Remote Sensing and Photogrammetry GISC 4331
Department of Computer Science
Fall 2025

A. COURSE INFORMATION

Course number/section: GISC-4431-001/W01
Class meeting time: MW 2-3:15 PM
Class location: BH-128 (lecture) and Online (*refer to Section G)
Course Website: Accessed via Canvas: https://canvas.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Michael J. Starek
Professor of Geospatial Systems Engineering
College of Engineering & Computer Science
Chair of Remote Sensing & Autonomous Systems for Geomatics
Director of Measurement Analytics Lab (MANTIS)
Conrad Blucher Institute for Surveying and Science
Office location: NRC 3407
Office hours: T 1:00 to 4:00 PM, W 11:00 AM to 1:00 PM (or by appointment)
Telephone: 361.825.3978
e-mail: michael.starek@tamucc.edu, Include "GISC 4431" in subject line.
Appointments: Scheduled by email, phone, or MS Teams.

C. COURSE DESCRIPTION

Catalog Course Description

Provides the foundations to interpret, process, and apply remotely sensed data acquired by satellites and sub-orbital platforms (aircraft, UAVs) for mapping and analysis of our natural and built environment. Principles of electromagnetic energy-matter interaction, remote sensing systems and data characteristics, digital image processing, and information extraction methods will be covered. Included is treatment of: aerial photogrammetry; multispectral, thermal, and hyperspectral sensing; earth observation satellites; radar and lidar; emergent topics. Emphasis will be on their use for geospatial and environmental applications.

Extended Course Description

This course is intended to give students the foundational and practical applications of geodetic and earth observation using remote sensing technology. Remote sensing is rapidly becoming a critical component in the geomatics and GIS profession as well as many others. Topics include aerial photogrammetry, multispectral remote sensing, uncrewed aircraft systems (UAS) for surveying, lidar, reality capture and 3D point cloud data. Having requisite knowledge in remote sensing and photogrammetry will help to advance one's toolset for high tech careers in today's rapidly evolving and diverse geospatial field.

D. PREREQUISITES AND COREQUISITES

Prerequisites

PHYS 2425 - University Physics I and GISC 3300 - Geospatial Mathematical Techniques or equivalent; or instructor permission. Working knowledge of ArcGIS Pro.

Corequisites

None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)

Remote Sensing and Image Interpretation, **7th Edition**. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, 2015.

Optional Textbook(s) or Other References

Additional reading materials will be provided from my own sources and other sources to complement material in text and lecture.

Supplies

Scientific calculator for some assignments and the exam. Desktop computer or laptop capable of running ArcGIS Pro and photogrammetry software, such as Pix4Dmapper or equivalent, will be required to work on assignments (see comment below about CI 229).

Remote sensing requires image processing and analysis capabilities. This course will primarily use ArcGIS Pro software for processing remotely sensed data. Students will have the ability to obtain a licensed, student version of ArcGIS Pro for use on their personal machine for free and it is available in the geospatial computer lab, CI 229. Other software for drone photogrammetry (such as Pix4Dmapper) and lidar data processing will be used and instructions for access/use will be provided. ArcGIS Pro must be run on Windows or a Windows emulator for Macs. Pix4Dmapper is similar.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course's student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Determine the appropriate types of remote sensing (RS) data for a particular problem

2. Apply techniques to manipulate and enhance imagery for analysis
3. Define and characterize basic principles of aerial/drone photogrammetry
4. Define and characterize basic principles of lidar mapping systems
5. Derive information and mapping products from 2D/raster and 3D remotely sensed data

In order to achieve these goals we need to acquire the following requisite knowledge:

A. Types of RS platforms and data characteristics
B. Spectral, temporal, and spatial resolution considerations for selecting an RS platform
C. Physics of electromagnetic (EM) energy interaction with the atmosphere and surface
D. Exploitation of spectral signatures in RS data for detection and parameter estimation
E. Fundamentals of aerial photogrammetry and structure-from-motion
F. Fundamentals of reality capture with UAS and lidar mapping systems
G. Fundamentals of digital terrain modeling and 3D point cloud data
H. Exploitation of RS data within GIS for land cover mapping and monitoring
I. Digital image processing techniques for image correction and enhancement
J. Image classification methods using geospatial AI to derive new mapping products
K. How to assess the accuracy of surveying and mapping products derived from RS

G. INSTRUCTIONAL METHODS AND ACTIVITIES

Approach: lecture, discussion, quizzes, and practice exercises. Weekly readings will be assigned. There will be up to ten lab assignments requiring the use of relevant GIS and photogrammetry software, or conceptual/analytical problem solving. Non-graded class problem sets and graded quizzes will be given to gauge student progress, ensure students are following the material, and spur your thinking. A midterm exam and final project (provided to you) requiring RS image classification and data analysis.

