NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
Faculty of Plant Protection, Biotechnology and Ecology

"APPROVED"

Dean Agrobiology Faculty
Dr._____ Y. Kolomiets
"_____"_____2021

TEACHING MATERIALS

Course: **„Soil Science with the Basics of Geology"**

Field of study: **101 "Ecology"**

Qualification: **Bachelor**

Faculty: **Plant Protection, Biotechnology and Ecology**

Department: **Soil Science and Soil Conservation**

Department Code: **05.09**

Instructor: **Dr. Yuriy Kravchenko**

Kyiv – 2021

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Soil Science and Soil Conservation Department

"APPROVED"
Dean Agrobiology Faculty
Dr._____ Y. Kolomiets
"_____"_____2021

REWIEWED AND APPROVED at the Soil Science & Soil Conservation Department, Minutes of Meeting
№ 11 from 2. 06. 2021
Head of Department
Prof._____ A.Balayev
"_____"_____2021

SYLLABUS of
"Soil Science with the Basics of Geology"

Field of study: **101 "Ecology"**
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Syllabus for Soil Science with the Basics of Geology

Field of Knowledge, Field of Study, Specialty, Educational-Qualification Level		
Field of knowledge	101 Ecology	
Field of study	10 Natural Sciences	
Specialty	-	
Educational-qualification level	Bachelor	
Discipline Characteristics		
Kind	Compulsory	
Total amount of hours	90	
ECTS hours	3	
Modules	3	
Coursework	+	
Mode of inspection	Exam	
Loading hours for the full and part time students		
	Full time	Part time
Year of study	2	-
Semester	3	-
Lectures	30 hours	-
Practical work	-	-
Lab work	30 hours	-
Self-work	30 hours	-
Individual work	-	-
Weekly hours loading for a full-time students: contact self-student work	-	-

Soil Science with the Basics of Geology
Lecture, Laboratory, Individual and Self work Schedule

Lecture Topic	Hours							Reading Assignments for Quizzes	Homework Assignments
	Full time								
	Wk	Total	including						
			l	p	lab	in	self		
1	2	3	4	5	6	7	8		
Module1. General Geology									
1. The Earth as space and physical body	1		0.5	-	-	-	-	ГОМ, P.9-16	Homework 1. Assigned endogenic processes
2. Internal and external spheres	1		0.5	-	-	-	-	GPG, P.7-10 ГОМ, P.16-22	
3. Magmatic, metamorphic and sedimentary processes	2		0.5	-	-	-	-	GPG, P.27-32 ГОМ,P.108-121	
4. Plate tectonics and crust deformations	2		0.5	-	-	-	-	GPG, P.19-27 ГОМ,P.24-29	
5. Volcanism	3		0.5	-	-	-	-	GPG, P.34-38 ГОМ,P.34-36	
6. Earthquakes	3		0.5	-	-	-	-	GPG, P.38-46 ГОМ,P.29-32	Homework 2. Assigned exogenic processes
7. Weathering	4		0.5	-	-	-	-	GPG, P.48-52 ГОМ,P.37-43	
8. Wind movement	4		0.5	-	-	-	-	GPG, P.96-107 ГОМ,P.43-46	
9. Mass wasting	5		0.5	-	-	-	-	GPG, P.55-64 ГОМ,P.46-52	
10. Rivers	5		0.5	-	-	-	-	GPG, P.64-77 ГОМ,P.52-62	
11. Lakes and bogs	6		0.5	-	-	-	-	GPG, P.116-128 ГОМ,P.65-70	
12. Oceans and seas	6		0.5	-	-	-	-	GPG, P.107-116 ГОМ,P.62-65	
13. Glaciers	7		0.5	-	-	-	-	GPG, P.86-96 ГОМ,P.70-83	
14. Ground waters	7		0.5	-	-	-	-	GPG, P.77-86 ГОМ,P.83-90	
Mid-term exam 1				-	-	-	-		
Total for Module 1		13	7	-	6	-	-		
`Module2. General Soil Science									
15. Introduction to Soil Science	8		0.5					FSS, P.4-17	
16. What is soil?	9		1	-	-	-	-	FSS, P.4-17	Homework 3. Assigned soil formation, taxonomy, soil water, physical properties and soil organic matter
17. Soil formation and soil processes	10		1	-	-	-	-	FSS, P.50-66	
18. Soil classification	11		0.5	-	-	-	-	FSS, P.226-228	
19. Soil taxonomy and morphology	12		0.5	-	-	-	-	FSS, P.230-246	
20. Soil physical properties 1. Texture and structure	13		1.5					FSS, P.39-50 FSS, P.148-156	
21. Soil organic matter	14		1.5	-	-	-	-	FSS, P.91-109	Homework 4. Assigned soil colloids, ion sorption,

									acidity, alkalinity, salinity
Mid-term exam 2			-	-	-	-	-		
22. Soil colloids	15		1	-	-	-	-	FSS, P.120-127	
23. Sorption, cation and anion exchange	16		1.5	-	-	-	-	FSS, P.127-137	
24. Soil acidity and alkalinity	17		1	-	-	-	-	FSS, P.137-146	
25. Soil salinity	18		1.5	-	-	-	-	FSS, P.208-210	
26. Soil physical properties 2. Soil structure. soil density, pore space, impacts of tillage	19		1.5	-	-	-	-	FSS, P.148-167	Homework 5. Assigned hydrology, climate, productivity
27. Soil water	20		1.5	-	-	-	-	FSS, P.167-185	
28. Soil and the hydrologic cycle	21		0.5				-	FSS, P.185-191	
29. Soil climate. Soil air and temperature	22		0.5	-	-	-	-	FSS, P.191-208	
30. Soil ecology	23		0.5				-	FSS, P.400-411	
31. Soil productivity and its evaluation.	24		1.5	-	-	-	-	FSS, P.217-226	
Mid-term exam 3			-	-	-	-	-		
Total for Module 2		25.5	17.5		16				
Soil Geography									
32. Geography of soil distribution	25		0.5				-	FSS, P.226-230	Homework 6. Assigned soil survey
33. Soils of the Forest zone	25		0.5				-	FSS, P.246-281	
34. Soils of the Forest-Steppe zone	26		0.5				-	FSS, P.281-324	
35. Soils of the Steppe zone	26		0.5				-	FSS, P.324-340	
36. Soils of the Arid-Steppe zone	27		0.5				-	FSS, P.340-355	
37. Saline soils	27		0.5				-	FSS, P.355-381	
38. Alluvial and meadow soils	28		0.5				-	FSS, P.271-281	
39. Carpathian and Crimean soils	28		0.5				-	FSS, P.381-400	Homework 7. Assigned soil ecology and erosion
40. Soil erosion and degradation	28		0.5				-	FSS, P.400-411	
41. Soil productivity management	29		0.5				-	FSS, chapters 16-22	
42. Human impacts on soil quality and sustainability	30		0.5				-	FSS, different chapters	
Mid-term exam 4							-		
Total for Module 3		26	5.5	-	8		-		
Total		60	30		30				

