GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2020-2021

Soil Physics (I002657)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 5.0 Study time 150 h Contact hrs 50.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	group work	0.0 h
			practicum	8.75 h
			microteaching	6.25 h
			seminar: practical PC room classes	5.0 h
			fieldwork	5.0 h
			self-reliant study activities	0.0 h
			seminar: coached exercises	10.0 h

Lecturers in academic year 2020-2021

Cornelis, Wim	LA20	lecturer-in-charge

Offered in the following programmes in 2020-2021	crdts	offering
Master of Science in Physical Land Resources (main subject Land Resources Engineering)	5	A
International Master of Science in Soils and Global Change (main subject Physical Land Resources and Global Change)	5	A
International Master of Science in Soils and Global Change (main subject Soil Biogeochemistry and Global Change)	5	A
Master of Science in Physical Land Resources (main subject Soil Science)	5	A
Master of Science in Bioscience Engineering: Land and Water Management	5	A
Exchange Programme in Bioscience Engineering: Agricultural Sciences (master's level)	5	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	5	A
Exchange Programme in Bioscience Engineering: Land and Forest management (master's level)	5	A

Teaching languages

English

Keywords

soil-water content, soil-water potential, water retention, soil-flow of water and chemicals in soils, soil structure

Position of the course

Soils constitute a central link between air, ground and surface water, and living organisms and are thus crucial to ecosystem functioning. This basic course aims at providing profound knowledge on and insights in physical properties and processes of and in soil, and how to measure and model them, applying physical and mathematical laws. Soil-water relationships are central to the course. A profound understanding of soil physical properties and processes is essential in studies on water and chemical transport in soils, irrigation and drainage, biomass production, trafficability, gas emission from soils, soil erosion, soil compaction, salinization and ecosystem functioning, among others.

Contents

Concepts and principles
1. Introduction to soil physics
Part 1. Soil solid phase
2. Composite soil properties
3. Soil structure
Part 2. Water retention in soils
4. Properties of water related to porous media
5. Soil-water content
6. Energy status of water in soil
7. Water retention curve
Part 3. Water movement in soil
8. Water flow in capillary tubes
9. Water flow in saturated soil
10. Water flow in unsaturated soil
Part 4. Chemical transport in soil
11. Conservation and flux equations
12. Convection-dispersion equation
Measuring and modeling in practice
Lab and field work to sample soil and measure soil physical and hydraulic properties from fields with different land use. At the field, water content and matric potential is measured. Data are used to assess the effect of land use on 1) soil health using soil physical quality indicators and 2) on the water regime with the Hydrus model.

Initial competences

The student should have good knowledge of mathematics and physics, and some basic understanding of earth sciences and soil science or pedology.

Final competences

1 Apply standard lab and field methods to determine hydrophysical properties of soil.
2 Use soil-moisture sensors and tensiometers to measure soil-moisture status.
3 Explain the principles behind lab and field methods, and instrumentation for monitoring soil-moisture status.
4 Analyse simple to more complex water transport processes in soil.
5 Evaluate physical quality of soils.
6 Apply parameter estimation methods to determine soil hydraulic properties.
7 Apply numerical models to predict changes in water content and matric potential with time.
8 Explain hydrophysical and soil mechanical properties of soil.
9 Explain the principles behind water and chemical transport in soil.
10 Present and discuss research results to peers.

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, microteaching, practicum, fieldwork, self-reliant study activities, seminar: coached exercises, seminar: practical PC room classes, online demonstration, online lecture, online lecture: plenary exercises, online lecture: response lecture

Extra information on the teaching methods

Self-reliant study activities: simple calculations + simulations with Hydrus model can be solved at home
Online lecture: short video's in preparation of on campus seminars
Online lecture: plenary exercises: examples are solved and recorded on video
Online lecture: response lecture: Q&A chat session with students
Fieldwork: soil sampling, measuring hydraulic conductivity, and soil-moisture status with sensors and tensiometers
Practicum: laboratory measurements of bulk density and porosity, water content (gravimetrically), water retention curve, hydraulic conductivity curve
Seminar: coached exercises: simple calculations are solved classically (pocket calculator/spreadsheet); model simulations with Hydrus model (laptop)
Seminar: practical PC-class room: estimation of parameters of water retention model, simulation of water flow with Hydrus model
Microteaching: two group presentations about fieldwork, practicum and practical PC-class room exercises (reporting and discussion of results)
Group work: preparation of presentations in group
Online demonstration: short videos in preparation of practicum

Learning materials and price

A syllabus is available. Additional documentation (slide shows, background information, exercises, video) can be found on Ufora platform.
Cost: 5.0 EUR

References

Jury, W.A. & Horton, R. 2004. Soil Physics. John Wiley & Sons.
Hillel, D. 1998. Environmental Soil Physics : Fundamentals, Applications, and Environmental Considerations. Academic Press.
Radcliffe, D.E. & Simunek, J. 2010. Soil Physics with HYDRUS: Modeling and Applications. CRC Press, Taylor & Francis Group

Course content-related study coaching

Instructors (professor/assistants) are available for questions and further explanations on appointment.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination with open questions

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

Written examination with open questions

Examination methods in case of permanent evaluation

Participation, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

Written examination with open questions (no multiple choice, closed book) on theory + exercises. This evaluates the teaching methods lecture, self-reliant study activity, seminar coached exercises: periodic evaluation.
Participation: assessment of participation in groupwork and group presentations, and of timely submission of small assignments. This evaluates the teaching methods fieldwork, practicum, microteaching, group work, seminar coached exercises.
Report: assessment of the group presentations. This evaluates the teaching method fieldwork, practicum, microteaching, group work.

Calculation of the examination mark

Written examination with open questions: 70%
Participation + Report: 30%
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.