NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Soil Science and Soil Conservation Department

APPROVED
Plant Protection, Biotechnology
and Ecology Faculty
“22” 06 2025

CURRICULUM OF ACADEMIC DISCIPLINE
Soil Science and Soil Conservation

Area of knowledge 10 "Natural Sciences "
Specialty 101 “Ecology”
Academic programme “Ecology”
Faculty “Plant Protection, Biotechnology and Ecology”
Developed by: Professor, Doc Hab., Y. Kravchenko
(position, academic degree, academic rank)

Kyiv – 2025

Description of the discipline

this course is an introductory designed for the Bachelor students and provides the basic concepts of all aspects of geology, soil science and soil conservation. It encompasses: Earth's composition and dynamics, pedosphere, anthropogenic influence on pedosphere. The course also presents the soil composition and genesis; physical, chemical, and biological properties; soil water; soil productivity, soil quality assessment, soil degradation and erosion, soil conservation; management practices. The course gives practical experience for sustainable use of soils, 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	*101 "Ecology"*	
Academic programme	*"Ecology"*	
Characteristics of the discipline		
Type	*Compulsory*	
Total number of hours	*154*	
Number of ECTS credits	*5.1*	
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	*2*	-
Term	*3*	-
Lectures	*30 hours*	-
Practical classes and seminars	*30 hours*	-
Laboratory classes	-	-
Self-study	*94 hours*	-
Number of hours per week for full-time students	*4 hours*	-

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

Aim – to demonstrate an understanding of geological theory and related concepts; to identify mineral and rock properties; and to analyze fundamental soil physical, chemical, and biological properties and processes, including their interactions in soil formation. This includes assessing soil suitability and capacity for production and ecological functions, employing laboratory techniques to evaluate soil properties, and applying this knowledge to inform land-use decisions, management practices, and soil sustainability - addressing risks of degradation while preserving critical soil functions.

Competences acquired:

Integral competence (IC): - the ability to solve complex specialized tasks and solve practical problems in the field of ecology, environmental conservation and sustainable nature use or the application of basic theories and methods of environmental sciences under complex and uncertain conditions during the learning process.

General competence (GC):

- GC 1 - knowledge and understanding of the subject area and understanding of the professional activity.

Special (professional) competence (SC):

- *SC* 2 – ability to critically comprehend the basic theories, methods and principles of natural sciences;

Expected learning outcomes (ELO):

- *ELO 3* – understand the basic concepts, theoretical and practical problems in the field of natural sciences that are necessary for analysis and decision-making in the field of ecology, environmental protection and optimal environmental management;
- *ELO 8* - be able to search for information using appropriate sources to make informed decisions.

2. Programme and structure of the discipline

Names of content modules and topics	Number of hours				
	Week	Total	Including		
			Lec	Lab	Self
Module1. Soil Science.					
1. The Earth and geological processes.	1	8	2	-	6
2. Soil formation and soil processes.	2	8	2	-	6
3. Soil classification, taxonomy and morphology.	3	8	2	-	6
4. Soil physics.	4	8	2	-	6
5. Soil chemistry.	5	8	2	-	6
6. Zonal soils of Ukraine.	6	10	2	-	8
7. Azonal and intrazonal soils of Ukraine.	7	8	2	-	6
Mid-term exam 1					
Total for Module 1	7	72	14	*14*	*44*
Module2. Soil Conservation.					
8. Theoretical basics of soil conservation.	8	6	2	-	6
9. Mechanical degradation.	9	6	2	-	6
10. Physical degradation.	10	6	2	-	6
11. Chemical degradation.	11	6	2	-	6
12. Physico - chemical degradation.	12	6	2	-	6
13. Biological degradation.	13	6	2	-	6
14. Reclamation of technogenic degraded soils.	14	6	2	-	6
15. Soil conservational management.	15	6	2	-	8
Mid-term exam 2	8				
Total for Module 2	15	82	16	16	50
Total		154	30	30	94

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.	2
7.	Azonal and intrazonal soils of Ukraine.	2
8.	Theoretical basics of soil conservation.	2
9.	Mechanical degradation.	2
10.	Physical degradation.	2