Soil Science with the Basics of Geology
Laboratory work Schedule

Lab Topic	Wk	lab	Reading Assignments Quizzes	Homework Assignments
1	2	3	4	5
Module1. General Geology				
1. The Earth crust composition	1	0.5	ГОМ,Р.16	Homework 1. Assigned Minerals properties and morphology
2. The general mineral properties and crystallography	1	0.5	ГОМ,Р.93-108	
3. Classification of minerals	2	0.5	ГОМ,Р.121-126	
4. Native elements, sulfides, halides, oxides	2	0.5	ГОМ,Р.126-146; 178-182	
5. Carbonates, phosphates, sulfates, nitrates	3	0.5	ГОМ,Р.146-156;	Homework 2. Assigned Crystallography of silicates
6. Silicates and alumosilicates	3	0.5	ГОМ,Р.157-178;	
7. Rocks as natural formations	4	0.5	ГОМ,Р.183-185;	
8. Igneous (magmatic) rocks	4	0.5	ГОМ,Р.185-195;	
9. Metamorphic rocks	5	0.5	ГОМ,Р.195-201;	
10. Sedimentary rocks	5	0.5	ГОМ,Р.201-227;	Homework 3. Assigned Soil parent materials
11. Quarternary deposits	6	0.25	ГОМ,Р.241-257;	
12. Agronomic ores	6	0.25	ГОМ,Р.257-266;	
13. Continental topography	7	0.25	ГОМ,Р.266-281;	
Mid-term exam 1	7	0.25		
Total for Module 1		6		
`Module2. General Soil Science				
14. Lab Safety. Soil sampling	8	0.5	SPM,P.13-15;	Homework 4. Assigned Soil phase components
15. Forms (categories) of soil water. Soil hygroscopic moisture determination.	8	1	SPM,P.15-18;	
16. Soil granulometry and particle size distribution	9	1	SPM,P.18-21;	
17. Methods of soil texture determination	10	0.5	SPM,P.21-24;	
18. Feel method	10	0.5	SPM,P.22	
19. International pipette and hydrometer methods	11	1.5	SPM,P.24-27;	Homework 5. Assigned Soil Organic carbon
20. Soil organic matter determination	12	1	SPM,P.87-92;	
21. Mid-term exam 2	13	0.5		Homework 6. Assigned Soil Acidity and alkalinity
22. Soil acidity	14	0.5	SPM,P.146-151;	
23. Active and exchangeable acidity determination	15	1	SPM,P.151-154;	
24. Hydrolytic acidity determination	15	0.5	SPM,P.154-155;	
25. Cation exchange capacity determination	16	1	SPM,P.126-133;	Homework 7. Assigned Soil Chemical soil amendment
26. Amendment of acid soils	17	1	SPM,P.158-169;	
27. Soil alkalinity	17	0.5	SPM,P.137-138;	

28. Active and reserved alkalinity determination	18	1	SPM,P.138-142;	
29. Gypsum-soil interactions	18	0.5	SPM,P.142-146;	
30. Soil salinity	19	0.5	SPM,P.169-170;	
31. Soil extract analysis	19	1	SPM,P.170-182;	
32. Type and extent of soil salinity	20	0.5	SPM,P.182-186;	
33. Saline soil reclamation	21	0.5	SPM,P.186-192;	
34. Soil productivity assessment	22	1	SPM,P.394-408;	
Mid-term exam 3	23	0.5		
Total for Module 2		16		
Soil Geography				
35. Soil distribution in Ukraine	24	1	SPM,P.217-224;	Homework 8. Assigned Soil Forming factors and processes
36. Soil profile description	24	1	SPM,P.204-214;	
37. Forest zone soils properties and management	25	0.5	SPM,P.231-255;	
38. Forest-Steppe zone soils properties and management	25	0.5	SPM,P.255-291;	
39. Steppe zone soils properties and management	26	0.5	SPM,P.291-299;	
40. Arid-Steppe zone soils properties and management	26	0.5	SPM,P.299-308;	
41. Saline soils properties and management	27	0.5	SPM,P.326-342;	
42. Alluvial and meadow soils properties and management	27	0.5	SPM,P.319-326;	
43. Carpathian and Crimean soils properties and management	28	0.5	SPM,P.342-365;	
44. Management of eroded and degraded soils	28	0.5	SPM,P.272-278; 297-299; 363-365;	
45. Soil productivity management	29	0.5	SPM,P.365-394;	
Mid-term exam 4	30	1		
Total for Module 3		8		
Total		30		

Textbooks Required:

1. [GPG] Kravchenko Y.S. Geology with the principles of Geomorphology. Part 1. Dynamic Geology. Київ, ТОВ "Центр ІТ». – 2009. – 142 с.
2. [FSS] Petrenko L.R., Berezhnyak M.F., Dudar T.V., Berezhnyak Ye.M. Fundamentals of soil science. Kyiv, NAU-druk, 2010. – 457 p.

