UNIVERSITY OF GUAM
UNIBETSEDÅT GUÅHAN

College of Liberal Arts and Social Sciences
Geography Program

FAÑOMNÅKAN (SPRING) 2025

INTRODUCTION TO REMOTE SENSING

GE - 580-01

Mondays & Wednesdays
9:30 AM – 10:50 AM

LOCATION: ROOM 207

DR. JOSE EDGARDO L. ABAN
abanj@triton.uog.edu
Office: Room 209
Telephone: (671) 735-2874

Office Hours:

Mondays	**12:30 PM – 2:00 PM**
Tuesdays	**9:00 AM – 11:00 AM**
Wednesdays	**8:30 AM – 9:30 AM**
	12:30 PM – 2:00 PM

COURSE DESCRIPTION

GE-580-01 Introduction to Remote Sensing provides the basic principles and concepts of earth observation (EO). It will also introduce students to key aspects of the design of satellite systems for EO. We will start by identifying the physical quantities that need to be measured in order to understand changes in the Earth's atmosphere, land surfaces and oceans. These parameters will be compared with the various natural phenomena that enable them to be measured remotely from space. Next, we will look at the design of instruments and satellite systems around these principles.

Remote Sensing and GIS find use and applications in a menagerie of areas including but not limited to biology, environmental science and resource management, engineering, oceanography, agriculture, climate science, urban planning and management, hydrology, geology, archaeology, and many more.

Towards the end of the course, students will be able to use the tools of the trade and apply the techniques learned to provide practical solutions to mundane issues and problems here in Guam.

Students are also expected to conduct annotated bibliography of related topics such as but not limited to the applications of remote sensing in natural resource management, technology trends and development in remote sensing, among others. Topics of choice will be discussed along the course of the semester.

STUDENT LEARNING OBJECTIVES FOR THE COURSE

By the end of the course, it is expected that you:

- Have a general understanding of the basic principles of remote sensing, satellite image processing and geographic information systems (GIS);
- Have a general understanding of how remote sensing systems work;

- Have a working technical knowledge of and skills in basic satellite image processing and analysis;
- Apply such knowledge to mundane environmental problems here in Guam.

GEOGRAPHY MINOR LEARNING OBJECTIVES

The Geography Program has four major learning objectives. Upon completion of your minor, it is expected that you will have fulfilled the following Program Learning Objectives (PLOs):

1. Physical Geography
- Explain and analyze knowledge of facts, functions, and processes of complex earth systems, as well as the methods and techniques used to study these systems. (R/M)

2. Human Geography
- Specify complex and changing demographic, population, political, economic, cultural and environmental patterns within a global context. (R)

3. GIS/Mapping
- Understand and apply analytical methods (e.g., map reading, statistics, advanced geospatial technologies) to geospatial phenomena. (R)

4. Environmental Synthesis
- Synthesize, evaluate and predict changing human and physical interactive Earth patterns in a spatial environmental framework with special emphasis on the Asia Pacific. (M)

**(I) indicates that this course introduces this particular objective.*
(R) indicates that this course re-enforces this particular objective.
(M) indicates that this course was specifically designed with this particular objective in mind.

COURSE DELIVERY METHODS

- The course will be delivered face-to-face. However, the following **Online Services** will be utilized and exploited for the delivery of course contents, online discussions and consultations, coordination, as well as the conduct of quizzes (if any) and long exams/finals. As such, students are expected to have access to any of these devices (connected to the Internet) such as a mobile phone, an Ipad, tablet, or a PC laptop, most specially during scheduled exams. It is important all students must have access to these systems/services for effective delivery of educational content as well as ideal learning experience.
  - ***UoG Moodle***
  - ***Google Docs and Google Forms (for quizzes, long exams and Final Exams)***
  - ***Google Video and/or Youtube***

- **UOG MOODLE**

  All course materials (e.g., syllabus, lecture slides, supplementary readings) will be available on UOG Moodle (http://moodle.uog.edu) . **Therefore you must self register yourself using the key provided by email.**

  Lecture slides generally get posted in the UoG Course Moodle a few days after the lecture.

  You will be expected to submit some of the assessments and assignments through Moodle, so start familiarizing yourself with the Web site. Furthermore, if you have questions on the material covered in class or would like to start a forum to discuss a particular topic more in-depth, I encourage you to use Moodle.

  If you are having problems with your account or with Moodle, please call UOG Moodle Support at (671) 735-2620 or send an email to moodlehelp@triton.uog.edu.