Live lectures will be conducted in person and on occasion, virtually via Zoom. The live lectures will be recorded and posted to the course's canvas website. Some lectures will consist of a pre-recorded lecture posted to the course website for you to watch asynchronously for class on that date. Lectures recorded for asynchronous viewing, not hosted live (either in person or virtually), will be posted before the start time of each lecture that week. Students are expected to keep pace with the course, watching each lecture in a timely fashion for that week. This is necessary to do well in the course.

Due to extenuating circumstances during the semester, such as work-related travel and project fieldwork, some lectures may be delivered virtually or provided as recordings. We will adapt as needed, and I will ensure there is no loss of instructional content or quality. Occasionally, there may be guest lecturers. Students will be informed in advance of any changes to the in-person lecture schedule.

Lab assignments for this course will be posted to the canvas website. The geospatial computer lab in CI 229 will be open to students to work on labs during and outside of the designated lab time. Students can also work on the lab assignments remotely via a personal computer. During the designated lab period, either myself or a graduate student/TA of mine will be available. Some lab assignments may not require use of the designated lab period.

H. MAJOR COURSE REQUIREMENTS AND GRADING

Your final grade will be based on the following point distribution:

ACTIVITY	% of FINAL GRADE
Midterm Exam	25%
Final Project	25%
HW Average	40%
Quiz Average	5%
Participation Score	5%

Max of 5 points is given for participation. Every student starts with a class participation score of C (= 3 points). A student who regularly attends class on time but does no more will maintain a C. In order to earn a participation grade higher than a C (3 points), you must actively participate. Listed below are examples of things you can do that will raise your class participation grade.

- Attempt to answer questions asked of the class (answers need not be correct but should be a constructive effort)
- Asks questions about the material being discussed
- Share ideas and contribute positively to the class discussion such as asking questions about the material or sharing material from outside the class.
- Regular attendance, complete assignments on time, pay attention during class.

Students who do not attend regularly, disrupt class, don't pay attention (e.g., sleep or surf the web on their cell phone) will receive a reduction in class participation with a minimum of 0 points. A 0 participation score means your maximum achievable grade in the course with a 100 on every assignment would be a 95.

The above list is illustrative, not exhaustive. The goal is to make this a fun and engaging course and that requires your help!

I. COURSE CONTENT/SCHEDULE

SCHEDULE is tentative and subject to change. The official schedule and required weekly readings will be posted to canvas. Assignments will be provided on a weekly to bi-weekly basis.

DATE (BY DAY OR	TOPIC	CHAPTER(S)	ASSIGNMENTS

WEEK)			
1	Course introduction		
2	Fundamentals of RS	See Canvas	Lab 1
3	How sensors record data	See Canvas	
4	EM radiation principles and spectral response patterns	See Canvas	Lab 2
5	Elements of photogrammetry	See Canvas	Lab 3
6	Elements of photogrammetry	See Canvas	Lab 4
7	Camera Calibration & AAT Ortho-Photo Generation	See Canvas	
8	MIDTERM (tentative)	See Canvas	
9	Structure-from-Motion UAS for Surveying	See Canvas	Lab 5
10	LiDAR & 3D Reality Capture	See Canvas	Lab 6
11	Digital Terrain Modeling ASPRS Accuracy Standards	See Canvas	
12	Earth Observation Satellites Thermal Imaging	See Canvas	Lab 7
13	Digital Image Processing	See Canvas	
14	Image Classification & GeoAI	See Canvas	Lab 8
15	Image Classification & GeoAI	See Canvas	
16	**Exam Week**	See Canvas	Final Project Due

Note: Changes in this course schedule may be necessary and will be announced to the class by the instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness

Attendance is required for in-person and virtual live lecture and counts towards your participation score. The student will be responsible for all materials that are covered in class. If you miss a class due to unavoidable circumstances, you need to review and watch the recorded lecture. Attendance is mandatory for exams, presentations, and in-class graded quizzes. Repeated tardiness will not be tolerated. In-person students are expected to attend face-to-face lectures and distance students are normally not permitted to attend in-person lectures without prior approval first. Previously recorded lectures posted for class dates that will not hold a live lecture are required to be watched. The canvas course website will be used to assess if a student is watching the pre-recorded lectures. Failure to

do so will count against your participation score.