Laboratory books Recommended:

3. [ГОМ] Тихоненко Д.Г. Геологія з основами мінералогії : уавч. посібник / Д. Г. Тихоненко, В. В. Дегтярьов, М. А. Щуковський та ін.; За ред. д-ра с. -г. наук, проф. Д. Г. Тихоненка. – К.: Вища освіта, 2003. — 287 с.
4. [SPM] Petrenko L., Berezhniak M., Kravchenko Yu., Tonkha O., Berezhniak Ie., Bykova O. Soil Science : Practical Methods Manual / [L. Petrenko, M. Berezhniak, Yu. Kravchenko та ін.]. – NUBIPU Publishing Center, Kyiv, 2013. – 429 pp.

Textbooks Recommended:

5. Brady, N.C. and R.R. Weil. 2010. Elements of the Nature and Properties of Soils, 3rd Edition. Pearson Prentice Hall.
6. Foth H. Fundamentals of soil science [8th ed.] / Henry D. Foth //John Wiley & Sons, New York, 1990. – 384 pp.

SOIL SCIENCE WITH THE BASICS OF GEOLOGY

National University of Life and Environmental Sciences of Ukraine
Spring – Autumn Semesters, 2019

Instructor:

Yuriy Kravchenko, PhD
Associate Professor (kravch@nubip.edu.ua)
Department of Soil Science and Soil Conservation
Office 23, Building 2 (17 Heroiv Oborony Str.)
+38 044 5278631 (office); +38 093 1171983 (cell)

Co-instructor - Richard Stehouwer, Ph.D.
Professor of Environmental Soil Science, AgSciences College, PSU, USA

Course Information

Credits: 3
Location: Building 2 (17 Heroiv Oborony Str.)
Time: Monday, Wednesday, Friday, 8:30 - 9:50 AM
Recitation/Office Hours: Scheduled by Appointment

Course Overview:

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.

Course Goal

Students will gain an appreciation of geology environment and soil as a valuable natural resources and as an integral and essential part of terrestrial ecosystems, and will be able to utilize their knowledge of geology and soil science to solve relevant issues confronted in their academic and professional careers.

Course Objectives

Skills and mastery. Students who complete this course will be able to

1. demonstrate understanding of the theoretical basis behind geology and its related concepts;
2. analyze the natural processes that govern and shape the earth;
3. observe and record geologic features and processes;
4. diagnose mineral and rock properties;
5. determine the elements of symmetry of minerals;
6. define the basic forms of relief in natural conditions;
7. give an overview of the geological catastrophic phenomena;

8. describe the generation and use of natural resources;
9. describe fundamental soil physical, chemical, and biological properties and processes as well as the interactions among them that
   - Govern soil formation, development and differentiation,
   - Determine soil suitability and capacity to perform various essential production and ecological functions, and
   - Allow for sustained use, conservation, and productivity of soil.
10. utilize laboratory techniques to determine soil properties;
11. 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.
12. Have gained the ability to retrieve and integrate soils information from a variety of sources and to utilize that information for land use and soil management decisions.

Specific topics covered in the course include the following:

- Earth's origin;
- Geospheres structure and composition;
- Rocks and minerals;
- Earth's internal processes: plate tectonics, metamorphic and magmatic processes, volcanism, earthquakes;
- Earth's external processes: weathering, mass wasting, rivers, ground waters, lakes and bogs, oceans and seas, glaciers, wind movement;
- Soil formation and soil taxonomy;
- Soil physical properties, texture and structure;
- Behavior and characteristics of water in soil; water movement and storage in soil;
- Soil aeration and gas exchange;
- Soil colloids (clays and organic matter), cation exchange;
- Soil acidity, alkalinity, salinity;
- Soil biology and ecology;
- Principles of nutrient management;
- Soil pollution/degradation and remediation/reclamation.

Grading Policy

There are 100 possible points in this course assigned as follows:

Lab reports	5
Homework assignments	5
Mid-term Exams (3 @ 20 points each)	60
Final Exam	30
Total possible points	100

Extra credit:

- **Field Trip:** There will be an optional field trip to the research site to gain practical skills in soil sampling, soil profile description, field crop management. To participate you must reserve a place and pay a small travel fee (amount to be determined - probably around $10.00). Additional details will be provided. Extra credit with value up to 10% of total semester points can be awarded to participants.
- **Other extra credit:** Additional extra credit opportunities with value up to 10% of total semester points will be identified by Dr. Yuriy Kravchenko as the semester progresses.

Lab reports - lab reports will be submitted in the students' lab book and teacher's journal. Lab reports submitted after the due date will be assessed a late penalty of 10% of the total lab report point value for each 24-hour period beyond the due date.

Homework assignments will be announced in the class. The homework assignments will consist of short summary or answer questions that are related to the subject matter being covered in lecture. Homework assignments *must* be submitted as additional text in student workbook.

Mid-term Exams. All mid-term exams dates and themes are shown in the course schedule. At least one week prior to each exam students will receive requesting them to be prepared to examination. Students also will be provided with Study Guide/Learning Objectives for exam. Mid-term exam could be based on oral, writing, quizzing, project or computer-testing procedure. Students who have documented course conflicts with these exam dates and times must contact Dr. Yuriy Kravchenko at least one week prior to the exam date to arrange an alternate exam time. They should get a dean's permission for this extra examination.

Final Exam. The final is a comprehensive examination and is a writing-quizzing based exam. Date and location for the final exam will be as indicated on the University final exam schedule. Make-up exams will only be granted to students with an excused absence, must be get a dean's permission, and scheduled with Dr. Yuriy Kravchenko.

