ATS 670: Satellite Remote Sensing I
Professor: Sundar A. Christopher, Ph.D.

1. **Disability Statement.** The University of Alabama in Huntsville will make reasonable accommodations for students with documented disabilities. If you need support or assistance because of a disability, you may be eligible for academic accommodations. Students should contact Disability Support Services Office (256.824.1997 or 317 Wilson Hall) as soon as possible to coordinate accommodations.

2. **Contact Information**

   Email Address: christs@uah.edu ; Availability, Office Hours: By email. Please use CANVAS for all class-related communication.

3. **Course Information**

   This is **an asynchronous online course** which means that students will work through the material based on the syllabus. There are no "live" lectures. All lectures have been prerecorded.
   Course Name: Satellite Remote Sensing I – ATS 670
   Credit Hours: 3
   Semester/Year: Spring 2021
   Meeting day, time, and location: Online
   Prerequisites: ATS 509

4. **Course Description**

   4.1 Catalog Description: Using a hands-on approach, this course covers a broad range of topics concerning digital image processing applied to the remote sensing of atmospheric, cloud and surface properties using various satellite data sets. Prerequisites: ATS/ESS 509.

   4.2 List of topics.
   1. Basic atmospheric radiation processes
   2. Sensors, orbits, and image correction
   3. Image interpretation
   4. Radiometric enhancement
   5. Geometric enhancement.
   6. Principal Components
   7. Selected Applications
   8. Supervised classification
   9. Clustering and unsupervised classification
   10. Canonical Transform Analysis

11. Image Classification Methodologies
12. Future of Satellite Remote Sensing

4.3 Course Learning Objectives. Students will:

a) <u>Understand</u> and apply atmospheric radiation processes of the earth-atmosphere system to satellite remote sensing data sets.
b) <u>Understand</u> current and future satellite sensors, their orbits, wavelengths, and important sensor characteristics.
c) <u>Apply</u> digital image processing techniques to analyze, classify, interpret, and analyze multi-spectral satellite data.
d) <u>Apply</u> radiative transfer principles and image processing techniques to detect and analyze clouds, vegetation, and forest fires using multi-spectral satellite data.

4.3.1 Course Outcomes. By the end of the course students will be able to:

a) Explain radiation laws as it pertains to satellite remote sensing
b) Describe various satellites, sensors and their characteristics.
c) Interpret polar orbiting and geostationary images
d) Use satellite data to perform radiometric and geometric enhancement
e) Use satellite data to separate clouds and aerosols from other features in the image
f) Use satellite data to detect thermal hotspots in imagery
g) Use multi-spectral satellite imagery and use supervised and unsupervised classification methods to classify a pixel into one of many classes
h) Describe atmospheric correction of satellite imagery
i) Use Principal components for classifying images
j) Use satellite imagery and map vegetation using satellite imagery
k) Describe future satellite sensors and compare against current satellite data sets.

4.4 Course Materials

Required: Richards, John A., Remote Sensing Digital Image Analysis, Springer, ISBN: 978-3-642-30061-5 (Fifth edition).

4.5 Recommended Text Books:
1) Computer processing of Remotely Sensed Images, An Introduction by Paul Mather, John Wiley and Sons
2) Practical IDL programming (Paperback) by Liam Gumley, Academic Press.
3) Digital Image Processing, Gonzalez and Woods, Addison Wesley publishers.
4) Satellite Meteorology, An Introduction, Kidder and Vonder Haar, Academic Press.
5) Remote Sensing and Image Interpretation, Lillesand and Keifer, Wiley Publishers.
6) Remote Sensing of the Lower Atmosphere, An Introduction, Graeme Stephens, Oxford press.

4.6 Additional Course Requirements – Journal Papers. Several journal papers will be assigned as part of this course. See the Module called Supplemental Resources for Students – Assigned Journal papers. This module is at the end of the module list.

