

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

Department Soil Science and Soil Conservation

"APPROVED"

Land Management Faculty

"18" __06__2026

**CURRICULUM OF ACADEMIC DISCIPLINE
Soil Science with the Fundamentals of Geology**

Area of knowledge G "Engineering, Manufacturing and Construction"

Specialty G18 "Geodesy and Land Management"

Educational programme "Geodesy and Land Management"

Faculty "Land Management"

Developed by: Yuriy KRAVCHENKO Professor, Doc Hab.

(First and LAST NAME, scientific degree, academic rank)

Kyiv – 2026

Description of the discipline Soil Science with the Fundamentals of Geology

(name)

this course is an introductory designed course for the Bachelor student, which provides the basic concepts of all aspects of geology and soil science. It encompasses: Earth's origin; internal and external Earth's dynamics; minerals and rocks – formation, composition, diagnostics and properties changes; agronomic ores properties and application; anthropogenic influence on geologic environment. The course presents the soil composition and genesis; physical, chemical, and biological properties; soil water; classification and mapping; soil conservation; management practices; and soil fertility and productivity (soil testing, use of fertilizers and liming), soil quality assessment. The course gives practical experience as an aid in developing understanding of the minerals, rocks and soils as natural bodies, the use of which has an influence on environmental, human society and life in general.

Area of knowledge, specialty, academic programme, academic degree	
Area of knowledge	H “Agriculture, forestry, fisheries and veterinary medicine”
Academic degree	<i>Bachelor</i>
Specialty	<i>G18 “Geodesy and Land Management”</i>
Academic programme	<i>“Land Management”</i>
Characteristics of the discipline	
Type	<i>Optional</i>
Total number of hours	<i>120</i>
Number of ECTS credits	<i>4</i>
Number of modules	<i>2</i>
Course project (work) (if any)	<i>-</i>
Form of assessment	<i>Exam</i>
Indicators of the discipline for full-time and part-time forms of university study	
	University study
	Full-time
Year of study	<i>1</i>
Term	<i>2</i>
Lectures	<i>30 hours</i>
Practical classes and seminars	<i>30 hours</i>
Laboratory classes	<i>-</i>
Self-study	<i>60 hours</i>
Number of hours per week for full-time students	<i>4 hours</i>

1. Aim, prerequisites, competences and expected learning outcomes of the discipline

Aim: demonstrate understanding of the theoretical basis behind geology and its related concepts; diagnose mineral and rock properties; describe fundamental soil physical, chemical, and biological properties and processes as well as the interactions among them that; govern soil formation; determine soil suitability and capacity to perform various essential production and ecological functions; utilize laboratory techniques to determine soil properties; be able to relate those fundamental soil properties and processes to land use and soil management decisions and implications for soil sustainability, function, and degradation.

Prerequisites of the discipline (if any):

1. Advanced Mathematics; 2. Physics; 3. Geoinformatics, Computer Science and Programming; 4.

Introduction to Geomorphology; 5. Electronic Surveying Instruments; 6. Psychology; 7. Economic Theory; 8. Land Law; 9. Mathematical Methods and Modelling; 10. Theoretical Foundations of Basic Military Training; 11. History of Ukrainian Statehood; 12. Philosophy; 13. Ukrainian Language for Professional Purposes; 14. Foreign Language; 15. Physical Education; 16. Occupational and Life Safety; 17. Legal Culture; 18. Ethnoculturology.

Acquisition of competences:

Competences acquired:

Integral competence (IC): - ability to solve complex specialized tasks of geodesy and land management.

General competence (GC):

- GC 1 – ability to learn and master modern knowledge;
- GC 2 – ability to apply knowledge in practical situations;
- GC 5 – ability to communicate in a foreign language.
- GC 13 – ability to preserve, increase moral, cultural, scientific values and achievements of society based on an understanding of the history, patterns of development of the subject area, its place in the general system of knowledge about nature and society, as well as in the development of society, technology and technology, to use various types and forms of physical activity for recreation and healthy lifestyle.

Special (professional) competence (SC):

- SC 1 – ability to apply fundamental knowledge to analyze phenomena of natural and man-made origin in the performance of professional tasks in the field of geodesy and land management.
- SC 3 – ability to apply regulatory legal acts, regulatory and technical documents, reference materials in professional activities;
- SC 5 – ability to apply modern information, technical and technological support to solve complex issues of geodesy and land management.