Teaching methods

The teaching of soil science is no longer being confined to its traditional founding in agriculture and agronomy, and is now included in disciplines or majors like: fundamental physics and chemistry, botany, forestry, geology, ecology, hydrology, cartography, geography and resource sustainability. The content of soil science is uneasily placed between natural science on the one hand, and the world of professional practice on the other. This course is provided with a new set of tools and techniques available by which we investigate soils, and the foci are shifting toward other disciplines and changing research questions. That course offers a number of training opportunities. The fundamental soil science is provided with unique hands on experience standard methods and technologies included: soil field and lab testing, soil survey studying, soil morphology analysis, soil taxonomy and classification approaches, agronomy assessment of soil fertility, soil sensing, active optical sensor networks, etc. Students in cooperation with faculty partners develop and implement comprehensive solutions to increase the efficiency of agribusiness. They select the tools that allow our clients to get more profit from each hectare of land: soil analysis, agro-diagnostics, soil and crop monitoring, agricultural practices increasing soil fertility and a content of a soil organic carbon, as well as modern software and equipment used in conservation resilient agriculture.
As such, teaching methods include: - "Authority lecturing" method with the teacher-centered approach (including ppt presentations, audio & video tools); - "Demonstrator" method, is used to acquire a full understanding of the theoretical and practical knowledge of the subject (soil museum, lab equipment, tools and techniques available by which we investigate soils); - "Real learning" method is used for demonstrating real situations in agriculture and land management; - "Facilitator" method or action method is used to develop problem-solving skills, for ex., how to solve the problems related to: soil organic matter declining, soil acidity, soil salinity, soil compaction, etc.; - "Delegator" or group or the student-centered approach method is beneficial for students group work used in soil mapping and chemical lab-based experiments; - "Blended learning" is based on a strategy that encourages the use of personal preferences in studying research or practical soil science along with face-to-face instruction. This is an integrated teaching style incorporates individual extra-curricular knowledge and specific interests into students scientific or diploma work; - "Field-Trip" method entails visits to places were students studying soils in the nature as well as it has been changed under agriculture influence; - "Brainstorming" method is also beneficial for generating ideas or solving problems within a student group; - "Independent Study" method is widely used outside of the campus and combined with "Online learning" by means of usage "Moodle" planform. This method is focused on students' self-work; -

other methods. There are also other enjoyed techniques used in the course teaching: enthusiasm, pictures, and stories that bring soils alive in the classroom, along with laboratory and field experiences that allow students to grow confidence in their ability to understand and work with soils. To adopt the best teacher practices, a module from geology uses a concept of independent students' testing with a preliminary self-work preparation at http://wps.prenhall.com/esm_tarbuck_earth_8/19/5071/1298207.cw/index.html web page.

The module-rating system, as part of the University's quality assurance procedures, stirring up the student auditorium and self-work. Principle of module training is that training material of the course is divided into logical content modules completed on a base of theoretical material and practical work. Recommended amount of modules is 2-4 for a semester per course.

Modules			Educational work	Final attestation exam	Total
I module	II module	III module			
100	100	100	70	30	100

The total rating of soil science course is estimated as : $R_{total} = R_{ed} + R_{at}$, where, Red – rating of educational work, R_{at} – final attestation exam. The rating of educational work is calculated by summarizing of all module points, dividing them on their amount and multiplying them on factor - 0.7. For ex. - R_{ed} = (I module + II module + III module / 3) x 0.7.

Grading Scale

National Grade	ECTS Letter Grade	Ratio of students, %	Definitions of ECTS	Subject rating, points
Excellent	A	10	Excellent – the excellent performance with the minor ratio of mistakes	90 - 100
Good	B	25	Very Good – above the average level with several mistakes	82 - 90
	C	30	Good – a good work in general with a certain number of gross errors	74 – 82
Satisfactory	D	25	Satisfactory – not bad but with the considerable amount of draw- backs	64 - 74
	E	10	Adequate – the performance satisfies the minimal criteria	60 – 64
Unsatisfactory	FX	-	Unsatisfactory – the work is required to pass the test (a positive mark)	35 - 60
	F	-	Unsatisfactory – the serious further work is required	< 35

Attendance Policy

Students are expected to be present at all lectures and to arrive on time. If a student must miss a lecture, her/his is responsible for all material presented during lecture and for the assigned textbook reading. A complete schedule of lectures, reading assignments and homework assignments is shared with students at the begin on course. Make-up quizzes, homework assignments, and examinations will only be provided for students with excused absences. Excused absences will only be granted for documented academic conflicts, documented medical reasons and force majeure. Excused absences can only be granted by Dr. Yuriy Kravchenko. Students are expected to respect the rights of others in the class. Cell phones and other electronic equipment should be turned off prior to the beginning of class. Use of these items during class

time, or any other unwarranted classroom disruption, will result in your immediate excusal from class for the remainder of the period.

Examination Policy

Students are required to take all three mid-term exams and the final exam in this course. Make-up exams will only be offered to students who have an excused absence for the missed exam. Excused absences will normally only be granted for *documented* medical / faculty reasons. Students who have an excused absence for a missed exam must make arrangements with Dr. Yuriy Kravchenko for a make-up exam.
Copying of others' work, use of disallowed material on exams, plagiarism in assignments, or cheating in any other form as defined by the instructor will result in a grade of zero for that assignment. Multiple infractions will result in a grade of 'F' for the course. No electronic equipment, except calculators, will be allowed during exams. Violation of this will result in an immediate grade of '0' for the exam.

Academic Integrity Statement

Faculty, alumni, staff and fellow students expect each student to uphold the University's standards of academic integrity both in and outside of the classroom. Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The National University of Life and Environmental Sciences of Ukraine, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, plagiarism, misrepresentation or deception. The University's standards of academic integrity apply both in and outside of the classroom.

Nondiscrimination Statement

The NUBiP is committed to equal access to programs, facilities, admission and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state law), sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, physical or mental disability, gender, perceived gender, gender identity, genetic information or political ideas.

Mandated Reporting Statement

NUBiP's policies require me, as a faculty member, to share information about incidents of sex-based discrimination and harassment (discrimination, harassment, sexual harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation) with University coordinator or deputy coordinators,

NUBiP Principles

The NUBiP is a community dedicated to personal and academic excellence. The NUBiP Principles were developed to embody the values that we hope our students, faculty, staff, administration, and alumni possess. At the same time, the University is strongly committed to freedom of expression. Individuals will voluntarily endorse these common principles, thereby contributing to the traditions and scholarly heritage left by those who preceded them and will thus leave NUBiP a better place for those who follow.

