GGS379-001 Spring 2026
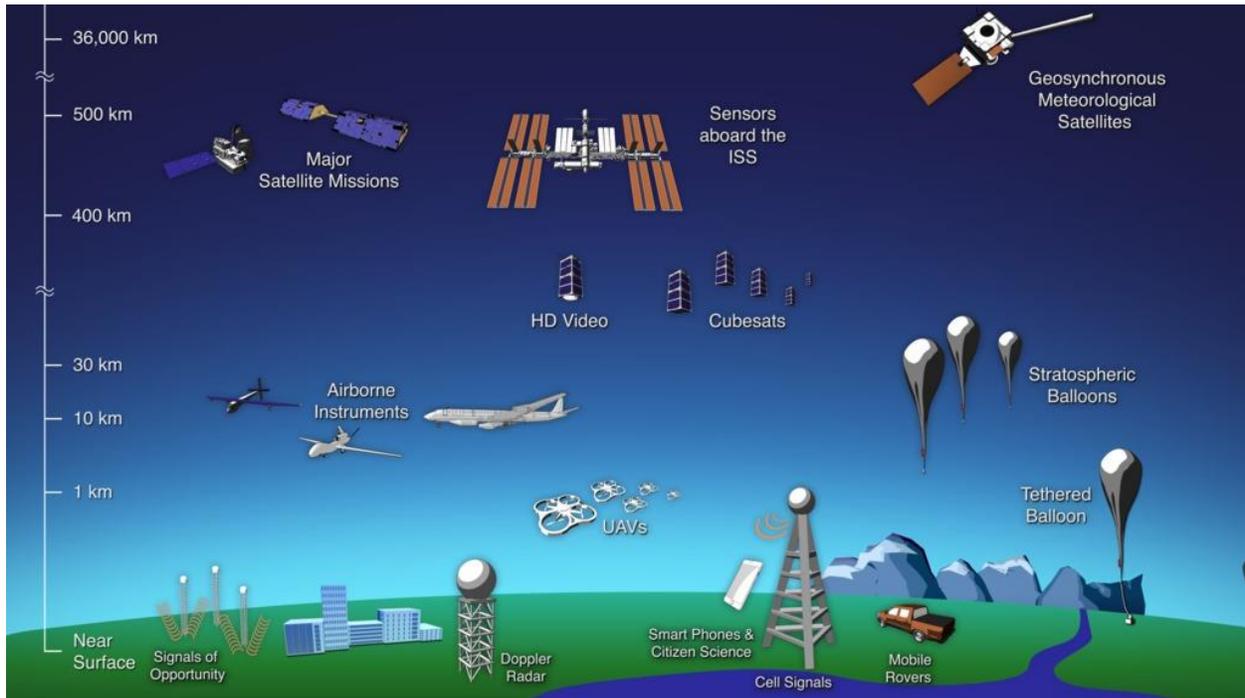
Introduction to Remote Sensing

(01/20/2026)

Course Information:

Title: Introduction to Remote Sensing
CRN: 12375
Time: 3:00 -4:15PM, Tuesdays in-person EXPL 2103 Fairfax
Thursdays, 3:00-4:15PM Online Synchronous vs Zoom
Instructors: Prof. John J. Qu
Telephone: (703) 993-3958
E-mail: jqu@gmu.edu
Office: Room 2412 Exploratory Hall
Office Hour: 2:00—4:00PM Tuesdays or make appointment.
TA: Mr. Shahrukh Vasaya
Email: svasaya@gmu.edu
After in-person class 4:15PM Tuesdays or make appointment.

Course Description:

The world is currently experiencing a rapid proliferation of image data from satellites, aircraft, and unmanned aerial vehicles (UAVs). These data must be efficiently processed and analyzed to generate geospatial information that supports natural resource management, urban and regional

planning, defense and security intelligence, and business decision-making. This course introduces the fundamental principles of remote sensing, along with the processing and analysis of imagery for diverse Earth system and societal applications using ENVI. Key topics include electromagnetic radiation, passive (multispectral) and active (LiDAR) sensor systems, and methods for image processing, classification, and geospatial information extraction. The course also introduces emerging artificial intelligence and machine learning techniques for remote sensing data processing, including automated feature extraction, image classification, and pattern recognition. This course is required as a prerequisite for most advanced remote sensing courses.

Learning Objectives:

Upon successful completion of this course, students will be able to:

1. Understand and clearly explain the fundamental theories and principles of remote sensing and image analysis.
2. Apply image processing techniques and tools to transform raw imagery into meaningful geospatial products.
3. Demonstrate foundational insight into the application of remote sensing technologies across a range of real-world and interdisciplinary contexts.
4. Understand the state of the art in Earth observation, including current satellite missions, sensor technologies, data products, and emerging trends.

Credits for this course

This course was developed by Prof. Konrad J. Wessels, who also contributed lecture slides and assignments. Selected materials will be used during the spring semester.

Prerequisites:

There are no formal prerequisites.

Required textbook(s) and/or materials

Relevant chapters are available made available by the library as pdf under " Textbook" at the bottom of the main menu of this course's Canvas page "Remote Sensing and Image Interpretation" by Lillesand, Kiefer and Chipman (7th edition, John Wiley & Sons). https://www.wiley.com/enus/Remote+Sensing+and+Image+Interpretation%2C+7th+Edition-p9781118919477.

