GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Soil Physics (I001550)

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

Credits 5.0	Study time 135 h	Contact hrs	60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	English	group work	1.25 h
		self-reliant study activities	0.0 h
		practicum	12.5 h
		fieldwork	7.5 h
		seminar: practical PC room classes	5.0 h
		seminar: coached exercises	2.5 h
		lecture: plenary exercises	2.5 h
		microteaching	1.25 h
		lecture	27.5 h

Lecturers in academic year 2018-2019

Cornelis, Wim	LA20	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Physical Land Resources (main subject Soil Science)	5	A
Master of Science in Bioscience Engineering: Forest and Nature Management	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

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 a field with contrasting land management. Data are used to assess physical soil quality and evaluate the effects of land management, and to estimate soil hydraulic parameters in a PC exercise.
At the field, water content and matric potential is measured. Data are used in a PC exercise to simulate water transport with the Hydrus model.

Initial competences

The student should have a profound knowledge of mathematics (Algebra and Analytical Geometry, Differential and Integral Calculus, Differential Equations) and physics (Mechanics, Electricity and Magnetism, Thermodynamics Physical Transport Phenomena), 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 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, lecture, microteaching, practicum, fieldwork, self-reliant study activities, lecture: plenary exercises, seminar: coached exercises, seminar: practical PC room classes, lecture: response lecture

Extra information on the teaching methods

Self-reliant study activities: simple calculations + simulations with Hydrus code can be solved at home
Lecture: interactive ex cathedra lectures (slides can be downloaded through Minerva)
Lecture: plenary exercises: examples are solved at the black board
Lecture: response lecture: questions related to a real-life project and the practical exercises need to be addressed by students prior to the lecture; students need to present their answers to their peers during group discussions at the beginning of each lecture
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
Seminar: coached exercises: simple calculations are solved classically using a pocket calculator
Seminar: practical PC-class room: estimation of parameters of water retention model, simulation of water flow with Hydrus code

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

Learning materials and price

A syllabus is available. Additional documentation (slide shows, background information, exercises, video) can be found on Minerva 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, skills test, 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

Lecture, self-reliant study activity, seminar coached exercises: periodic evaluation: open questions (no multiple choice, closed book) about theory + exercises
Fieldwork, practicum, microteaching, group work: permanent evaluation: group presentations; participation is compulsory; deadlines for submission need to be respected, otherwise no marks will be given for the group presentation

Calculation of the examination mark

Lecture, self-reliant study activity, seminar coached exercises: 75%
Fieldwork, practicum, microteaching, group work: 25%
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.