4.7 Organization of Course/Instructional Methods. This course will be taught completely in an online format. Students will listen to prerecorded videos and/or read material on canvas, read assigned portions of the book and work on assignments and projects.

4.8 Course Communication. In this class the official mode of communication is through Canvas. All communication between student and instructor and between student and student should be respectful and professional. Each student is responsible for course information communicated via Canvas. Students can expect responses from the instructor to Canvas messages and emails, within a 48-hour timeframe.

4.9 Course-specific resources. Check out the module "Student Technology and Resource Tool Box - Course Specific". In this module there are numerous resources ranging from sample IDL programs and how to access relevant data bases for your work. This module is at the top of the module list.

5 **Attendance Policy.** This online course is accessible completely online and active participation will greatly improve your success in this course. You are expected to log into the course at least 2 to 3 times a week to complete course assignments/quizzes, participate in discussions, and to check updates related to the course. Please make sure that you check your email regularly for course updates.

5.1 Missed Assignments/Make-Ups/Extra Credit. To ensure fairness to all students, **late assignments are not accepted** and will be given a grade of zero. Since the entire course is released at the beginning of the semester students are expected to work at their own pace and complete the assignments on time.

Evaluation and Grading. The following grading scale will apply to all work:

A = 90%–100%
B = 80%–89%
C = 70%–79%
D = 60%–69%
F = 0%–59%

Grading Elements
Assignments : 25%
Exam   : 25%
Discussion   : 15%

Final Project : 35%
TOTAL   : 100%

Assignment Descriptions.

i) **Assignments:** Assignments include a combination of regular text book problems and image analysis that includes programming. Multiple modules are combined thematically to create assignments. All assignments must be submitted via Canvas and must be submitted as one file and not as multiple attachments. Assignments are considered summative assessments for modules.

ii) **The take home exam.** The exam is a summative assessment for the course. This will be a "take-home" exam that works on an honor-based system. Students cannot use internet resources or discuss with fellow students or others.

iii) **Final Project.** Each student is required to do a class project independently that involves satellite image classification. The final project requires careful thought and analysis and students are required to classify multi-spectral satellite image and write a comprehensive report.

iv) **Class Participation**. Class participation through online discussion is required where students will interact with peers and instructor.

6   Course Conduct. Students are expected to show respect for the instructor and other students.

7   Academic Honesty. Your written assignments and examinations must be your own work. Academic misconduct will not be tolerated. To insure that you are aware of what is considered academic misconduct, you should review carefully the definition and examples provided in the Student Handbook, p. 139. If you have questions in this regard, please contact me without delay.

8   Use of Prior Work. You may not submit in fulfillment of requirements in this course any work submitted, presented, or used by you in any other course.

9   Copyright. All federal and state copyrights in my lectures and course materials are reserved by the instructor. You are authorized to use course material for your own personal use and for no other purpose. You are not authorized to record the instructor's lectures or to make any commercial use of them or to provide them to anyone else other than students currently enrolled in this course, without the instructor's prior written permission. In addition to legal sanctions for violations of copyright law, students found in violation of these prohibitions may be subject to University disciplinary action under the Code of Student Conduct. This course may also contain copyright protected materials such as audio or video clips, images, text materials, etc. These items are being used with regard to the Fair Use doctrine in order to enhance the learning environment. Please do not copy, duplicate, download or distribute these

items. The use of these materials is strictly reserved for this course and your use only. All copyright materials are credited to the copyright holder.

10 **Privacy Statement.** During this course, you might have the opportunity to use public online services and/or software applications sometimes called third-party software such as a blog or wiki. While some of these could be required assignments, you need **not** make any personally identifying information on a public site. Do not post or provide any private information about yourself or your classmates. Where appropriate you may use a pseudonym or nickname. Some written assignments posted publicly may require personal reflection/comments, but the assignments will not require you to disclose any personally identity-sensitive information. If you have any concerns about this, please contact your instructor.

