment is established in the classroom. In accordance with SSM 104-02 of the Student Services Manual, students enrolled in this course have a responsibility to support an environment that nurtures individual and group differences and

encourages engaged, honest discussions. The success of the course rests on your ability to create a safe environment where everyone feels comfortable to share and explore ideas. We must also be willing to take risks and ask critical questions. Doing so will effectively contribute to our own and others' intellectual and personal growth and development. We welcome disagreements in the spirit of critical academic exchange, but please remember to be respectful of others' viewpoints, whether you agree with them or not.

All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances.

Prohibition of Commercial Notetaking Services

In accordance with ACD 304-06 Commercial Note Taking Services, written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the note taker's name as well as the instructor's name, the course number, and the date.

Course Evaluation

Students are expected to complete the course evaluation. The feedback provides valuable information to the instructor and the college and is used to improve student learning. Students are notified when the online evaluation form is available. The results are always anonymous and cannot be reviewed by the instructor/department until after final grades have been posted.

Trigger Warning

Please note that some course content may be deemed offensive by some students, although it is not my intention to offend anyone. In addition, some materials that we link with online might also be considered offensive, troubling, or difficult to review in terms of language or graphics. I attempt to provide warnings when introducing this kind of material; yet, if I forget to do so, or if something else (in my materials or posts from fellow students) seems offensive, please contact me at Fabio.Albuquerque@asu.edu, or the faculty head, Douglas Green.

Academic Affairs Manual

For a complete guide to Arizona State University course policies, please refer to the Academic Affairs Manual (ACD).

Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. Remember to check your ASU email and the course site often.