11.	Chemical degradation.	2
12.	Physico - chemical degradation.	2
13.	Biological degradation.	2
14.	Reclamation of technogenic degraded soils.	2
15.	Soil conservational management.	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.	3
4.	Soil organic matter determination.	3
5.	Soil acidity and cations determination.	2
6.	Soils of Ukraine.	3
7.	Land degradation and its evaluation.	3
8.	Water erosion evaluation.	3
9.	Wind erosion evaluation.	3
10.	Contour – ameliorative land management.	3
11.	Calculations of CO_2 emission and humus balance.	3

5. Topics of self-study

No.	Topic	Hours
1.	Earth as space and physical body. Internal and external spheres.	5
2.	Magmatic, metamorphic and sedimentary processes.	4
3.	Plate tectonics and crust deformations. Volcanism. Earthquakes.	4
4.	Weathering. Wind movement. Mass wasting. Rivers. Lakes and bogs. Oceans and seas. Glaciers. Ground waters.	4
5.	Soil genesis.	4
6.	Soil texture.	4
7.	Soil organic matter.	4
8.	Soil colloids and retention capacity.	4
9.	Soil water and water-related properties.	4
10.	Soil acidity and alkalinity.	5
11.	Soil physical properties.	4
12.	Soil solution. Redox potential.	4
13.	Soil aggregates. Physical and mechanical characteristics of soils.	5
14.	Soil productivity and its evaluation.	5
15.	Soil erosion and degradation.	5
16.	Physical degradation.	5
17.	Biodiversity problem on arable lands.	5
18.	Types of soil disturbances effected by geological exploration, mining and road construction.	5
19.	Reclamation of disturbed lands.	7
20.	Soil conservational practices.	7

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, 8. 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. Know laboratory and field safety protocols; learn proper soil sampling techniques; comprehend the role of living organisms in soil organic matter	-
Laboratory work 1. Diagnostics of Physical Properties of Minerals.		7
Lecture 2. Soil formation and soil processes.		-
Laboratory work 2. Forms (categories) of soil water. Soil hygroscopic moisture determination.		7
Lecture 3. Soil classification, taxonomy and morphology.		-
Laboratory work 3. International pipette method of soil texture determination.		10
Lecture 4. Soil physics.		-
Laboratory work 4. Soil organic matter determination.		10
Lecture 5. Soil chemistry.		-
Laboratory work 5. Soil acidity and cations determination.		7
Lecture 6. Zonal soils of Ukraine.		-
Laboratory work 6. Soils of Ukraine.		4
Lecture 7. Azonal and intrazonal soils of Ukraine.		-

Laboratory work 6. Soils of Ukraine.	accumulation; and predict soil organic carbon content using balance calculations.	5
Self-study 1. Working with soil properties and geography.		20
Module control work 1.		30
Total for module 1		**100**
Lecture 8. Theoretical basics of soil conservation.	ELO 3, 8. Be able to assessing soil suitability and capacity for production and ecological functions, employing laboratory techniques to evaluate soil properties, and applying this knowledge to inform land-use decisions, management practices, and soil sustainability - addressing risks of degradation while preserving critical soil functions.	-
Laboratory work 7. Land degradation and its evaluation.		5
Lecture 9. Mechanical degradation.		-
Laboratory work 7. Land degradation and its evaluation.		5
Lecture 10. Physical degradation.		-
Laboratory work 8. Water erosion evaluation.		5
Lecture 11. Chemical degradation.		-
Laboratory work 8. Water erosion evaluation.		5
Lecture 12. Physico - chemical degradation.		-
Laboratory work 9. Wind erosion evaluation.		10
Lecture 13. Biological degradation		-
Laboratory work 10. Contour – ameliorative land management.		10
Lecture 14. Reclamation of technogenic degraded soils.		-
Laboratory work 11. Calculations of CO_2 emission and humus balance.		5
Lecture 15. Soil conservational management.		-
Laboratory work 11. Calculations of CO_2 emission and humus balance.		5
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	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

rules	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=3296;
- 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.