Remote Sensing GISC 4431
Geographic Information Science and Geospatial Systems Engineering Program
Fall 2019

A. COURSE INFORMATION

Course number/section: GISC-4431-001/201 or GISC-4431-W01/W11
Class meeting time: Lecture: MW 2-3:15 PM, Lab: 9-11:50 AM
Class location: CI 229 (lecture and lab)
Course Website: Accessed via Blackboard (Bb): https://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Michael J. Starek
Associate Professor of Geospatial Systems Engineering
School of Engineering and Computing Sciences
Director of Measurement Analytics Lab (MANTIS)
Conrad Blucher Institute for Surveying and Science
www.mantisresearch.org

Office location: NRC 3407
Office hours: M, W 11:00 AM to 12:30 PM, T 2:00 to 4:00 PM
Telephone: 361.825.3978
Contact e-mail: Send via Bb messages/email
Office e-mail: michael.starek@tamucc.edu; include “GISC 4431” in subject line.
Appointments: Schedule by email, phone, or stop by my office.

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 four credit course is intended to give students the theoretical and practical applications of earth observation with remote sensing. Remote sensing is rapidly becoming a critical component to support a wide range of fields including GIS, civil engineering, land surveying and geomatics, environmental science, defense intelligence, resource monitoring, oil and gas exploration, and many others. Having requisite knowledge in remote sensing will help to advance one’s toolset for high tech careers in today’s geospatially ubiquitous world.
D. PREREQUISITES AND COREQUISITES

Prerequisites

Corequisites
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)

Optional Textbook(s) or Other References
Additional reading materials will be provided to complement material in text and lecture.

Software
Remote sensing requires image processing and analysis capabilities. This course will primarily use ArcGIS for processing remotely sensed data. Students will have the ability to obtain a licensed, student version of ArcGIS for use on their personal machine for free and it is available in CI 229 GIS lab. Other software, such as for UAV photogrammetry and lidar processing will be used and instructions for access/use will be provided.

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 RS data for a particular problem and acquire it
2. Apply techniques to manipulate and enhance imagery for analysis
3. Derive information products from remotely sensed data for end-user applications

In order to achieve these goals we need to acquire the following requisite knowledge:
A. Types of RS platforms and data characteristics
B. Physics of electromagnetic (EM) energy interaction with the earth’s surface
C. Effects of the atmosphere on EM propagation and resultant sensor measurements
D. How RS platforms record reflected and emitted EM energy
E. Response of surface materials (e.g. water) at different wavelengths
F. Exploitation of these spectral signatures for object detection and parameter estimation
G. Spectral, temporal, and spatial resolution considerations for selecting an RS platform
H. State and federal web resources for obtaining regional and global scale RS data
I. Basic digital image processing techniques for image correction and enhancement
J. Pattern classification methods for deriving new maps and information products
K. How to assess the accuracy of the resulting maps

G. INSTRUCTIONAL METHODS AND ACTIVITIES

Approach: lecture, discussion, and practice exercises. Weekly readings will be assigned. There will be up to eleven lab assignments requiring the use of relevant software or problem solving.

In class problem sets will occasionally be given to gauge student progress and spur discussion. Graded quizzes will occasionally be given in class (including “pop quizzes”) or assigned as a take home problem set.

H. MAJOR COURSE REQUIREMENTS AND GRADING

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

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Final Project</td>
<td>25%</td>
</tr>
<tr>
<td>HW Average</td>
<td>40%</td>
</tr>
<tr>
<td>Quiz Average</td>
<td>5%</td>
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<tr>
<td>Participation Score</td>
<td>5%</td>
</tr>
</tbody>
</table>

Grade Scale: A (90-100%) B (80-89%) C (70-79%) D (60-69%) F (<60%).

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 constructively 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) 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!

Online student participation can come in the form of postings to the course blog, interaction with me via Bb Messages or phone, course discussion form, etc.

### I. COURSE CONTENT/SCHEDULE

SCHEDULE is tentative and subject to change. The official schedule will be on Blackboard with the required weekly readings posted.

