GGS426-001, Fall 2023 (Hybrid)

Physical Fundamentals of Remote Sensing

Course Information

Title: GGS426-001 Physical Fundamentals of Remote Sensing (Hybrid)

Time: Tuesdays 4:30 - 5:45 PM

Classroom: Exploratory Hall 2312

Instructors: Dr. John Qu and Dr. Xianjun Hao

Telephone: (703) 993-3958

Office: Exploratory Hall, Room 2412

Office Hour: Stop by 3:00-4:00 PM on Tuesdays and Thursdays or make appointment.

Course Description

This course is designed to give undergraduate students with limited Earth science satellite remote sensing background a thorough introduction to gather the basic concepts and physical fundamentals of remote sensing. The main emphasis of this course is on the basic physical and mathematical principles underlying the satellite remote sensing techniques, including radiometric

and geometric information, satellite orbit and geo-location simulation, designing, atmosphere corrections, raw data record (RDR), sensor data record (SDR), environment data record (EDR), climate data record (CDR) and in situ measurements in support of remote sensing. In addition, this class will provide a focus on the NASA, NOAA and USGS current and future satellite instruments. This course aims to provide students all-inclusive overview of the state of the art in physical fundamentals of remote sensing and applications for monitoring global, regional and local atmosphere, ocean and land surface.

Detailed Schedule

Week one	Introduction to Earth science satellite remote sensing
Week two	Satellite data products and analysis
Week three	Physical fundamentals of remote sensing
Week four	Top atmospheric solar radiation
Week five	Radiation transfer in the atmosphere
Week six	Applications radiation transfer principles to remote sensing
Week seven	Platform for remote sensing and Raw Data Record (RDR) data products
Week eight	Satellite orbit and geo-location simulation
Week nine	Sensor Data Record (SDR) algorithms and data products
Week ten	SDR algorithms and instrument calibrations
Week eleven	Atmospheric correction and surface reflectance
Week twelve	Selected scientific Environmental Data Record (EDR) algorithms
Week thirteen	Physical Principals of Climate Data Record (CDR)
Week fourteen	Student final project presentations
Week fifteen	Final term paper due

Grading:

Grades will be based upon students' performance on the homework exercises, 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%
- Quiz 20%
- Midterm: 25%
- Final Exam 30%
- Class Attendee 5%
  (A=90-100, B=80-89, C=70-79, D=60-69, F=<60)

Prerequisites:
College Math (such as MATH 214) and physics (such as PHYS 262), or permission of instructor.

Required Textbook: None

Reference Books:

1. Kuo-Nan Liou, 2002, An Introduction to Atmospheric Radiation, Second Edition, Academic Press, ISBN 0-12-451451-0
2. Charles Elachi, 1987, Introduction to the Physics of Remote Sensing, Wiley Series in Remote Sensing, John Wiley & Sons Inc., ISBN-0-471-84810-7.
3. Wiley J. Larson and James R. Wertz, 1997, Space Mission Analysis and Design, Space Technology Series. Kluwer Academic Publishers, ISBN 1-881883-01-9 (paperback), ISBN 0-7923-1998-2 (hardback).

Honor code:

Students must follow the GMU Scholastic Honor Code. Please show respects to everyone in the classroom. Copying homework (or quiz) is considered cheating.