Additional Textbook: In the lecture presentations I also use figures and Examples from "Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition" by J.R. Jensen. (4th edition, Pearson). https://www.pearson.com/us/higher-education/program/Jensen-IntroductoryDigital-Image-Processing-A-Remote-Sensing-Perspective-4thEdition/PGM30020.html

Computer Requirements

ENVI has the following system requirements:

Operating systems: Windows 10 and 11 (Intel/AMD 64-bit) macOS 11.5 and 12 (M1 and Intel 64-bit)(not recommended – ENVI on iOS is slow as it uses X-Windows. Rather use windows PC / Laptop)

An X-Windows manager is required for macOS. ENVI was tested using XQuartz 2.8.5.

Course-specific Software

You will have to install ENVI on your own computer. Temporary student licenses have been provided for home installation by NV5 Geospatial.
https://www.nv5geospatialsoftware.com/Products/ENVI

Home installation instructions will be provided on Canvas page /Start Here/Welcome.

Final term paper

The description of the Final Term Paper will be discussed in the classroom.

Grading:

Grades will be based upon your performance on the homework exercises, tests/g midterm, class attendance and final term paper and presentation. The weighted contribution of each of these items to your final grade is given below:

Homework 15 %

Tests/quizzes 20 %

Mid-term 25 %

Final term paper: 35 %

Class attendance and discussions 5 %

(A=90-100, B=80-89, C=70-79, D=60-69, F=<60)

Academic Integrity and Honor Code

Mason upholds an Honor Code, and you can find a comprehensive explanation of this code and the honor committee process at the Office for Academic Integrity's website (https://oai.gmu.edu/). The principle of academic integrity is of paramount importance, and any

violations are treated with utmost seriousness. In the context of this course, what does academic integrity entail? In essence, it signifies that when you are assigned a task, it is your responsibility to carry it out. If you draw upon someone else's work to enhance your task, proper and accepted credit must be given. Furthermore, another facet of academic integrity is fostering an environment of open idea exchange. Robust discussions and debates are strongly encouraged throughout the course, under the clear expectation that all interactions within the class will uphold civility and show respect for diverse ideas, viewpoints, cultures, and traditions. If uncertainties arise in any capacity, please don't hesitate to seek guidance and clarification. Please take note: the assignments in this course should reflect your individual efforts and should not involve collaboration with other students. If you have any inquiries regarding the assignments, feel free to reach out to the instructor at jqu@gmu.edu.

Students must strictly follow the honor code, both for individual and teamwork. No exception will be made. University policy requires that faculty members report incidents of Honor Code Violation. Scholastic dishonesty includes but is not limited to plagiarism (reference your sources and quotations), copying others' work, limiting others' access to course materials, sabotaging others' work, turning in the same paper or project for two classes without permission from all instructors, and many other things. You are responsible for the GMU Scholastic Honor Code, found in the GMU University Catalogue.

This Course Policy Addendum must be made available to students in all courses (see Catalog Policy AP.2.5) (https://catalog.gmu.edu/policies/academic/course-information/#AP-2-5).

Students with Disabilities

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

Student use of electronic devices

The use of computers, either lab desktops or personal laptops, is required for the course. You will only be permitted to work on material related to the class, however. Engaging in activities not related to the course will result in a significant reduction in your participation grade. Please be respectful of your peers and instructor and avoid email, social media, and other distracting uses of computers.

Class Cancellation

If a class is cancelled due to inclement weather or other reasons, the syllabus will be updated as early as possible. Best efforts will be made to send each student an email with information on the cancellation of class. Make up classes will be scheduled during the next lecture. When an exam is cancelled, it will be given during the next lecture.

Revised Detailed Course Schedule (01/20/2026)

Week one 01/20, 01/22	Introduction to Radiation, Remote Sensing history and applications Read textbook (Chapter 1, 1.1-1.4), page 1-30 **Set-up ENVI License and DO ENVI tutorials with TA**
Week two 01/27, 01/29	Energy Sources, Energy Interactions with surface. Read textbook Chapter 1 1.4-1.9, page 45-49 **Homework one (online)**
Week three 02/03, 02/05	Geometric influence on spectral response, Digital image acquisition, Four digital image resolutions: Radiometric resolution Read textbook page 25-35
Week four 02/10, 02/12	**Quiz 1(in-person)** Spatial resolution, Types of multispectral sensors, Spectral resolution, Satellite orbits, Temporal resolution Read textbook sections: 271-281, 598-602, 245 – 269
Week five 02/17, 02/19	Spatial resolution, Types of multispectral sensors, Spectral resolution, Satellite orbits, Temporal resolution Read textbook: 491-495
Week six 02/24, 02/26	Geometric correction, Image enhancement, spatial filters Read textbook: 495-499, 500-06, 507-512, 147-148
Week seven 03/03, 03/05	**Mid-term (in-person)** **ENVI and AI Applications on RS Data Processing (TA, Synchronous Online)**
Week eight 03/17, 03/19	Spectral Indices, Vegetation indices time series Read textbook page 517-522

Week nine 03/24, 03/26	Data transforms, Image Classification - Supervised and Unsupervised Read textbook: p529-530, 537-556 **Homework 2 (online)**
Week ten 03/30, 04/02	Land Cover classification, Accuracy Assessment Read textbook: 575-580, 611-618
Week eleven 04/07, 04/09	Sub-pixel classification, Object-based Classification Read Textbook: 562-567, 568-570, 570-573
Week twelve 04/14, 04/16	**Quiz 2 (in-person)** Change Detection Read textbook: 582-587
Week thirteen 04/21, 04/23	LiDAR remote sensing Read textbook: 471-482
Week fourteen 04/28,04/30	Hyperspectral and Thermal remote sensing and applications Read textbook sections: 271-281, 598-602, 245 – 269 **Homework 3 (online)**
Week fifteen 05/05, 05/07	Independent study to prepare the final term paper
Week sixteen 05/12	Final term paper due date