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
<th>ASSIGNMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fundamentals of remote sensing</td>
<td>See Bb Schedule</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>3</td>
<td>How sensors record data</td>
<td>See Bb Schedule</td>
<td>Assignment 2</td>
</tr>
<tr>
<td>4</td>
<td>EM radiation principles and</td>
<td>See Bb Schedule</td>
<td>Assignment 3</td>
</tr>
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<td></td>
<td>spectral response patterns</td>
<td></td>
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<tr>
<td>5</td>
<td>Elements of photogrammetry</td>
<td>See Bb Schedule</td>
<td>Assignment 4</td>
</tr>
<tr>
<td>6</td>
<td>Elements of photogrammetry</td>
<td>See Bb Schedule</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Structure from Motion and Mapping</td>
<td>See Bb Schedule</td>
<td>Assignment 5</td>
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<tr>
<td></td>
<td>with UAS</td>
<td></td>
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<tr>
<td>8</td>
<td>MIDTERM (tentative date)</td>
<td>See Bb Schedule</td>
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<tr>
<td>9</td>
<td>Data Quality Satellite Earth</td>
<td>See Bb Schedule</td>
<td>Assignment 6</td>
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<td></td>
<td>Observation</td>
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<tr>
<td>10</td>
<td>Thermal/Hyperspectral</td>
<td></td>
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<tr>
<td>11</td>
<td>Digital Image Processing (DIP)</td>
<td>See Bb Schedule</td>
<td>Assignment 7</td>
</tr>
<tr>
<td>12</td>
<td>DIP</td>
<td>See Bb Schedule</td>
<td>Assignment 8</td>
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<tr>
<td>13</td>
<td>LiDAR</td>
<td>See Bb Schedule</td>
<td>Assignment 9</td>
</tr>
<tr>
<td>14</td>
<td>LiDAR</td>
<td>See Bb Schedule</td>
<td>Assignment 10</td>
</tr>
<tr>
<td>15</td>
<td>LiDAR/Last Class</td>
<td>See Bb Schedule</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Exam Week</td>
<td>See Bb Schedule</td>
<td>Final Project</td>
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</tbody>
</table>
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 since the student will be responsible for all materials that are covered in class. It is counted for your participation grade. If you miss a class due to unavoidable circumstances, you should copy class notes from another student in the class and review recorded lecture. Attendance is mandatory for exams, final project, and presentations. 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. Recorded lectures may be restricted to distance students at discretion of the instructor. Online student attendance will be gauged based on regular Blackboard access.

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 ET on the day following the assignment due date:
- 1 to 3 days late - Minus 3 pts or 3% of max score per day past due
- 4 to 6 days - Minus 4 pts or 4% of max score per day past due
- 1 week late – Minus 30 pts or 30 % of max score plus minus 5 pts each day after
- After assignment is graded and returned = 0 (typically 1 week!)

Example: Max score on an assignment is 100 and you are 5 days late, then max grade you can get is 80.

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 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. Refer to participation grading criteria under Section H above.

Exam Policy for Distance Students
Exams will be given in-class. Therefore, distance students must take the same exam on that same day. Online students will be notified of the procedure at least one week in advance. Implementation will either be through Blackboard or exam proctoring service. Exam-proctoring charges may range from $1 - $50.00 per exam. Students may be required to schedule exams at least 24 hours in advance or incur late scheduling charges. All costs for exams are the responsibility of the student. Students may also be responsible for providing webcams to be used in test proctoring.

Others
All work submitted for grading must be the student's own work. Plagiarism 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 cheating and/or copying, in the exams or assignments, in the instructor's opinion, 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

- 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.
• **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 VII 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)**
  The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must be submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar [http://www.tamucc.edu/academics/calendar/] for the last day to drop a course.

• **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, 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 encouraged 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.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). 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 Science and Engineering 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.

[http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering 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 Center for Instruction 350 or can be reached at (361) 825-3928.

**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.
GENERAL GUIDELINES FOR COURSES AND LABS
IN THE GISC PROGRAM

CULTURE, REGULATIONS, MODES OF OPERATION AND PROCEDURES

These guidelines are designed to inform scholars of their responsibilities and of the course requirements in order to make this course a positive experience. The instructor is always available for consultation and discussion with students on any aspect of a course and of these general guidelines.

CLASS CULTURE

1. Consider yourself as a scholar rather than a student. The term “student” may imply some passivity, whereas the term “scholar” implies active participation, understanding and searching. We will use these terms interchangeably with the meaning of “scholar” implied. Osmosis does not work in a learning environment!

A good scholar takes NOTES at every class meeting.

2. Further, define yourself as a “thinking explorer”. You are responsible for your education; an instructor can only be a guide and a facilitator. An instructor cannot learn for you. If you come across something that really interests you, explore it further.