Expected learning outcomes (ELO):

- ELO 3 – to communicate information, ideas, problems, solutions, own experience and arguments to specialists and non-specialists;
- ELO 5 – apply conceptual knowledge of natural and socio-economic sciences in performing geodesy and land management tasks;
- ELO 6 – know the history and peculiarities of the development of geodesy and land management, their place in the general system of knowledge about nature and society;
- ELO 7 – perform surveys and surveying, topographic and geodetic, cartographic, design and design and survey work in the performance of professional tasks in geodesy and land management;
- ELO 8 – participate in the creation of state geodetic networks and special engineering geodetic networks, organize and carry out topographic and cadastral surveys, geodetic measurements, engineering geodetic surveys for design, construction and operation of construction facilities.

2. Programme and structure of the discipline

Names of content modules and topics	Number of hours						
	Full time form						
	weeks	total	including				
l			p	lab	ind	self	
Module 1. General Geology							
Topic 1. Introduction to course. What is soil?	1	4	2	2	-	-	-
Topic 2. Internal and external spheres of the Earth.	2	8	2	2	-	-	4
Topic 3. Magmatic, metamorphic and sedimentary processes	3	8	2	2	-	-	4
Topic 4. Endogenic geological processes.	4	12	2	2	-	-	8
Topic 5. Weathering processes and soil formation	5	8	2	2	-	-	4
Topic 6. Exogenic geological processes.	6	12	2	2	-	-	8
l for module 1		52	12	12	-	-	28
Module 2. Soil Science							
Topic 7. Soil formation, processes and taxonomy	7	7	2	2	-	-	3
Topic 8. Soil texture, structure, density and porosity	8	8	2	2			4
Topic 9. Soil organic matter	9	8	2	2	-	-	4
Topic 10. Soil colloids and sorption	10	6	2	2	-	-	2
Topic 11. Soil cations, anions, acidity, alkalinity, salinity	11	8	2	2	-	-	4
Topic 12. Soil water, air and temperature.	12	7	2	2	-	-	3
Topic 13. Soil productivity assessment.	13	8	2	2	-	-	4
Topic 14. Zonal soils of Ukraine	14	8	2	2	-	-	4
Topic 15. Azonal soils of Ukraine	15	8	2	2	-	-	4
Total for module 4		68	18	18	-	-	32
Course project (work) on Soil Science							1
Total hours		120	30	30	-	1	60
Course project (work)		75	-	-	-	75	-
Total hours		195	30	30	-	75	60

3. Topics of lectures

No.	Topic	Hours
1.	Introduction to course. What is soil?	2
2.	Internal and external spheres of the Earth.	2
3.	Magmatic, metamorphic and sedimentary processes	2
4.	Endogenic geological processes.	2
5.	Weathering processes and soil formation	2
6.	Exogenic geological processes.	2
7.	Soil formation, processes and taxonomy	2
8.	Soil texture, structure, density and porosity	2
9.	Soil organic matter	2
10.	Soil colloids and sorption	2
11.	Soil cations, anions, acidity, alkalinity, salinity	2
12.	Soil water, air and temperature.	2
13.	Soil productivity assessment.	2
14.	Zonal soils of Ukraine	2
15.	Azonal soils of Ukraine	2

4. Topic of laboratory (practical, seminars) classes

No.	Topic	Hours
1.	The general mineral properties and crystallography	2
2.	Soil minerals	2
3.	Silicates	2
4.	The general rock properties and their formation	2
5.	Quaternary deposits and agronomic ores	2
6.	Lab Safety. Soil sampling	2
7.	Forms (categories) of soil water. Soil hygroscopic moisture determination.	2
8.	Soil granulometry and particle size distribution. Feel method of soil texture determination.	2
9.	International pipette method.	2
10.	Soil organic matter determination.	2
11.	Cation exchange capacity determination.	2
12.	Active and exchangeable acidity determination.	2
13.	Hydrolytic acidity determination.	2
14.	Zonal soils of Ukraine properties and management	2
15.	Azonal soils of Ukraine properties and management	2

5. Topics of self-study

No.	Topic	Hours
1	Working with geological processes	28
2	Soil genesis, morphology, properties, geography and amendment	32

6. Methods of assessing expected learning outcomes:

- oral or written survey;
- interview;
- test;
- defending practical, design/graphical works, projects;
- self-assessment;
- other types.

7. Teaching methods:

- problem-based method;
- practice oriented studying method;
- case method;
- project education method;
- research based method;
- learning discussions and debates method;
- team work, brainstorm method;
- other types.

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force.

