NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Soil Science and Soil Conservation Department

APPROVED

Land Management Faculty
"10" 06 2025

CURRICULUM OF ACADEMIC DISCIPLINE

Soil Science with the Basics of Geology

Area of knowledge G "Engineering, Manufacturing and Construction"
Specialty G18 "Geodesy and Land Management"
Academic programme "Geodesy and Land Management"
Faculty "Land Management"
Developed by: Professor, Doc Hab., Y. Kravchenko
(position, academic degree, academic rank)

Kyiv – 2025

Description of the discipline

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		
Academic degree	*Bachelor*	
Specialty	*G18 "Geodesy and Land Management"*	
Academic programme	*"Land Management"*	
Characteristics of the discipline		
Type	*Optional*	
Total number of hours	*60*	
Number of ECTS credits	*2*	
Number of modules	*2*	
Course project (work) (if any)	-	
Form of assessment	*Exam*	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	**Part-time**
Year of study	*1*	-
Term	*2*	-
Lectures	*15 hours*	-
Practical classes and seminars	*15 hours*	-
Laboratory classes	-	-
Self-study	*30 hours*	-
Number of hours per week for full-time students	*2 hours*	-

1.Aim, 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.

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				
	Week	Total	Including		
			Lec	Lab	Self
Module1. Soil Genesis.					
1. The Earth and geological processes.	1	7	2	-	5
2. Soil formation and soil processes.	3	7	2	-	5
3. Soil classification, taxonomy and morphology.	5	6	2		4
Mid-term exam 1			-	-	-
Total for Module 1		35	6	6	14
Module2. General Soil Science and Soil Geography.					
4. Soil physics.	7	6	2		3
5. Soil chemistry.	9	6	2		4
6. Zonal soils of Ukraine.	11-13	7	3		4
7. Azonal and intrazonal soils of Ukraine.	15	6	2		4
Mid-term exam 2			-		-
Total for Module 2		40	9	*9*	*16*
Total	15	60	15	15	30

3. Topics of lectures

No.	Topic	Hours
1.	The Earth and geological processes.	2
2.	Soil formation and soil processes.	2
3.	Soil classification, taxonomy and morphology.	2
4.	Soil physics.	2
5.	Soil chemistry.	2
6.	Zonal soils of Ukraine.	3
7.	Azonal and intrazonal soils of Ukraine.	2

4. Topic of laboratory (practical, seminars) classes

No.	Topic	Hours
1.	Diagnostics of Physical Properties of Minerals.	3
2.	Forms (categories) of soil water. Soil hygroscopic moisture determination.	1
3.	International pipette method of soil texture determination.	2
4.	The general rock properties and their formation	2
5.	Soil organic matter determination.	2
6.	Soil acidity determination.	1
7.	Cation exchange capacity determination.	2
8.	Soils of Ukraine.	2

5. Topics of self-study

No.	Topic	Hours
1.	Earth as space and physical body. Internal and external spheres.	2
2.	Endogenic processes.	2
3.	Exogenic processes.	2
4.	The quaternary period and soil parent materials.	2
5.	Soil genesis.	2
6.	Soil texture.	2
7.	Soil organic matter.	2
8.	Soil colloids and retention capacity.	2
9.	Soil water and water-related properties.	2
10.	Soil acidity and alkalinity. Soil solution. Redox potential.	2
11.	Soil physical properties. Soil aggregates. Physical and mechanical characteristics of soils.	2
12.	Soil productivity and its evaluation.	2
13.	Soils of the Forest, Forest-Steppe and Steppe zones of Ukraine. Classification, genesis, properties, management.	2
14.	Salt-affected soils (solonchak, solonez, solod). Classification, genesis, properties, management.	2
15.	Flooding plain soils (soddy, swampy, alluvial, meadow). Classification, genesis, properties, management.	2

6. Methods of assessing expected learning outcomes:

- oral and written survey;
- interview;
- test;
- defending laboratory works, projects;
- peer-to-peer assessment, self-assessment.

7. Teaching methods*:*

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

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. **Soil Genesis.**		
Lecture 1. The Earth and geological processes.	ELO 3, 5, 6. Understand Earth's landforms, develop the ability to identify endogenous and exogenous processes and their resulting landforms, recognize minerals and rocks, and characterize quaternary deposits. Understand soil forming factors and processes; master the classification of water categories in soil; assess plant-available water content; determine hygroscopic moisture, soil texture, and organic matter.	-
Laboratory work 1. Diagnostics of Physical Properties of Minerals.		15
Lecture 2. Soil formation and soil processes.		-
Laboratory work 2. Forms (categories) of soil water. Soil hygroscopic moisture determination.		15
Lecture 3. Soil classification, taxonomy and morphology.		-
Laboratory work 3. International pipette method of soil texture determination.		20
Self-study 1. Working with Soil Genesis.		20
Module control work 1.		30
Total for module 1		100
Module 2. **General Soil Science and Soil Geography.**		
Lecture 4. Soil physics.	ELO 7, 8. Know laboratory and field safety protocols; learn proper soil sampling techniques; comprehend the role of living	-
Laboratory work 4. The general rock properties and their formation		10
Lecture 5. Soil chemistry.		-

Laboratory work 5. Soil organic matter determination.	organisms in soil organic matter accumulation; and predict soil organic carbon content using balance calculations.	10
Lecture 6. Zonal soils of Ukraine.		-
Laboratory work 6. Soil acidity determination.		10
Laboratory work 7. Cation exchange capacity determination.		10
Lecture 7. Azonal and intrazonal soils of Ukraine.		-
Laboratory work 8. Soils of Ukraine.		10
Self-study 2. Working with soil properties and geography.		20
Module control work 2.		30
Total for module 2		**100**
Class work	**(M1 + M2)/2 · 0,7 ≤ 70**	
Exam/credit	**30**	
Total for year	**(Class work + exam) ≤ 100**	
Course project/work		**100**

8.2. 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

8.3. Assessment policy

Deadlines and exam retaking rules	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).
Academic integrity rules	cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	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., Berezhniak M., Kravchenko Y., Kozak V., Berezhniak E. Soil Science with Elements of Geology. K.: 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., Berezhniak M., Kravchenko Yu., Tonkha O., Berezhniak 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.