3. Your experience at this University should not consist of passing a series of courses to earn a degree. Your experience should rather be a series of activities that will give you an education.

4. Concentrate on “learning to learn”. You will have to be a life-long learner to survive in your chosen career.

5. There is no such thing as a stupid question; there is such a thing as a stupid answer. So ask questions, the instructor is taking all the risks! Ask questions of your instructor and of your fellow scholars. Many times questions are more important than answers.

6. Keep copious notes of all that is going on in all the meetings related to your course. Make a note of what the instructor is stressing. At the end of each lecture you should be able to answer two questions: What did I learn from this lecture? and What was not clear to me? At the beginning of each lecture, if the instructor does not ask for questions, you need to ask if there is something you did not understand from the last lecture. Review, consolidate, annotate and organize your lecture/lab notes on a regular basis, at least once a week. The Internet is a tremendous resource and also a great danger. When you find information on the Internet, you have no idea if it is correct. View such information with caution. But, use the Internet to explore topics that interest you. Do not only prepare for the exam in a course – learn as much as you can on the topics introduced to you by the course material. You are responsible for the extent of your education! READ MINDFULLY !!!!!

7. In addition to details of the syllabus given in class, the syllabus for the course includes all the chapters of the required textbook/s unless indicated otherwise by the instructor. The student is responsible for all materials/topics covered in class, in handouts, in assignments, in labs, and in outings or field trips. The instructor is NOT responsible for informing absent students exactly what was covered in previous classes, meetings, etc.

PROCEDURES & REGULATIONS
8. The final letter grade for the class will be based on the raw composite numerical score obtained from the weighted average of the tests, quizzes, exams, labs, etc. as indicated by the instructor. The raw composite numerical score may be adjusted (curved) based on the highest score, the statistical profile of the scores and other academic standards or other considerations. Generally the letter grade of A is 90% and over of the adjusted score, a B is between 80% and 89% (inclusive) of the adjusted score, a C is between 70% and 79% (inclusive) of the adjusted score, a D is below 70% of the adjusted score and an F is below 60% of the adjusted score. An incomplete (I) will only be given in very unusual circumstances. The University regulations on incomplete grades state: “An incomplete notation may be given to a student who is passing but has not completed a term paper, examination, or other required work for reasons beyond the student’s control other than the lack of time”. Students are expected to take ALL tests, quizzes, exams, etc., and to complete and hand in all labs and other assignments. There is no provision for “extra credit”. No final grades will be given via the telephone, e-mail, etc.

9. All University rules, regulations and expected student conduct apply to this course. Students are held responsible for the information given in the current Catalog and Student Handbook. Make yourself aware of the University security regulations.

10. All labs, assignments, etc. must be handed in on the assigned due date. Scholars having problems must notify the instructor well before the due date. Marks will be deducted for poor and sloppily presented work.

11. Labs, etc. handed in after the due date may be subject to a penalty of loss of marks. Labs, etc. handed in after the graded labs, etc. have been returned to students will get zero marks but must be handed in to the instructor. Labs will be returned to students, after they have been graded, at a class meeting or on Blackboard.

12. Scholars are asked to take special note of the penalties, which the University attaches to Academic Dishonesty. Consult the Student Handbook.

13. All work handed in to the instructor must be the student's own work. Extracts, excerpts, etc. from the work of others must be suitably noted, acknowledged and properly referenced. Any Group Work will be judged in the same way. That is, it is the work of the group and the extracts, excerpts, etc. of others must be acknowledged.

14. All written and graphical work handed in must be presented neatly printed and bound (staples are adequate). Students’ written work will be judged on written communication skills, critical thinking and problem solving ability.

15. Students are expected to be present at all meetings (lectures, labs, etc.) of the class. Students are expected to be present at the date and time assigned for all tests, exams, quizzes, etc. There are NO provisions for making up missed exams except in cases where prior arrangements have been made and agreed to by the instructor. During the assigned lab session, ONLY assigned labs are to be done. All other work must be done in other rooms.

16. All cellular phones and other similar devices MUST BE TURNED OFF during lectures, labs and other class meetings.

17. All students must keep their university e-mail addresses (firstname.lastname@islander.tamucc.edu). This will be the means of communication between the instructor and the class.

18. The instructor reserves the right to make changes to the above with due notice to the
students. These changes will be announced in class and each student is responsible for keeping herself/himself informed of such changes.