GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Environmental Soil Sensing (I002658)

Course size *(nominal values; actual values may depend on programme)*

Credits 4.0 **Study time 120 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 2)	English	Gent	practical
			lecture

Lecturers in academic year 2025-2026

De Smedt, Philippe	LA20	lecturer-in-charge
Mouazen, Abdul	LA20	co-lecturer

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Master of Science in Bioscience Engineering: Land, Water and Climate	4	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	4	A
Exchange Programme in Bioscience Engineering: Land and Forest management (master's level)	4	A

Teaching languages

English

Keywords

Environmental Surveying, Soil mapping, Soil sensors, Environmental Geophysics, Soil Spectroscopy, Geochemical Prospection.

Position of the course

Environmental Soil Sensing provides theoretical and practical insights into near surface sensing methods to characterize, map, and monitor variations in the shallow subsurface in space and time. The course focusses on geophysical and geochemical methods to acquire high-resolution continuous information on the pedosphere and its interface with the bio- and lithosphere (critical zone). Emphasis of the course is on providing practical solutions in a broad range of environmental applications including studies into ecology, pollution, utilities, precision agriculture, hydrology and forensics, as well as heritage management. This includes the adaptive design of appropriate survey strategies and accompanying modelling methods and calibration/validation sampling. The provided practical insights build on a robust understanding between subsurface material (soil) properties on the one hand, and geophysical and geochemical properties on the other. These relationships are discussed during the theoretical course units.
The course positions itself alongside other earth inventory course units, including *Teledetectie*, *Geografische Informatiesystemen: basis*, *Geostatistiek*, and builds on insights from *Bodemeigenschappen en bodemprocessen*

Contents

THEORY:
1] Fundamental principles of sampling with sensors;
2] Introduction to geophysical soil properties and geophysical soil modelling
3] Principles and applications of common near surface geophysical methods (electrical resistivity; ground penetrating radar; electromagnetic induction; magnetometry and environmental magnetism)
4] Introduction to spectroscopy and geochemical soil sensing
5] Principles and applications of common spectroscopic methods

PRACTICE:
1] field application of geophysical sensors & introduction to invasive field sampling to complement soil sensor data;
2] analysing and interpreting geophysical sensor data;
3] analysing and interpreting geochemical & multi-sensor data;

Initial competences

Basic knowledge of (geo)statistics, soil science and geographical information systems

Final competences

1 develop adaptive survey approaches that integrate non-invasive and invasive techniques to support environmental research;
2 understand the operating principles of geophysical and geochemical sensors and their limitations for practical implementation;
3 have the necessary practical skills to use the sensors for on-site data collection;
4 *understand the general principles for data processing and analysis for the different discussed sensing methods;*
5 have an overview of the most commonly used and commercially available tools for environmental soil sensing

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, Seminar, Lecture, Practical

Extra information on the teaching methods

practicum: fieldwork, practicum and pc-exercises

Study material

Type: Syllabus

Name: Online syllabus on basic principles of ESS and practicum info
Indicative price: Free or paid by faculty
Optional: no

Type: Slides

Name: Course slides
Indicative price: Free or paid by faculty
Optional: no
Language : English

Type: Reader

Name: compulsary journal papers to support course units
Indicative price: Free or paid by faculty
Optional: no

Type: Software

Name: jupyter notebooks for practicum
Indicative price: Free or paid by faculty
Optional: no

References

References to relevant (non-compulsory) literature is provided during the lectures, and made available via UFora.
These references include:
Evans, M.E., Heller, F., 2003. Environmental Magnetism. Principles and Applications of Enviromagnetics, Academic Press, California.
Jol, Harry M. *Ground Penetrating Radar: Theory and Applications*. Oxford: Elsevier, 2009.
Jordanova, N., 2017. Soil Magnetism. Applications in Pedology, Environmental Science and Agriculture, Academic Press, London, UK.;
Webster, R. & Lark, M. (2013). Field Sampling for Environmental Science andManagement. Oxon, United Kingdom: Routledge. ISBN: 978-1-84971-368-9

Telford, W. M., L. P. Geldart, and R. E. Sheriff. *Applied Geophysics*. Cambridge University Press, 1990

Course content-related study coaching

Interactive discussion during lessons: questions before, during and after lecture. Individual (for extensive questioning): after appointment with lecturer or assistants. Support via Ufora (forum for students). Organisational announcements are made via Ufora.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Participation, Written assessment, Assignment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Peer and/or self assessment, Assignment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Non-periodic: reporting on collected and processed field (sensor + soil sampling) data

Calculation of the examination mark

75% periodic evaluation
25% non-periodic evaluation