4. LECTURES NOTES.

MODULE 1. GENERAL GEOLOGY

1. **The Earth as space and physical body.** The Earth in Universe, its structure, composition, age, development. Forms and sizes of the Earth. Figure of the Earth, mass, density. Gravitation, magnetic, thermal and other geophysical fields. Continental and oceanic types of the Earth's crust. Asthenosphere. Continents and oceans, its relief and structure. Old and young platforms. Geosynclinals.
2. **Internal and external spheres**. What makes up our planet and how does it work? Major Earth Cycles. How we know what's inside? The Earth layers, its properties. The Earth and the Earth crust elemental composition. Internal geosphere subdivisions: Sedimentary layer, "Granite" layer, "Basalt" layer, upper mantle, Mohorovicic discontinuity, Substrate, Guttenberg layer, asthenosphere, Golytzyn layer, lower mantle, outer core, inner core. Layers of the upper Earth: lithosphere, asthenosphere, oceanic and continental crust, subduction zones, lithospheric plates (thickness), "Continental drift", isostasy. Gravitation, magnetic, thermal and other geophysical fields. The pressure, geothermal gradient, seismic wave
3. **Magmatic, metamorphic and sedimentary processes**. A concept about a magma. Origin of Magma. Intrusive magmatism. Mantle and crust magma. The pneumatolitic and hydrothermal processes. Effusive magmatism is volcanic magmatism. Basic factors of metamorphism. Basic types of metamorphism. Chemical and mineralogical changes during metamorphism. Metasomatism and metasomatites. Dynamometamorphism. Auto metamorphism. Regional metamorphism. Contact metamorphism. Minerals are related to the metamorphic rocks and processes. General life history of sediment: Weathering, Transport, Deposition, Cementation (diagenesis, katagenesis, lithification). Depositional environments: Continental (fluvial, eolian, lacustrine, glacial), Marine (continental shelf and reef, abyssal plain), Transitional (deltaic, beaches). Sediments in the rock cycle.
4. **Plate tectonics and crust deformations.** Basic concepts about the geodynamic systems and processes. Processes of external and internal dynamics. Sources of energy. Theory of plate tectonics. Evidence for Continental Drift. World System of Plates. Lithosphere plate, transformation break, Bhenof zones. Types of Stress. Ductile (Plastic) deformations of rocks. Elements of fold. Types of folds and their forms in a plan. Concept about syn- and anti-forms. Types of fold formations. Types of brittle (faults) deformations.
5. **Volcanism**. Effusive magmatism is volcanic magmatism. Explosive and non-explosive eruptions. Types of volcanoes: shield volcano, pyroclastic cone, cinder cone, stratovolcano, crater, thermal springs and geysers, lava dome, fissure eruptions, caldera, pillow lava. Products of volcanic eruption: gaseous, liquid, solid. Categories of eruptions: Hawaiian, Peleyian, Etno-Vezuvianskiy, Bandayskiy. Geological pre-conditions of origin of volcanoes. Geographical and geological distribution of active volcanoes.
6. **Earthquakes**. Cause of earthquakes. Geographical distribution of earthquakes. Benioff zones. Resilient (seismic) waves, their types and speed of distribution. Seismic stations and seismographs. Measuring earthquake intensity and magnitude. Classification and types of earthquakes. Earthquake focus and epicenter. Earthquake Categories. Intensity of earthquakes, scale are for their estimation in marks. Isostaties. Energy and power class of earthquakes. Frequency of earthquakes. Destructive effects of earthquakes. Problem of prognosis of earthquakes.
7. **Weathering**. Weathering types and factors, that cause its. Agents of physical weathering. Oxidation, reduction, hydration, dehydration, hydrolysis, kaolinitization, montmorilonitization. Weathering influence on relief. Core of weathering as a natural complex of mountains, relief, climate which was made historically. Formation of weathering core, its types, structure and depth in different climatic areas. Geographical distribution of the cores of weathering in Ukraine. Young and old layers of weathering. Eluvium as a mother of sedimentary rocks, including parent materials of soils.
8. **Wind movement**. Geological activity of wind. Movement of sediment. Flow: laminar, turbulent, suspended, saltation, bed. Wind as an agent of denudation in dry lands (eolian processes). A specific of eolian activity is in different landscape areas. Deserted landscapes of different climatic areas. Types of the deserts. Wind erosion: deflation, abrasion, deposition. Eolian, silt and clay deposits, forms of relief, their geography. Continental, marine, transitional deposits. Lithification processes: compaction, desiccation,

cementation, crystallization. Wind erosion and its kinds, and measures of fight. Features of the use of soils are on eolian territories (agricultural deflation and others like that).

9. **Mass wasting**. Slope stability. Forces involved in mass wasting: Gravity (Slope gradient, Weathering and climate, Water content, Vegetation, Overloading), Triggering mechanisms (Excessive amounts of water, Earthquake, Volcanic eruptions, Vibrations, Noise). Types of Mass Wasting (Heave, Creep, Solifluction, Slumps, Earthflows, Debris slides, Rockfalls, Debris flows, Mudflows, Rockslides). Minimizing Mass Wasting Effects. Fluvial processes and their factors (streams of the melted snow, temporal and permanent river-bed rain-waters). Forms of water streams. Regularity, areas and cycles of denudation. Unstreamflow, flat-bed out- wash and it development. Delluvium and other slope gravitation deposits. Temporal river-bed streams, cones of bearing-out and prolluvium. Forms of water erosion. Forms of eroded relief. Gully erosion.

10. **Rivers**. Bottom and lateral erosion. Temporary and ultimate base level. Type of flow. Flow velocity: channel shape and roughness, stream gradient, discharge. Permanent river-bed streams (rivers, brooks) and river-bed-delta processes. Carried the clastic, dissolved material and mudflow. Characteristics of streams. Meanders, cut banks, point bars, oxbow lakes, reasons of their origin and role in expansion of valley and forming an alluvium. Floods and floodplain deposits. The alluvium origin, its lithologic description. Alluvial deposits of minerals. Types of the alluvium. Principal reasons of terraces formation. Types of terraces. River valleys, their types, asymmetry, origin, evolution. Forms of valleys are on the stage of morphological youth and maturity. Deltas, estuary, liman.