EVALUATION

Laboratory Exercises and Reports	**70%**
Presentations	**10%**
Annotated Bibliography (for possible peer-review)	**20%**
TOTAL	**100%**

Log No. 6412

New Policy:

Letter Grade	Grade Point Value	Percent Grade	Definition	
A+	4.00	98-100%	Outstanding	Honors-level performance with superior quality and extraordinary distinction.
A	4.00	93-97%		
A-	3.67	90-92%		
B+	3.33	87-89%	Good	Solid accomplishment, indicating a substantial mastery of course materials and a good command of skills required by the course.
B	3.00	83-86%		
B-	2.67	80-82%		
C+	2.33	77-79%	Adequate	Students have achieved the level of competency needed for advancing to a subsequent course which has this course as pre-requisite.
C	2.00	70-76%		
D	1.00	60-69%	Deficient	Minimal passing, but not adequate to take a subsequent course which has this course as pre-requisite.
F	0.00	<60%	Failure	Inadequate to receive credits.
P			Pass	
I			Incomplete	
NC			No Credit	

The percentage values listed above must be used in every course unless specified otherwise in the official catalog course description.

Current Policy: No policy concerning percentage values of grades.

PLAGIARISM

Do not plagiarize. Plagiarized work is an automatic failure; this is your only warning. This is an extremely serious offense in higher education. The UOG Student Handbook strictly prohibits plagiarism. If you fail to give credit for information (in the form of written work, art, music, statistical data) or ideas that are not your own, you are violating the intellectual property rights of the original author. Evidence of plagiarism in any assignment will result in an "F" grade, and a hearing at the Student Discipline Committee.

For a clear explanation of plagiarism, watch this video: http://www.commoncraft.com/video/plagiarism. You will also have to watch this video during class.

LATE ASSIGNMENTS (ONLINE SUBMISSIONS)

In general, I do not accept late assignments. Late assignments will be marked as 0 or F. However, I do make exceptions (e.g., death in the family, sickness, natural hazards) on a case-by-case basis. But you must talk to me, well in advance to make arrangements, before the assignment is due. If you come to me after the deadline for the assignment has passed, I will not help you and the assignment will be marked 0. There are no make-up assessments, quizzes, or assignments for unexcused absences.

STUDENT CONDUCT

All UOG students are expected to conduct themselves in a manner consistent with the University of Guam Rules, Regulations and Procedures Manual (available at

www.uogonline.com/gateway/forms/rules_regs_proc_man.pdf). I maintain the right to provide a positive learning environment in the physical classroom and online. Some general house rules:

- Respect yourselves and respect each other (in the classroom and online).
- If you are confused or have a question, ask (if you do not want anyone else hearing you, you can do it via Moodle, email, or during office hours -videocall).
- Do not cheat. Do not do someone else's homework for them. You are committing a great disservice. Do not let someone else do your homework for you. You are forfeiting an opportunity to learn.

ADA POLICY AND COMMITMENT TO STUDENT LEARNING

The University is committed to providing an inclusive and welcoming environment for all members of our community free of all forms of discrimination and harassment in all programs, activities, and employment practices as required by Title VII and Title IX and other applicable statues and policies. If you experience harassment or discrimination, report it immediately to the Director of EEO/ADA & TITLE IX Office, at 671-735-2244, 671-735-2971, 671-735-2244 (TTY) or eeoada@triton.uog.edu. For immediate assistance in an emergency call 911.

ADA Accommodation Services— For individuals covered under the ADA (Americans with Disabilities Act), if you are a student with a disability requiring academic accommodation(s), please contact the Disability Support Services Office to discuss your confidential request. A Faculty Notification letter from the Disability Support Services counselor will be provided to me. To register for academic accommodations, please contact or visit Sallie S. Sablan, DSS counselor in the School of Education, office 110, disabilitysupport@triton.uog.edu or telephone/TDD 671-735-2505.

INDICATIVE CLASS SCHEDULES

(This may slightly change in the course of the semester)

WEEKS	INDICATIVE TOPICS	Laboratory Exercises (Tutorial Sessions)
1-2	***Chapter 1 Fundamentals of Remote Sensing***	
	1.1 Concept of remote sensing 1.2 Characteristics of electro-magnetic radiation 1.3 Interactions between matter and electro-magnetic radiation 1.4 Wavelength regions of electro-magnetic radiation 1.5 Types of remote sensing with respect to wavelength regions 1.6 Definition of radiometry 1.7 Types of Reflections 1.8 Reflectance 1.9 Spectral reflectance of land covers 1.10 Spectral characteristics of solar radiation 1.11 Transmittance of the atmosphere	
3	***Chapter 2 Sensors***	
	2.1 Types of sensors 2.2 Characteristics of optical sensors 2.3 Resolving power 2.4 Dispersing element 2.5 Spectroscopic filter 2.6 Spectrometer 2.7 Characteristics of optical detectors 2.8 Cameras for remote sensing 2.9 Film for remote sensing 2.10 Optical mechanical scanner 2.11 Pushbroom scanner 2.12 Imaging spectrometer 2.13 Atmospheric sensors 2.14 Sonar 2.15 Radar/Laser radar 2.15.1 Principles of microwave remote sensing 2.15.2 Attenuation of microwave 2.15.3 Microwave radiation 2.15.4 Surface scattering 2.15.5 Volume scattering 2.15.6 Types of Antenna 2.15.7 Characteristics of Antenna 2.15.8 Types of microwave sensor 2.15.9 Real aperture radar 2.15.10 Synthetic aperture radar 2.15.11 Geometry of radar imagery	
4	***Chapter 3 Remote Sensing Platforms***	**Tutorial Session on Image Processing Software (e.g. ERDAS and/or MultiSpec)**
	3.1 Types of platform 3.2 Atmospheric condition and altitude 3.3 Attitude of platform 3.4 Attitude sensors 3.5 Orbital elements of satellite 3.6 Orbit of satellite 3.7 Satellite positioning systems 3.8 Remote sensing satellites 3.9 Landsat, SPOT, NOAA 3.10 New Generation High Resolution Satellites (e.g. IKONOS, etc.) 3.12 Geostationary meteorological satellites 3.13 Polar orbiting platforms	