11 **Technology Statement.** This course will use UAH's learning management system, Canvas, as well as other technology tools. Students will be expected to have access to a computer with internet capabilities in order to fully participate in this course. Students are encouraged to reference accessibility information regarding specific technologies.

If you encounter technical difficulties with Canvas, report the behavior to Canvas Support. Canvas Support is available 24/7 for all faculty and students. In order to get immediate help:

1. Call the Canvas Support at 844-219-5802
2. Click on the "Help" icon on the left panel navigation in Canvas and select "Chat with Canvas Support"
   When submitting a support ticket include your name, your class, the element/assignment being affected, and a detailed description of the issue. Providing a screenshot is often very helpful in diagnosing an issue.

Only under extraordinary circumstances would technical difficulties be considered as a mitigating factor in late or missed assignments (e.g., Canvas is down for two days, which is a highly unlikely event). In other words, if technology fails when a student waits until the last hour or two to complete an assignment, that situation does not qualify as an extraordinary circumstance. In the event that deadline extensions are indeed allowed, you must show documentation that you have first followed the above procedures. Canvas support will email you a ticket number. You can forward the email to the instructor as documentation.

Access to and use of certain software tools will be helpful in the completion of course requirements. Students will be expected to have access to a computer frequently, as all writing assignments used will be typed out and not handwritten. The software you use to write your assignments is irrelevant, as long as you follow my writing guidelines outlined later in my syllabus. It is recommended that you have access to a computer weekly. You will be expected

to have access to the internet and email since the instructor will be emailing you about assignment updates, additions and changes.

12 **Student Resources.** The University of Alabama in Huntsville offers a range of student services to enhance the experience of students.

- [Student Support Services](#)—Counseling Center, Disability Support Services, Student Health Services, Office of International Services, Multicultural Affairs, etc.
- [Academic Support Services](#)—Student Success Center, Tutoring, PASS, Academic Support Centers by College
- [M. Louis Salmon Library](#)—Printed and Online Resources, Reference Services, Group Study Rooms, AV Resources, Printing
- Canvas Support—Call 844-219-5802 to report an issue with Canvas.
- OIT Help Desk—For technical support, contact the OIT Help Desk (helpdesk@uah.edu; 256.824.3333)

13. Elasticity Statement. The instructor will make every effort to follow the guidelines of this syllabus as listed; however, the instructor reserves the right to amend this document as the need arises. In such instances, the instructor will notify students via email and will endeavor to provide reasonable time for students to adjust to any changes.

14. **Netiquette.** Every student is expected to follow these guidelines when interacting with your instructor and classmates online in our class. Failure to do so will result in a warning. Ignoring the warning will result in zero (0) points on assignments.
- Be respectful of your instructor and fellow students. Be careful with your language.
- Spell out words - e.g. "you" instead of "u"
- Do not share inappropriate material or material not related to the topic
- DO NOT TYPE IN ALL CAPS! It looks like you are screaming.
- Be careful with the use of emojis - they are a friendly and informal style of communication that is easily misinterpreted
- Sarcasm does not work when typed on the screen. Do not use it. (I am not being sarcastic!)
- Be forgiving - assume initially others are not trying to disobey the rules or offend

15. **Complaint Procedure**. If you have difficulties or complaints related to this course, your first action should be to discuss them with your instructor. If such a discussion would be uncomfortable for you, or fails to resolve your difficulties, you should contact the Chair of the Department at aes-chair@uah.edu. If you are still unsatisfied, you should discuss the matter with the Associate Dean of the College of Science, adeancos@uah.edu.

16. **Academic Continuity Plan**. If for some reason I am not able to be *present in this online course*, please contact the chair of the department (aes-chair@uah.edu) . The chair of the

department is my supervisor and will step in to assess the situation and provide contingency plans. If for some reason we are not able to utilize Canvas, you can email christs@uah.edu and if that network is down you can reach me at sundar@nsstc.uah.edu for non-Canvas-related communication.