11. **Lakes and bogs**. Lakes and bogs, as geological and geomorphological factor. Lakes, their origins, types, geography, geological activity, short life, hydrological mode, dynamics. Chemistry of lacustrines. Sediments of lakes (terrigenous, chemical, biogenic). Salt dome, their influence on relief, soils, phythocenosis. Lacustrine deposits, as agronomical ores, minerals and soil forming rocks. Lacustrine terraces and other forms of relief. Bogs, their origins, types (up-river, low-laying area, transitional), spreading, geological activity, connection with relief, biosphere functions, evolution. Classification based on the method of water supply, landforms. Chemical and organogenic bog deposits. Peat forming. Progression from lake to bog. The transition from vegetal matter to peat. Peat characteristics. Bog flora. Agricultural use of bogs and peat.

12. **Oceans and seas**. Geological activity of seas and oceans. Sea relief. Morphological, physical and chemical features of the World ocean. Pressure, temperature, specific gravity, salinity, chemical and gas composition of oceans and seas. Organic life in oceans and seas: nekton, plankton, benthos. Tides. Abrasion. Seas deposits in: littoral shelf, bathyal zone, abyssal zone. Types of sediments: terrigene, organic, chemical, volcanic. Ocean crust. Diagenesis, lithification, katangese, epigenesis, hypergenesis marine deposits. Origin of oil and natural gas. Transgression, regression and sea inversion.

13. **Glaciers**. Origin of Glacial Ice. Glacial and cryogenic processes, its geological and relief functions. Conditions of snow accumulation and origin of glaciers. Snow line, seasonal and long-term snows, avalanche, glacier ice. The structure of ice layer. Mechanism and rate of glacier movement. Types and modes of glaciers. Glaciers of Antarctic Continent and Greenland. Mountain (Alpine) and intermediate (fiord) glaciers. Formations of glacial deposits, their structure, glacier-accumulative forms of relief. The Glacial Budget (zones of accumulation, wastage (ablation)). Glacial movement. Glacial erosion and transport (U-shaped valleys, truncated spurs, fiords, hanging valleys, cirques, horns, aretes, roche moutonnees). Glacial Deposits, Glacial Sediments: till, moraines, drumlins, glacial erratics, outwash plains, ozy, kames, kettles, eskers, dropstones. Glacial epoch, glacial cycle. Types of underground ices. Reasons of glacial processes, prognosis on the future.

14. **Ground waters**. Origin, composition, classification, geographical spreading of groundwater. Zones of aeration, saturation. Groundwater movement, Darcy's Law. Waterproof rocks. Springs, water wells, and artesian systems. Recharge of groundwater. Geological work of underwater ((suffusion, karst (carbonate, gypsum, salts), corrosion, displasement, pseudo karst)), its influence on relief. Different types of groundwater in sediments. Mineral water. The deposition from underwaters. Geysers, thermal sources. Upper-water, ground, without and with pressure (artesian) between layer water. The origin of groundwater and their water supply. Estimation and account of underwater. Groundwater protection.

Mid-term exam 1

MODULE 2. GENERAL SOIL SCIENCE.

15. **Introduction to Soil Science**. Introduction of the course: overview, syllabus, schedule, objectives, grading policy, teaching methods, the module-rating system, grading scale, attendance policy, examination policy, NUBiP principles.
16. **What is soil**? A concept about the soil. Soil as a natural body, medium for plant growth. The soil functions as a component of biogeocenosis, lithosphere. A role of soil properties in ecological stability of landscapes. Soil as a difficult natural structural system. Structural levels of a soil organization. A place, functions and role of soil in nature. Effect of minerals and rocks weathering on soil formation. Primary and secondary minerals. Small biological and big geological cycles.
17. **Soil formation and soil processes**. Soil forming factors, regimes and processes. Macro-, meso- and micro processes within a solum. General diagram of soil formation. A concept of the primary, medium and mature phases of soil formation. The energy and particles distribution in a soil profile. A concept about the soil horizons. Types of soil profiles. Soils evolution and degradation.
18. **Soil classification**. A concept about soil classification, nomenclature and diagnostics. Classification problems in soil science. Principles, goals and values of soils classification. History of soils classification development.
19. **Soil taxonomy and morphology.** Taxonomy units of genetic classification: type, subtype, genious, spieses, soil texture, lithologic seria. Climatic, hydrological and biological principles of soil diagnostics. Morphologic-genetic, chemical and other indexes of soil diagnostics.
20. **Soil physical properties 1. Texture and structure**. Classification of soil texture, particles and their properties. Mechanical analysis. The field and pipet method. Stokes' Law. Texture of Ukrainian soils. Extent of soil profile differentiation by texture, granulometric factor of soil aggregation. Binomial and trinomial, American classifications of soil texture, their principles, differences and characteristic features. General genetic, agronomical and ecological values of soil texture.
21. **Soil organic matter**. Sources of SOM and its composition. OM remains quantity and quality in different ecosystems. SOM Determination. A classification scheme for soil organic matter. Specific and non-specific organic/humus substances. Structure and properties of humus (humic substances). Interactions of humic substances with mineral components. Types of humus. SOM status after L.O. Grishina and D.S. Orlov. Organic matter in different soil types. Humification.