5	***Chapter 4 Data Sources in Remote Sensing***	**Continuation of Tutorial Session on Image Processing Software (e.g. ERDAS and/or MultiSpec)**
	4.1 Digital data 4.2 Geometric characteristics of image data 4.3 Radiometric characteristics of image data 4.4 Format of remote sensing image data 4.5 Auxiliary data 4.6 Calibration and validation 4.7 Ground data 4.8 Ground positioning data 4.9 Map data 4.10 Digital terrain data 4.11 Media for data recording, storage and distribution 4.12 Satellite data transmission and reception 4.13 Retrieval of remote sensing data	
6	***Chapter 5 Image Processing Systems***	**Laboratory Exercise 1**
	5.1 Image processing in remote sensing 5.2 Image processing systems 5.3 Image input systems 5.4 Image display systems 5.5 Hard copy systems 5.6 Storage of image data	
7	***Chapter 6 Image Processing - Correction***	**Continuation of Laboratory** Exercise 1
8	***Continuation of Chapter 6 Image Processing - Correction***	**Continuation of Laboratory Exercise 1**
	6.1 Radiometric correction 6.2 Atmospheric correction 6.3 Geometric distortions of the image 6.4 Geometric correction 6.5 Coordinate transformation 6.6 Collinearity equation 6.7 Resampling and interpolation 6.8 Map projections	
9-10	***Chapter 7 Image Processing - Conversion***	**Laboratory Exercise 2**
	7.1 Image enhancement and feature extraction 7.2 Gray scale conversion 7.3 Histogram conversion 7.4 Color display of image data 7.5 Color representation -color mixing system 7.6 Color representation -color appearance system 7.7 Operations between images 7.8 Principal component analysis 7.9 Change Detection – NDVI and Difference Images 7.10 Spatial filtering 7.11 Texture analysis	
11-12	***Chapter 8 Image Processing – Classification***	**Continuation of Laboratory Exercise 2**
	8.1 Classification techniques 8.2 Estimation of population statistics 8.3 Clustering 8.4 Parallelpiped classifier 8.5 Decision tree classifier 8.6 Minimum distance classifier 8.7 Maximum likelihood classifier 8.9 Trends in Image Classification (e.g. Neural Networks & Expert systems)	

13-14	*Chapter 9 Image Interpretation and Accuracy Assessment* 9.1 Information extraction in remote sensing 9.2 Image interpretation and analysis 9.3 Stereoscopy 9.4 Interpretation elements 9.5 Interpretation keys 9.10 Accuracy Assessment	Laboratory Exercise 3 and Field Work *
15-16	***Chapter 10 Applications of and Current Trends in Remote Sensing***	**Continuation of Laboratory Exercise 3** **Field Trip (to be determined)**
	10.1 Land cover classification 10.2 Land cover change detection 10.3 Global vegetation map 10.4 Water quality monitoring 10.5 Measurement of sea surface temperature 10.6 Snow survey 10.7 Monitoring of atmospheric constituents 10.8 Lineaments extraction 10.9 Geological interpretation 10.10 Height measurements (DEM generation) 10.11 UAVs/ Drones and new technologies	

**** as may be necessary for accuracy assessment/ground-truthing of classified land cover types.***

REMOTE SENSING/IMAGE PROCESSING SOFTWARES (FOSS Free and Open Source Software) :

- Multispec Software and /or QGIS
- PC on Windows or Mac

GENERAL REFERENCES:

Curran, P. (1995) *Principles of Remote Sensing*, Longman Scientific and Technical.

Chandra, A.M. and Ghosh S.K. (2006), *Remote Sensing and Geographical Information Systems*, Narosa Publishing House.

Burrough, A. (1986), *Principles of Geographical Information Systems for Land and Resource Assessment*, Clarendon Press.