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1. General Geology		
Lecture 1. Introduction to course. What is soil?	ELO 6, 10. Understand Earth's landforms, shape, and structure; study the properties of Earth's inner and outer geospheres; develop the ability to identify endogenous and exogenous processes and their resulting landforms, recognize minerals and rocks, and characterize Quaternary deposits (soil-forming rocks) and their role in soil formation.	-
Laboratory work 1. The general mineral properties and crystallography.		10
Lecture 2. Internal and external spheres of the Earth.		-
Laboratory work 2. Soil minerals.		8
Lecture 3. Magmatic, metamorphic and sedimentary processes.		-
Laboratory work 3. Silicates.		8
Lecture 4. Endogenic geological processes.		-
Laboratory work 4. The general rock properties and their formation.		8
Lecture 5. Weathering processes and soil formation.		-
Laboratory work 5. Quaternary deposits and agronomic ores.		8
Lecture 6. Exogenic geological processes.		-
Laboratory work 6. Lab Safety. Soil sampling.		8
Self-study 1. Working with geological processes.		10
Module control work 1.		40
Total for module 1		100
Lecture 7. Soil formation, processes and taxonomy	ELO 10, 11, 14. Understand soil forming factors and processes; know laboratory and field safety protocols; learn proper soil sampling techniques; master the classification of water categories in soil; assess plant-available water content; determine hygroscopic moisture, soil texture, and organic matter; comprehend the role of living organisms in soil organic matter accumulation; and predict soil organic carbon content using balance calculations. ELO 6, 10, 11, 14. Be able to determine soil chemical composition and apply chemical reclamation methods; calculate lime and gypsum application rates for acidic and alkaline soils; assess soil salinity type and degree, as well as leaching water requirements;	-
Laboratory work 7. Forms (categories) of soil water. Soil hygroscopic moisture determination.		4
Lecture 8. Soil texture, structure, density and porosity		-
Laboratory work 8. Soil granulometry and particle size distribution. Feel method of soil texture determination.		4
Lecture 9. Soil organic matter		-
Laboratory work 9. International pipette method.		6
Lecture 10. Soil colloids and sorption		-
Laboratory work 10. Soil organic matter determination.		6
Lecture 11. Soil cations, anions, acidity, alkalinity, salinity		-
Laboratory work 11. Cation exchange capacity determination.		6
Lecture 12. Soil water, air and temperature.		-
Laboratory work 12. Active and exchangeable acidity determination.		6
Lecture 13. Soil productivity assessment.		-
Laboratory work 13. Hydrolytic acidity determination.		6
Lecture 14. Zonal soils of Ukraine		-
Laboratory work 14. Zonal soils of Ukraine properties and management	6	
Lecture 15. Azonal soils of Ukraine	-	
Laboratory work 15. Azonal soils of Ukraine properties and management	6	

Self-study 2. Soil genesis, morphology, properties, geography and amendment	understand agrotechnological measures for regulating soil air, water, and thermal regimes; and evaluate soil quality and fertility. ELO 10, 11, 14. Be able to classify Ukrainian soils according to their taxonomic units; understand the genesis of soils in different climatic zones of Ukraine; master techniques for morphological description of soil profiles and soil-forming factors; assess soil properties in relation to various agricultural crops; and manage soil fertility at the profile level using modern agrotechnical methods.	10
Module control work 2.		40
Total for module 2		100
Class work	$(M1 + M2)/2 \cdot 0,7 \leq 70$	
Exam/credit	30	
Total for year	$(\text{Class work} + \text{exam}) \leq 100$	
Course project/work		100

8.1. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.2. Assessment policy

<i>Deadlines and exam retaking rules</i>	works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
<i>Academic integrity rules</i>	cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
<i>Attendance rules</i>	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids

- e-learning course of the discipline: <https://elearn.nubip.edu.ua/course/view.php?id=2700>.
- lecture notes and presentations (in electronic form);

- textbooks, manuals, lab notes;
- methodological materials for the study of the discipline;
- summer training programme of the discipline.

10. Recommended sources of information

Textbooks:

1. Petrenko L., Berezniak M., Kravchenko Y., Kozak V., Berezniak E. Soil Science with Elements of Geology. К.: ЦП "Komprint", 2020. 702 p.
2. Kravchenko Y.S. Geology with the principles of Geomorphology. Part 1. Dynamic Geology. Київ, ТОВ "Центр ІТ». 2019. 142 p.
3. Brady, N.C. and R.R. Weil. 2021. Elements of the Nature and Properties of Soils, 15th Edition. Pearson Prentice Hall.
4. Бережняк М. Ф., Якубенко Б. Є., Тонха О. Л., Чурілов А. М., Сендзюк Р. В., Бережняк Є. М. Ґрунтознавство з основами геоботаніки. Навчальний посібник. Київ: Вид-во "Ліра". 2019. 636 с.

Laboratory books:

1. Petrenko L., Berezniak M., Kravchenko Yu., Tonkha O., Berezniak Ie., Bykova O. Soil Science: Practical Methods Manual. NUBIPU Publishing Center, Kyiv, 2023. 429 p.
2. Tomaizeh S. Soil Science Manual Lab. Hebron University, Soil and Irrigation Department, 2020, 56 p.