Mid-term exam 2

22. **Soil colloids**. A concept about the soil colloids. Structure, composition, origin, classification and properties of soil colloids. Colloidal state, coagulation and peptization. Adsorption, electro kinetics, protective and other properties of soil colloids, their influence on soil formation. A role of soil colloids in the formation of soil fertility. Ecological value of soil colloids.
23. **Sorption, cation and anion exchange**. Mechanical, physical, exchangeable, chemical, biological retention. A role of calcium, iron, sodium and other cations and dispersion matters in the processes of soil absorption. A role of absorbed cations in soil formation. Saturated and unsaturated soils with bases and its dependence on cations composition. The energy of ions sorption. Cation exchange capacity. Cation composition of Ukrainian soils. Base saturation percent. Influence of mineral fertilizers on the cation adsorbing capacity and properties of soils. Agronomical and ecological essence of soil adsorption.
24. **Soil acidity and alkalinity**. Sources of soil acidity. pH reaction and its ranges. Active and reserve acidity and methods its determination. Base exchange capacity. Chemical amendment of acid soils, liming rate. Active and potential alkalinity. Extent of soil sodicity. Determination of the extent of soil sodicity and calculation of gypsum rates. Resistance of agricultural crops to soil acidity and sodicity.
25. **Soil salinity**. Salt-affected soils. Soil Extract Analysis. The concentration of soil colloids. Toxic salts. Extent and type of soil salinity. The oxidation and reduction processes in Soil solution. Redox potential, T.Clark index. Salt tolerance of plants. Secondary salinity or sodicity. Management of salt-affected soils. Leaching rate.
26. **Soil physical properties 2. Soil structure. soil density, pore space, impacts of tillage**. Soil aggregates classification. Agronomically favorable structural aggregates. Aggregates coagulation and disintegration. Aggregates within different soils, soil horizons. Dry and wet aggregate analysis. Particle density, bulk density, determination and analytical procedure. Optimum values of the bulk density. Soil

porosity. Total, aeration, capillary porosity determination. Soil's resistance to tillage. Soil's physical maturity for tillage. Soil hardness.

27. **Soil water**. A role of water in plant growing, vital functions of animals and microorganisms. State, forms of connection and category of water in soil. Features of connection of water with the solid phase of soil, chemical matter, molecules and ions. Soil water and water-related properties. States, forms, categories of soil water and its properties. Field, capillary, maximum adsorbing, full, available water capacity of soils. Non-available water. Soil water potential.

28. **Soil and the hydrologic cycle**. Soil Productive water content evaluation. Soil water balance, regimes. Soil water management.

29. **Soil climate. Soil air and temperature**. Gaseous phase of the soil. Composition of soil air. CO_2 dynamics. Convection, diffusion. Air penetrability. Anaerobiosis. Air regime and its regulation. Energy exchange processes. Radiation, convection, conduction. Heat adsorbing capacity, albedo, heat capacity, specific heat capacity. Heat conductivity, heat regime of soil. Thermal regimes.

30. **Soil ecology**.

31. **Soil productivity and its evaluation**. Essential Criteria. The typical soil grades in points. Etalon of grades. The prices of the grades of soil evaluation. Weighted average grade. Correction coefficients. Soil grade. Soil class. Land Area Evaluation. Bonitation grade of a field. Correction Coefficients for the Technological Properties of Land Areas. Correction Coefficients for the Nonuniformity of Soil Cover. The grade point of land area evaluation.

Mid-term exam 3

MODULE 3. GENERAL SOIL SCIENCE.

32. **Geography of soil distribution**. Spatial heterogeneity of soils distribution. The law of soil distribution in a nature by V.V. Dokuchaev and M.M. Sibirtsev. Horizontal and vertical heterogeneities of soils. Soil distribution conformities. Latitudinal and mountain conformities. Azonal and intrazonal soils. Soil placing in topographical rows, provinces and micro areas. Correlations between the factors of soil formation A concept about micro soil localities: inversion, interference and migration. Structure and complexity of the soil covering. Complication and contrasting of structure of the ground covering. A value of structure of the ground covering is for drawing a map and organization of the using of land.

33. **Soils of the Forest zone**. Soddy-Podzolic, Sod, Swampy soils. Classification, genesis, properties, management.

34. **Soils of the Forest-Steppe zone**. Grey forest soils, Podzolized, Leached, Typical Chernozems. Classification, genesis, properties, management.

35. **Soils of the Steppe zone**. Ordinary and Southern Chernozems. Classification, genesis, properties, management.

36. **Soils of the Arid-Steppe zone**. Chestnut soils. Classification, genesis, properties, management.

37. **Saline soils.** Solonchak, solonetz, solod. Classification, genesis, properties, management.

38. **Alluvial and meadow soils**. Meadow-chernozems, meadow, soddy, swampy, alluvial soils. Classification, genesis, properties, management.

39. **Carpathian and Crimean soils**. Burozems and Brown soils. Classification, genesis, properties, management.

40. **Soil erosion and degradation**.

41. **Soil productivity management**.

42. **Human impacts on soil quality and sustainability**.

Mid-term exam 4

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE			
ECL «**Bachelor**» Specialties: Ecology, Land management, Agrobiology	Soil Science and Soil Conservation department 201__–201__ yr.	**Exam paper** **№ 1** from Geology	**Approved** Head of department _____ Balayev A.D. _____ 201__ p.

MID TERM EXAM 1

1. **Common information about the Earth and its structure**. The Earth in Universe, its structure, composition, age, development. Forms and sizes of the Earth. Figure of the Earth, mass, density. Internal and external the Earth layers, its properties (lithosphere, mantle, core, atmosphere, hydrosphere, biosphere). Gravitation, magnetic, thermal and other geophysical fields. Continental and oceanic types of the Earth's crust. Asthenosphere. Continents and oceans, its relief and structure. Old and young platforms. Geosynclinals.

2. **Weathering**. Weathering types and factors, that cause its. Agents of physical weathering. Oxidation, reduction, hydration, dehydration, hydrolysis, kaolinitization, montmorilonitization. Weathering influence on relief. Core of weathering as a natural complex of mountains, relief, climate which was made historically. Formation of weathering core, its types, structure and depth in different climatic areas. Geographical distribution of the cores of weathering in Ukraine. Young and old layers of weathering. Eluvium as a mother of sedimentary rocks, including parent materials of soils.

