

**Syllabus**

**GGS 429 / GGS 629: (N) Remote Sensing of Earth System**

**Classroom/Time:** EXPL 2310 every Thursday from 4.30 to 7.10 PM

Office hours: TBA

**Course Instructors**

Dr. Donglian Sun (main)

Dr. John Qu, Dr. Daniel Tong, Dr. Ron Resmini, Dr. Konrad Wessels, and Dr. Paul Houser

**GENERAL INFORMATION**

**Catalog description**

Theory and methods for remote sensing features and phenomena comprising the Earth system. Topics include surface and atmospheric information retrieval, such as radiation budgets, atmospheric gas detection, mapping the cryosphere, measurements of vegetation and biomass, soil moisture, and precipitation. Focus on satellite-based systems, with applications to both passive and active sensor systems.

**Course Overview**

This course is designed to give students with Earth science and remote sensing background a thorough and advanced introduction and overview of the theories and applications of remote sensing to environmental and Earth systems. The main emphasis of this course is remote sensing of the Earth's surface and atmospheric parameters and applications. The course will cover the most recent algorithms and techniques about how to use satellite observations to derive and retrieve the Earth's surface and atmospheric information, such as radiation budget, aerosols, air quality, surface land cover/land use, surface temperature, surface reflectance/albedo, precipitation, snow, ice, soil moisture, and climate change, etc. Selected topics are planned (see calendar) but can still be modified according to students’ interests.

This course is designed as a team-taught class, which will be taught by our remote sensing team, including Dr. Donglian Sun, Dr. John Qu, Dr. Paul Houser, Dr. Ron Resmini, and Dr. Konrad Wessels. The instructor of record will be in charge of 50% lectures and other faculty will teach one set related to individual expertise area.

**Prerequisite**

GGS 429 requires GGS 379 or 416 as a prerequisite. GGS 629 has a recommended prerequisite of GGS 579.

**COURSE MATERIALS**

**Course on-line materials**

The GGS 429/629 course site is at <https://courses.gmu.edu>, where all announcements, class materials, exams, and grades will be posted.

**Textbooks**

In this course, textbooks are used as **reference material**. A list of books is provided, so the students can select the one that adapts better to their needs.

* Emilio Chuvieco. Fundamentals of Satellite Remote Sensing: An Environmental Approach. CRC Press, Second Edition. ISBN 9781498728058
* Chuvieco, E. and Huete, A. 2010. Fundamentals of Remote Sensing. CRC Press (Taylor & Francis Group), Boca Raton (Florida). ISBN 978-0-415-31084-0
* John Qu, Alfred Powell, and M.V.K. Sivakumar. [Satellite-based Applications on Climate Change](https://link.springer.com/book/10.1007%2F978-94-007-5872-8). (<https://link.springer.com/book/10.1007/978-94-007-5872-8>).
* Shunlin Liang. Quantitative Remote Sensing of Land Surfaces. John Wiley & Sons,
* Campbell, J.B. and Wynne, R. H. 2011. Introduction to Remote Sensing. Guildford Press, New York. 5th Edition. ISBN 978-1-60918-176-5
* Jensen, J.R., Remote Sensing of the Environment - An Earth Resource Perspective, 592 pp., Prentice Hall, Upper Saddle River, NJ, 2007. ISBN: 0131889508, Second Edition
* Jones H.G., Vaughan R.A. Remote Sensing of Vegetation: Principles, Techniques, and Applications. Oxford University Press. ISBN-10: 0199207798; ISBN-13: 978-0199207794
* Richards, J. A. 2013. Remote Sensing Digital Image Analysis. An Introduction. Springer-Verlag, Berlin, Heidelberg. Fifth Edition. ISBN 978-3-642-30061-5

**GRADING AND ASSESSMENT**

The final grade is computed out of 100 points using the following letter mapping:

|  |  |  |  |
| --- | --- | --- | --- |
| Undergraduate | | Graduate | |
| 100-96 A+ | 79-77 C+ | 100-96 A+ | 79-70 C |
| 95-93 A; | 76-73 C | 95-93 A; | < 69 F |
| 92-90 A-; | 72-70 C- | 92-90 A-; |  |
| 89-87 B+ | 69-60 D | 89-87 B+ |  |
| 86-83 B | < 59 F | 86-83 B |  |
| 82-80 B- |  | 82-80 B- |  |

**Attendance, Participation, and Preparation (10% Graduate, 15% Undergraduate)**

Attendance will be taken at the beginning of each class. Students more than 15 minutes late will be considered absent. Two absences are allowed with no penalty. One point will be taken for each additional absence up to a total of 12 absences. Students absent for more than 12 lectures will receive an F. Oral questions about the course material and the reading assignments will be asked and students are expected to actively participate in the discussion.