Please notify me via email if you are unable to make class.

Late Work and Make-up Exams
You are expected to work individually on all assignments/exams unless otherwise stated. Assignment due dates will be specified for each assignment.

Effective as of 12:00 AM CDT on the day following the assignment due date:
- 1 to 2 days late: - 5 pts
- 3 to 4 days late: - 10 pts
- 5 days late: - 15 pts
- > 5 days late: 0 (assignment will not be accepted)
  **policy can be adapted during the semester if late returns become a recurring issue*

If you are not able to meet a particular deadline, **you must notify me well before** the due date to request an extension. Reduced penalty extensions will be granted on a case-by-case basis **and will be refused for repeat offenders**. Once an assignment is graded and returned to the class you receive a 0.

Extra Credit
May be given on occasion and will be announced in class or added as bonus point question/s on an exam or assignment.

Cell Phone Use
Cell phones must be TURNED OFF and not utilized during class.

Laptop Use
Laptops can only be used for looking at lecture notes/materials; cannot be used to search web or work on other things not class or lecture related.

Food in Class
Not permitted.

Missed Exam
You are expected to take the exam when scheduled. Make-up exams will only be permitted under department approved circumstances.

Participation
Participation is expected.

Exam Policy for Distance Students
N/A

Student Safety Trainings

Required safety trainings and/or lab safety seminars must be successfully completed once every academic year, normally in the Fall. Students will be required to take the course from Blackboard in either the first lecture or first lab to complete their training assignments and show the certificate of completion before the end of the class or lab. Students who are still covered by having taken the safety training earlier should show their certificate of completion. For students unable to attend first day of class/lab (or still registering for the class), a reasonable completion date will be flagged in Starfish. A possible grade penalty can be enforced for non-completion.

Others

All work submitted for grading must be the student's own work. Plagiarism or cheating will result in a score of 0 (zero) for the work or dismissal from the course and the Dean of Students office will be notified. No copying from another student's work, or past work of any type, is allowed. It is the student's duty to allow no one to copy his or her work. Anyone found violating this policy on assignments or exams may receive an automatic F for the course.

If you are having a problem finishing an assignment or other concerns, please talk to me. My goal is to help you succeed in the course.

K. COLLEGE AND UNIVERSITY POLICIES

COVID-19 Campus Safety Measures

While the University does not require face coverings or vaccinations, we encourage every Islander to consider getting vaccinated, wear a face covering while indoors, and wash your hands frequently to aid in reducing the spread of COVID-19.

Anyone with COVID-19 symptoms should not report to campus. Students, faculty, and staff who test positive are required to report their test results to the University Covid-19 Reporting Form.

Please use the below links for COVID-19 guidelines:

If You Test Positive, Regardless of Vaccination Status

If you are exposed to Someone with COVID-19

If you have Symptoms Regardless of Vaccination Status

Complete the COVID-19 Self Reporting Form and notify instructor.

More COVID-19 related information may be found on the university website at https://www.tamucc.edu/campus-guide/covid-protocol.php

Campus Emergencies*

At TAMU-CC, your safety is a top concern. We actively prepare for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus.

