

Soil Chemistry (I002773)

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

Credits 5.0

Study time 150 h

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)

English

Gent

lecture

practical

Lecturers in academic year 2024-2025

Tack, Filip

LA24

lecturer-in-charge

Offered in the following programmes in 2024-2025

crdts

offering

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

International Master of Science in Soils and Global Change (main subject Soil Ecosystem Services and Global Change)

5

A

International Master of Science in Soils and Global Change (main subject Soil-Plant System Processes and Global Change)

5

A

Exchange Programme in Bioscience Engineering: Agricultural Sciences (master's level)

5

A

Exchange Programme in Bioscience Engineering: Land and Forest management (master's level)

5

A

Teaching languages

English

Keywords

soil, chemistry, pedology, dynamics of elements

Position of the course

This course is a basic course for soil science students aiming to provide students with the chemical aspects of soil that are of importance in understanding its functioning, management and use. Along the trajectory, relevant chemical methods of soil analysis are studied.

Contents

Chapter 1 General concepts in environmental chemical analysis 6

1.1 Chemical elements 6

1.2 Matter 8

1.3 Chemical binding 9

1.4 Chemical reactions 10

1.5 Chemical equilibria 11

1.6 Concentration 12

1.7 Chemical analysis 16

1.8 Analytical performance 20

Chapter 2 Soil composition 29

2.1 Composition of soils 29

2.2 Soil sampling 35

Chapter 3 Acidity and alkalinity 40

3.1 Aqueous acid-base theories 40

3.2 Acid-base equilibria in water 40

3.3 Autoprotolysis of water and the pH scale 41

3.4 Calculation of the pH of solutions 42

3.5 Soil reaction: acidity and alkalinity 54

3.6	Chemical analysis	55
Chapter 4 Oxidation and reduction 66		
4.1	Redox reactions	66
4.2	Redox equilibria	70
4.3	Redox and pH: the stability region of water	73
4.4	Microbial reduction processes	75
4.5	Redox processes in the environmental	76
4.6	Potentiometry	77
Chapter 5 Carbonates 88		
5.1	Calcareous soils	88
5.2	CO ₂ -equilibria	89
5.3	Chemical analysis	95
Chapter 6 Organic matter 101		
6.1	Soil organic matter	101
6.2	Peat soils	103
6.3	Chemical analysis	105
Chapter 7 Sesquioxides 109		
7.1	Hydrated oxides of iron and aluminium	109
7.2	Aluminium	114
7.3	Chemical analysis	116
Chapter 8 Soluble salts 120		
8.1	Solubility	120
8.2	Soluble salts and saline soils	127
8.3	Electrical conductivity	128
8.4	Sodium adsorption ratio and sodic soils	129
8.5	Effects of salinity and sodicity	131
8.6	Analytical determination	133
Chapter 9 Sorption 143		
9.1	Sorption phenomena	143
9.2	Cation exchange	146
9.3	Analytical determination	149
9.4	Anion exchange	150
Chapter 10 Mayor nutrients: nitrogen 154		
10.1	Nitrogen in soils	154
10.2	Analysis of nitrogen	157
Chapter 11 Mayor nutrients: phosphorus 163		
11.1	Introduction	163
11.2	Forms of occurrence	163
11.3	Phosphate solubility in the presence of Al, Fe and Ca	164
11.4	Behavior in soils	167
11.5	Analysis of P	169
Chapter 12 Mayor nutrients: potassium and secondary macronutrients 173		
12.1	Potassium in soils	173
12.2	Calcium and magnesium in soils	174
12.3	Sulfur	175
Chapter 13 Trace elements 178		
13.1	Environmental chemistry and behavior	178
13.2	Analysis of trace elements	181
13.3	Spectroscopic methods for elemental analysis	183

Initial competences

Elementary knowledge of inorganic chemistry

Final competences

- 1 Explain soil components and chemical reactions in soils
- 2 Explain the principle of analytical methods for soil characterization
- 3 Select suited analytical methods for characterizing soil properties
- 4 Interpret analytical results of soil analysis
- 5 Evaluate the accuracy and the reliability of analytical data

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

Lecture, Practical

Extra information on the teaching methods

Practicum: lab exercises: Analysis of soil

Lecture: plenary exercises: during the theory class, example exercises are interactively solved.

Study material

Type: Syllabus

Name: Soil Chemistry

Indicative price: € 25

Optional: no

Language : English

Type: Slides

Name: Slides

Indicative price: Free or paid by faculty

Optional: no

Type: Lab Material

Name: Alcohol Felt Tip Pen

Indicative price: € 10

Optional: no

References

-

Course content-related study coaching

Illustration of theory via problems and hands-on laboratory exercises.

Assessment moments

end-of-term and continuous assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

Continuous assessment: evaluation based on reports of practical laboratory exercises

End-of-term assessment: written examination with open-ended questions (60%) and numerical problems (40%)

Calculation of the examination mark

Continuous assessment: 8/20

End-of-term assessment: 12/20

Students who do not pass both the continuous assessment and the end-of-term assessment, or who eschew one or more evaluation moments without legal justification, may be failed by the examiner. In these cases, a score of at most 9/20 will be assigned.