Course Information

Title: GGS756-001 Physical Principles of Remote Sensing
CRN: 78545
Time: Monday 7:20 - 10:00 PM
Classroom: Exploratory Hall 2103
Instructor: Dr. John Qu
Telephone: (703) 993-3958
Office: Exploratory Hall, Room 3411
Office Hour: Stop by Monday or make appointment

Course Description

This course is designed to give students with limited Earth science satellite remote sensing background a thorough introduction to gather the basic concepts and fundamentals of physical principles 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, science algorithm designing, atmosphere corrections, and in situ measurements in support of remote sensing. In addition, this class will provide a focus on the NASA current and future Earth Observing System (EOS) instruments, such as the Moderate Resolution Imaging Spectroradiometer (MODIS), future National Polar-orbiting Operational Environmental Satellite System (NPOESS, now JPSS) and NPOESS Preparatory Project (NPP, now Suomi National Polar-orbiting Partnership) missions. These students will understand not only what remote sensing systems do, but how they work.

Schedule

Week one (08/30)	Introduction to Earth science satellite remote sensing
Week two (09/06)	Physical fundamentals of remote sensing
Week three (09/13)	Top atmospheric solar radiation
Week four (09/20)	Atmospheric absorption and scattering
Week five (09/27)	Radiation transfer in the atmosphere
Week six (10/04)	Applications radiation transfer principles to remote sensing I
Week seven (10/11)	Applications radiation transfer principles to remote sensing II
Week eight (10/18)	Platform for remote sensing and Electro-optical systems
Week nine (10/25)	Satellite orbit and geo-location simulation
Week ten (11/01)	Sensor Data Record (SDR): data products
Week eleven (11/08)	SDR algorithms and calibrations
Week twelve (11/15)	Atmospheric correction and vegetation indices
Week thirteen (11/22)	Selected scientific Environmental Data Record (EDR) algorithms

Week fourteen (11/29)	Student presentations
Week fifteen (12/06)	Final Term Paper Due

Final project
EOS, JPSS or NPP related topics and focusing on physical principles of satellite remote sensing.

Grading

- Midterm 30%
- Homework 20%
- Final Project 50%

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

Prerequisite
Permission of the instructor

Required Textbook: None

Reference Books and Documents

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).
4. John J. Qu, Wei Gao, Menas Kafatos, Robert E. Murphy, Vincent V. Salomonson, 2006, Earth Science Satellite Remote Sensing Vol. 1: Science and Instruments http://link.springer.com/book/10.1007%2F978-3-540-37293-6
5. John J. Qu, Wei Gao, Menas Kafatos, Robert E. Murphy, Vincent V. Salomonson, 2006, Earth Science Satellite Remote Sensing Vol. 2 Data, Computational Processing, and Tools. http://link.springer.com/book/10.1007%2F978-3-540-37294-3
6. Some EOS, JPSS, and NPP Algorithm Theoretical Basis Documents (ATBDs) will be used during this class.

Useful Links

7. NASA Earth Observing System

8. Seleced EOS instrument ATBDs
9. NASA Visible Earth
10. NASA/GSFC MODIS Direct readout
11. NASA Remote Sensing Tutorial
12. NPP Web Page
13. JPSS Web Page
14. NASA AERONET (AErosol RObotic NETwork) program
15. MODIS Rapid Response System