- For any emergency, dial the University Police Department (UPD) at **361-825-4444** or dial 911. It's a good idea to have the UPD emergency number (and non-emergency number 361-825-4242) saved in your cell phone.
- There are nearly 200 classroom telephones throughout campus. If you feel threatened or need help and don't have a cell phone, dial 4444 (emergency) or 4242 (non-emergency) to be connected to UPD.
- If we hear a fire alarm, we will immediately evacuate the building and proceed to _____the nearest parking lot_____(location).
    - Proceed to the nearest building exit or evacuation stairway. Do not use the elevator. Persons who need help navigating stairs should proceed to a marked Area of Rescue Assistance, if possible.
    - Persons with disabilities should speak with their faculty about how to best assist them in case of an emergency.
    - Review the evacuation route (see specific Building Emergency Plan).
- TAMU-CC employs the Code Blue Emergency Notification System, an alert system which connects the campus community during emergency situations.
    - The notifications include emails, text, and pre-recorded messages, as appropriate.
    - Code Blue emergencies may include severe weather warnings, threats, school closures, delays, evacuations, and other incidents which disrupt regular campus activities.
    - Students can update personal contact information anytime at https://emergency.tamucc.edu/contactform/.
- Shelter in Place via Code Blue.
    - "Shelter-in-place" means to take immediate shelter where you are and may be implemented for severe weather, hazardous material spills, active shooters, or other dangerous situations.
    - If there is a shelter in place for a **tornado warning**, our preferred location is the bottom floor of this building, away from windows and doors.
- Active Threat Protocol. There are three things you could do that make a difference if there is an active threat: Run, Hide, and/or Fight. For more information about the Run, Hide, Fight protocol, including what to do when law enforcement arrives, visit **page 6** of the Quick Reference Guide to Campus Emergencies https://www.tamucc.edu/finance-and-administration/facility-administration/ehs/emergency-management/assets/documents/finalbooklet.pdf.

For the *Quick Campus Guide to Campus Emergencies* (including a list of Areas of Rescue

Assistance and additional protocols on assisting persons with physical disabilities, hurricanes, bomb threats, animal bites, crime reporting, elevator entrapment, etc.), visit https://www.tamucc.edu/finance-and-administration/facility-administration/ehs/emergency-management/assets/documents/finalbooklet.pdf.

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity, or plagiarism. (Plagiarism is the presentation of the work of another as one's own work.) In this class, academic misconduct, or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Permit AI with Conditions**
  - As a part of this course, students may have the opportunity to interact with artificial intelligence (AI) tools for educational purposes. These tools can provide valuable insights and assistance in understanding course material, generating ideas, and enhancing learning experiences. However, it's important to note that while AI tools can be helpful, they are not a substitute for critical thinking, creativity, and human judgment. Students are expected to use AI tools responsibly, acknowledge their limitations, and critically evaluate the information provided by these tools. It's also crucial to consider ethical considerations, such as bias and privacy when using AI assistance in this course or any other educational context. The use of AI tools should align with the course objectives and policies, and students should always properly cite and acknowledge the use of AI tools in their work. The instructor will provide guidance as to proper use of AI assistance, and students are encouraged to seek clarification or raise any concerns they may have regarding the use of AI tools in the course including prohibitions.
  - **Permit AI Tools for Learning:** Use of generative AI tools is allowed as assistive learning tools to understand and clarify concepts for self-learning and to assist in programming (e.g., error checking but not to write the logic and code for you); however, such tools do not replace research, use and citation of reputable original sources of work, such as books, journal articles, patents, and other sources as relevant to this course; nor does use of such tools replace critical thinking, analysis and interpretation of results by the student. Students are responsible for their academic integrity when representing their knowledge and skills when using such tools and other sources.

  - **Prohibit AI Tools for Assignments**: The use of AI or other automated writing tools to complete assignments, quizzes, exams, etc., is strictly prohibited in this class except to assist with checking grammar. Writing is

required to be one's own writing. Students may not use ChatGPT or any other similar generative AI tool programs to write any course assignments. Assignment files uploaded to Turnitin are checked for likelihood of being written with an AI program. Any student assignment Turnitin reports to be likely prepared by an AI program will be uploaded to ZeroGPT or a similar program. If that program likewise identifies the assignment as likely prepared by an AI program, the assignment will receive a zero score. *Any evidence of the use of AI will be considered a violation of academic integrity and will be met with a failing grade for the assignment and may result in further disciplinary action. It is the responsibility of each student to ensure that all work submitted for this class is their own original work, written and completed without the use of AI or other automated writing tools.*

- **Special Note:** If the instructor suspects that a student engaged in academic dishonesty, cheating, and/or plagiarism for any of the course's assessments involving the use of third party individuals, groups, or technology (e.g., unpaid outsourcing, traded goods or services, paid goods or services, artificial intelligence and related machine learning systems, programs, software, applications/apps, etc.), the student will be required to have an in-person oral defense of the subject matter, content, format, resources, etc. with the instructor and another university faculty member or administrator present to determine the veracity and reliability of the student's work and mastery of material. Based on the results of the oral defense, consequences for academic dishonesty, cheating, and plagiarism include, but are not limited to, a failing grade for an assignment, a failing grade for the course, noncredit for an assignment, additional work, and/or direct referral to university officials.

