Remote Sensing GISC 4431
Geographic Information Science and Geospatial Surveying Engineering
Fall 2015

A. COURSE INFORMATION

Course number/section: GISC-4431-001/ 201 or GISC-4431-W01/W11
Class meeting time: Lecture: MW 1-2:15 PM, Lab: 9-11:15 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
Assistant Professor of Geospatial Engineering & GISc
School of Engineering and Computing Sciences
Associate Director of the Geospatial Computing Lab
Conrad Blucher Institute for Surveying and Science
Office location: CBI 113
Office hours: M,W 3:30 to 5 PM
Telephone: 361.825.3978
Contact e-mail: Send via Bb messages
Office e-mail: michael.starek@tamucc.edu
Reserved for pressing matters only; include “GISC 4431” in subject line.
Appointments: Schedule by email, phone, or stop by my office.

C. COURSE DESCRIPTION

This course will provide an introduction to the theory and practice of remote sensing. Focus will be on the underlying principles of earth observation from spaceborne and airborne platforms and on the processing and integration of such data for mapping and analysis applications. Included is treatment of: aerial photogrammetry; multispectral, thermal, and hyperspectral sensing; earth observation satellites; lidar and radar; and emergent topics.

D. PREREQUISITES AND COREQUISITES

Prerequisites
GISC 3300 - Geospatial Mathematical Techniques; PHYS 2425 - University Physics I.

Corequisites
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook
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 use ArcGIS in combination with other software tools (e.g. open source) 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.

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

H. 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 ten 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.

Online Students

My lectures will be recorded live (audio only) along with my screen shots (e.g. power points) using webex. It is up to the online student to ensure they keep up with the readings, lectures, and other material. Students taking the course must have continuous web access and are expected to keep pace with the course and adhere to all assignment deadlines, exam deadlines, etc.

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 or Exam</td>
<td>25%</td>
</tr>
<tr>
<td>HW Average</td>
<td>40%</td>
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<tr>
<td>Quiz Average</td>
<td>5%</td>
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<tr>
<td>Participation Score</td>
<td>5%</td>
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</tbody>
</table>

We may forgo a final exam for a final project; TBD after midterm.

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, 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.
- Completes assignments on time and pays attention

Students who do not attend regularly, disrupt class, don’t pay attention (e.g. sleep or surf the web on their iphone) will receive a reduction in class participation with a minimum of 0 points.
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, course discussion form, etc.

I. COURSE CONTENT/SCHEDULE

SCHEDULE is tentative and subject to change. Weekly readings will be posted to Bb.

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction</td>
</tr>
<tr>
<td>2</td>
<td>Fundamentals of remote sensing</td>
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<td>3</td>
<td>How sensors record data; EM radiation principles</td>
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<td></td>
<td>Assignment 1 Due</td>
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<td>4</td>
<td>EM surface interaction and spectral response patterns</td>
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<td></td>
<td>Assignment 2 Due</td>
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<td>5</td>
<td>Elements of photogrammetry</td>
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<td></td>
<td>Assignment 3 Due</td>
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<tr>
<td>6</td>
<td>Elements of photogrammetry</td>
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<td></td>
<td>Assignment 4 Due</td>
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<td>7</td>
<td>Satellite Earth Observation/hyperspectral</td>
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<td></td>
<td>Assignment 5 Due</td>
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<tr>
<td>8</td>
<td>Thermal</td>
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<td></td>
<td>MIDTERM (tentative date)</td>
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<tr>
<td>9</td>
<td>Intro to Digital Image Processing (DIP)</td>
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<td>Assignment 6 Due</td>
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<tr>
<td>10</td>
<td>DIP</td>
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<td>Assignment 7 Due</td>
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<tr>
<td>11</td>
<td>DIP</td>
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<td>Assignment 8 Due</td>
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<td>12</td>
<td>Data Accuracy</td>
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<td>Airborne Lidar Systems</td>
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<td>13</td>
<td>Terrestrial Lidar Systems</td>
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<td></td>
<td>Lidar Data processing</td>
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<td></td>
<td>Assignment 9 Due</td>
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<td>14</td>
<td>UAV remote sensing</td>
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<td>Assignment 10 Due</td>
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<td>15</td>
<td>Radar</td>
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<tr>
<td></td>
<td>Assignment 10 Due</td>
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<tr>
<td>16</td>
<td>Final Exam or Project</td>
</tr>
</tbody>
</table>

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
Regular attendance is expected. 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 (e.g. in-person attendance is poor due to students watching online as opposed to attending class). Online student attendance will be gauged based on regular Blackboard access.

Assignments and Late Work Policy
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% per day past due
- 4 to 7 days - Minus 4% per day past due
- Over 1 week late – Minus 30%
- After assignment is graded and returned - 0

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 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.

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

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

Exam Policy for Distance Students
Exams may be given as take home or in-class (to be determined). The course may require the use of exam-proctoring involving third party charges. 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. Online students will be notified of the procedure.
In-person students must take the exam in-class and distance students cannot take the exam in-person during class without instructor approval.

My Decree
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)
  It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior.
  See Full University Policy at http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity

- 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.

- 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 me before you decide to drop to be sure it is the best thing to do. 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, and the College of Science and Engineering Grade Appeals webpage at 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**
  Disability Services (DS) is the hub for coordinating services and accommodations to ensure accessibility and utilization of all programs for all Texas A&M University-Corpus Christi students with disabilities. Our services are designed to meet the unique educational needs of enrolled students with documented permanent or temporary disabilities. DS provides intake and consultation services to students seeking to register with our office. DS reviews an individual’s documentation of disability and assesses eligibility for services and the determination of reasonable accommodations. For more information visit the Disability Services Office at 116 Corpus Christi Hall or go to http://disabilityservices.tamucc.edu/

**L. OTHER INFORMATION**

See general guidelines for GISC Program at bottom.

**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.

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**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.