**Homework (30% Graduate, 35% Undergraduate)**

In answering homework, students are encouraged to use for their research any sources they believe appropriate.

**Midterm (20% Graduate, 20% Undergraduate)**

The midterm covers material from both lectures and assignments. This is an individual, closed book, in-class exam.

**Final Exam/Project (40% Graduate, 30% Undergraduate)**

Each student will complete a final project. Graduate student projects will be more in-depth and require a presentation during the last day of the course. More details will be provided during the semester. Students may also choose a final exam, which will cover materials from both lectures and assignments. This is an individual, closed book, in-class exam.

**Graduate student work**

Graduate students are expected to complete course deliverables at an appropriate, graduate level. The final project will be larger in scope than that of undergraduates. Details will be provided during the semester.

**ADMINISTRATIVE POLICIES**

**Policy on Absence**

Students are expected to participate in the lecture and class discussion actively. When a student misses a lecture, he/she is invited to let the instructor know in advance. The student is still responsible for the material and assignments covered in the lecture.

Refer to the attendance section of the Syllabus for grading information.

**Policy on Exams**

The midterm and the final exams are mandatory. There is no make-up exam, unless for extreme circumstances. If a student does not take the midterm exam, he/she will receive a 0 score. If a student does not take the final exam, he/she will receive an F grade.

**Policy on Late Work**

Homework will be due after two weeks of the assignment. 2 points will be taken for each 24 hours starting from 14:00 of the due date.

**Policy on Reading Assignments**

Students are required to read the book chapter relative to each lecture before coming to class. Questions about the text will be asked during the lecture, and students are expected to be able to answer them.

**University Policies**

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.

**GMU email accounts**

Students must use their Mason email accounts the existing MEMO system or a new MASONLIVE account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

**Honor Code**

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.

**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 deduction 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.

**COURSE SCHEDULE**

|  |  |
| --- | --- |
| Date | Topic |
| Week one | Introduction to this course and remote sensing (Sun) |
| Week two | Remote sensing of surface and atmosphere radiation budget (Sun, Laszlo) |
| Week three | Remote sensing of gases in chemical clouds (manmade and natural) (Resmini) |
| Week four | Remote sensing of aerosols and air quality (Dr. Daniel Tong) |
| Week five | Remote sensing of surface temperature (SST, LST, IST) (Sun) |
| Week six | Remote sensing of vegetation and biomass (Wessels) |
| Week seven | Surface land cover and land use extraction and classification from satellite observations (Sun) |
| Week eight | Spring Break |
| Week nine | Remote sensing of surface albedo and emissivity (Sun) |
| Week ten | Remote sensing of climate change (Qu) |
| Week Eleven | Precipitation retrieval from satellite observations (Sun) |
| Week Twelve | Snow and ice cover mapping and monitoring from satellite observations (Dr. Peter Romanov, NOAA; Sun) |
| Week Thirteen | Remote sensing of ice and cryosphere in polar region (Houser)/  Remote Sensing of Evapotranspiration (Sun) |
| Week Fourteen | Remote sensing of soil moisture (Zhan, NOAA; Sun) |
| Week Fifteen | Reading days |
| Week Sixteen | Final project presentations (students) |  |
| Week Seventeen | Project poster/paper due |  |

**Justifications for GGS429 and GGS629 students**

1. Requirements are different. Different homework tasks will be assigned, questions for exams will be different, and requirements for exams and projects will be different. GGS470 students are required to take the final exam, but GGS629 students are required to work on projects with their research using the tools and skills taught in the class and write the final term papers which are research-intensive papers. There will be a folder for “After-class Readings”, which will collect the most recent peer-reviewed publications on relevant topics for GGS629 students. Each GGS629 student is also required to make a presentation, that is used to demonstrate a student’s in-depth understanding of the course material and learning skills.
2. The learning objectives are different when GGS429 students focus on basic theory and fundamental knowledge of satellite remote sensing applications in our environment and the Earth system, including the Earth's surface and atmosphere. At the same time, the GGS629 students focus on advanced theory, in-depth knowledge, and critical thinking of future applications of satellite remote sensing in our environment and the Earth system (beyond textbooks).