- **Respect for yourself and your education:** I will strongly enforce the University's academic misconduct policies (for more information see section on academic misconduct). Collaboration or discussion about individual assignments with other persons, artificial intelligence, websites, or applications other than your instructor or other persons/materials approved by your instructor is considered cheating. As part of your introduction to the course, you will complete the CITI Plagiarism Training Module— more information on this is located on the course Blackboard site. Sharing of course content or materials may also result in copyright infringement and will be considered a breach of academic conduct.

- **Undergraduate and Graduate**

  The intent of academic integrity is to present your own original work on all assignments. Examples of Academic Integrity Violations include, but are not limited to, the following:

(1) Copying and pasting from the internet, without attribution,

(2) Copying and pasting from the textbook or other sources, without attribution,

(3) Using Artificial Intelligence applications to write, enhance, or alter your exam or assignment,

(4) Using Grammarly Go to write, enhance, or alter your exam or assignment,

(5) Forwarding your exam or assignment to another person for review and/or alteration,

(6) Paying a person, organization, or website to originate, review, write, or contribute to your exam or class assignment,

(7) Using unauthorized materials while taking an exam,

(8) Discussing an individual exam or assignment with another when not permitted, and

(9) Assisting another student by any of these means.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor's ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VIII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high-quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state, and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation, or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. ***Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.*** Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the registrar's office in the **University Center 324** and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. You may also submit a PowerFormSigner online. (November 7) is the last day to drop a class with an automatic grade of "W" this term.

- **Grade Appeals**
  As stated in University Procedure 13.02.99.c0.03, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is required to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C0.03, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at https://www.tamucc.edu/faculty/faculty-affairs/assets/student-grade-appeal-packet.pdf. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Engineering & Computer Science Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  https://www.tamucc.edu/disability-services/index.php

- **Civil Rights Complaints**
  Texas A&M University-Corpus Christi is committed to fostering a culture of caring and respect that is free from discrimination, relationship violence and sexual misconduct, and ensuring that all affected students have access to services. For information on reporting Civil Rights complaints, options and support resources (including pregnancy support accommodations) or university policies and procedures, please contact the University Title IX Coordinator, Rosie Ruiz, at Rosie.Ruiz@tamucc.edu ext. 5826, or visit website at Title IX/Sexual Misconduct/Civil Rights.

  Limits to Confidentiality. Essays, journals, and other materials submitted for this class are generally considered confidential pursuant to the University's student record policies. However, students should be aware that University employees, including instructors, are not able to maintain confidentiality when it conflicts with their

responsibility to report alleged or suspected civil rights discrimination that is observed by or made known to an employee in the course and scope of their employment. As the instructor, I must report allegations of civil rights discrimination, including sexual assault, relationship violence, stalking, or sexual harassment to the Title IX Coordinator if you share it with me.

These reports will trigger contact with you from the Civil Rights/Title IX Compliance office who will inform you of your options and resources regarding the incident that you have shared. If you would like to talk about these incidents in a confidential setting, you are encouraged to make an appointment with counselors in the University Counseling Center.

- **Statement of Academic Continuity**

  In the event an unforeseen academic disruption, such as a major hurricane, prevents class from being held on the campus of Texas A&M University-Corpus Christi; this course would continue via Blackboard and/or university email. In addition, the syllabus and class activities may be modified to allow continuation of the course. University email accounts will be the official mode of communication for this course and campus announcements. Students should be checking their university email account and opt into the University Code Blue emergency alert system.

L. OTHER INFORMATION

- **Academic Advising**

  The College of Engineering and Computer Science requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College's Academic Advising Center is located in the Faculty Center 148 or can be reached at (361) 825-3401.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.