Syllabus View [2026／ Remote Sensing, Geographical Information Systems and Analysis: Theory and Application ／Mesfin Sahle Achemo

Course Information

Year	AY 2025-2026	School	UNU-IAS		
Course Title	Remote Sensing, Geographical Information Systems and Analysis: Theory and Application				
Instructor & Contact Information	Mesfin Sahle Achemo (ms.achemo@unu.edu)				
Term/Day/Period	AY 2026 Autumn / Oct 2026-Jan 2027				
Category	Elective Course	Eligible Year	1st year and above	Credits	2
Classroom	Lecture room, 6th floor in the UNU building	Campus	UNU-HQ, Tokyo, Japan		
Main Language	English				
Class Modality Categories	On-Campus				
Course Code	RGIS				
Level	Graduate-level	Types of lesson	Lecture and practical training		

Syllabus Information

Subtitle	Open-source GIS and Remote Sensing for Social-Ecological and Policy Applications
Course Description (Word limit: 200)	This course introduces students to the theory and practical application of Remote Sensing (RS), Geographic Information Systems (GIS), and spatial analysis. The course is designed for postgraduate students from different academic backgrounds. Some students may be new to GIS and remote sensing, while others may already have experience using spatial data or geospatial software. The course focuses on the use of reliable open-source and freely accessible geospatial tools, especially QGIS, together with selected tools such as GDAL, Python/R, and Google Earth Engine. Students will learn how to collect, manage, analyze, visualize, and interpret spatial data for environmental, social-ecological, urban, climate, disaster-risk, and policy-relevant applications. The course combines lectures, hands-on training, assignments, projects, and final presentations.
Objectives and Learning Goals (Bullet points)	By the end of the course, students will be able to: • Understand the basic principles of GIS, remote sensing, and spatial analysis. • Use QGIS and other open-source tools to manage, analyze, and visualize spatial data. • Work with vector and raster data, including administrative boundaries, roads, rivers, land cover, satellite images, and elevation data. • Understand coordinate systems, map projections, spatial resolution, and data quality. • Download and process satellite imagery from open data platforms. • Calculate and interpret spectral indices such as NDVI, NDWI, and NDBI. • Conduct basic land-use/land-cover classification and accuracy assessment. • Apply GIS and remote sensing methods to real-world environmental and policy problems. • Produce clear maps, analytical outputs, written reports, and oral presentations. • Develop a final project using GIS and/or remote sensing methods.
Requirements *This part should include the expected working hours.*	Students are expected to attend classes, participate actively, complete practical exercises and assignments, submit a final report, and give an oral presentation. More than 80% attendance is required. Students should bring a laptop and install the required software. The expected workload for a 2-credit course is about 90 hours, including class time, readings, exercises, project work, and presentation preparation.

Course Outline

Detailed information could be provided on Moodle such as the information of the lecturers, etc.

Lecture	Outline
1	Introduction to GIS, RS, and geospatial thinking
2	Introduction to RGIS software and QGIS installation, open-source tools, and basic operations
3	Spatial data models, formats, projections, and open data sources
4	Georeferencing, digitizing, and vector data creation
5	Attribute management, joins, and vector geoprocessing
6	Cartography, visualization, and policy-oriented map design
7	Fundamentals of remote sensing and satellite systems
8	Satellite data acquisition and image preprocessing
9	Spectral indices and raster analysis
10	Spatial analysis I: interpolation, proximity, overlay, and suitability mapping
11	Spatial analysis II: terrain, hydrology, map algebra, and zonal statistics
12	Image classification and accuracy assessment
13	Change detection, time-series analysis, and cloud-based platforms
14	GIS/RS integration for SDGs, policy, and social-ecological applications
15	Final project presentation and course synthesis

Course Readings

Huisman, O., & de By, R. A. (2009). Principles of Geographic Information Systems. ITC.
Principles of Remote Sensing. ITC.
QGIS Training Manual; NASA Earthdata remote sensing resources

Reference

Suggested journals: Remote Sensing of Environment; ISPRS Journal of Photogrammetry and Remote Sensing; International Journal of Geographical Information Science; GIScience & Remote Sensing; Applied Geography.

Grading Policy

Rate	%	Evaluation Criteria
Exercises and assignments	40	Completion of practical GIS/RS tasks, correct workflow, map quality, and interpretation.
Final report	40	Problem framing, data and methods, analysis, map outputs, discussion, and recommendations.
Class participation	10	Attendance, active engagement, practical participation, and peer learning.
Oral presentation	10	Clarity, structure, visual quality, explanation of methods, results, and implications.

Note / URL if any

Main practical platform: QGIS. Advanced/optional tools: GDAL, Python, and Google Earth Engine. Detailed datasets, tutorials, and submission instructions will be provided on Moodle.
The course is designed to accommodate students from beginners to advanced levels. Students with strong backgrounds may not need to attend all sessions and can attend advanced-level sessions and work on advanced projects.