Test block

1. Distribute the minerals according the groups:			
1	Native elements	A	Quartz
2	Sulphides	B	Graphite
3	Silicon oxides	C	Pyrite
4	Iron oxides	D	Magnetite

2. Find the chemical formula of augite:	
1	$(CaNa)_m (Mg,Fe^{2+},Al,Fe^{3+})_n (OH) [Si_4O_{11}]$
2	**(**$CaNa) (Mg,Fe^{2+},Al,Fe^{3+}) [Si_2O_6]$
3	$(Mg,Ca,K,Na)_3Al_2(OH)_4 [Si_4O_8(OH)_2] \cdot nH_2O$
4	$(Mg,Fe^{2+},Fe^{3+})_3 [AlSi_3O_{10}] (OH)_2 \cdot 4H_2O$

3. Match the igneous rocks with the corresponding groups:			
1	Granite	A	Medium
2	Peridotite	B	Acid
3	Sienite	C	Ultra basic
4	Bazalt	D	Basic

4. Which rocks formed paragneisses as a result of metamorphism?	
1	Granites
2	Sandstones
3	Marbles
4	Loess

5. The shape of the Earth is ……

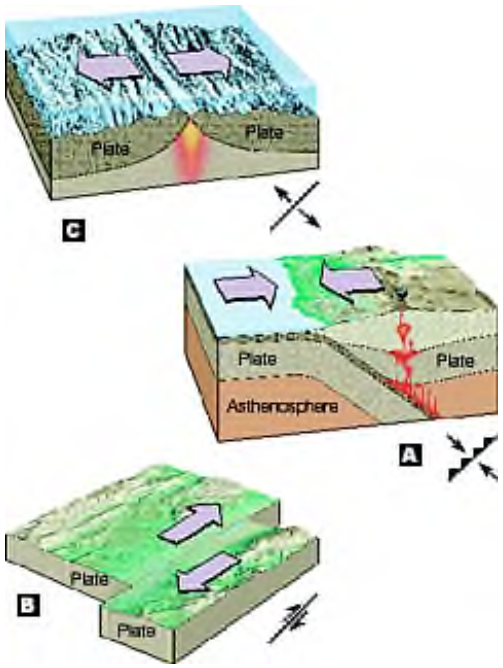
6. Name the type of primary magma:	
1	Schistic
2	Basaltic
3	Sedimentary
4	Biochemic

7. Name folding deformations:	
1	Fault
2	Syncline
3	Grabben
4	Covers (domes)

8. Geologic activity of swamps results in the formation of:	
1	Peat
2	Limnoabrasion
3	Clastic sediments
4	Coal

9. Rifts are a component of:	
1	Plain platform areas
2	Mountain areas
3	Zones of island bows
4	Ocean floor

10. Identify each of the indicated types of plate boundaries by selecting the correct response.



1 convergent boundary
2 transform fault boundary
3 divergent boundary

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE			
ECL «**Bachelor**» Specialties: Agrobiology Ecology, Plant Protection, Land management	Soil Science and Soil Conservation department 201__–201__ yr.	**Module 2** **№ 1** from Soil Science	**Approved** Head of department _____ Balayev A.D. _____ 201__ p.
MID TERM EXAM 2			

1. Match the colloidal sizes (mm) with corresponding fractions:	
1	< 0.001
2	> 0.001
3	> 0.0001
4	< 0.0001

2. Crystalline silicate clays - colloids are:	
1	Al-oxides (gibbsite)
2	Fe-oxides (goethite)
3	kaolinite, montmorillonite
4	long C-chain molecules in humus

3. Lyophobic colloid is considered if:	
1	it precipitates in a soil solution
2	the dispersed phase interacts with the dispersion medium
3	the dispersed phase does not interact with the dispersion medium
4	it is dissolved under low pH level

4. The uptake and retention of one material within another:	
1	desorption
2	cohesion
3	absorption
4	adsorption

5. Hydrogels are sols exists:	
1	as colloids that exhibits the properties of fluid
2	as precipitations formed by the coagulation
3	if the dispersion medium isn't water
4	if the dispersion medium is water

6. Colloids capable to change their charge depending on soil reaction are called:	
1	basoides
2	acidoides
3	ampholitoides
4	gel

7. Colloidal granula ends with:	
1	potential identified layer
2	Gouy-Chapman layer (diffusive layer)
3	Stern layer (electrical double layer)
4	outer Helmholtz layer

8. Which of fraction does possess with the highest adsorbing capacity?	
1	0,05-0,01
2	1-0,5
3	0,5-0,25
4	<0,005

9. What definition does belong to a physical adsorption?	
1	*molecular adsorption*
2	$Ca(H_2PO_4)_2+2Ca_2=Ca_3(PO_4)_2+4H$
3	$[SAC^{5-}]\overset{Ca^{2+}}{\underset{H^+}{Mg^{2+}}}5\text{KCL} \leftrightarrows [SAC^{5-}]5K^+CaCl_2 + MgCl_2 + HCl$
4	*capillary water movement downward* $h = \pi\, r2\, h\, p\, g$
5	*osmotic pressure (turgor) or solute potential*

10. Chemical adsorption is the:	
1	absorption of nutrition from the soil solution by the roots
2	detaining some bodies larger that the system of soil pores
3	formation of a new solid phase
4	molecular adsorption by the soil solid phase
5	ion exchange processes

11. The decreasing order of preference for adsorption is:	
1	H^+
2	Fe^{3+}
3	K^+
4	Al^{3+}

12. The decreasing order of preference for adsorption is:	
1	SO_4^{2-}
2	OH^-
3	Cl^-
4	PO_4^{2-}

13. The highest cation exchange capacitiy has a:	
1	kaolinite
2	loam
3	clay
4	organic matter

14. Base saturation percent (BSP) can be defined as:	
1	(Ca+Mg+Na+K/Ca+Mg+Na+K+H+Al) ·100
2	S+ Hh /S x 100
3	S-Hh
4	S/Hh x 100

15. Which BSP parameter may point at liming?	
1	92
2	53
3	67
4	97

16. Which pH_{KCl} parameter may point at liming?	
1	7.2
2	4.5
3	5.4
4	6.5

17. Active acidity is determined by extraction:	
1	1 N CN_3COONa
2	H_2O
3	1 N KCl
4	0.1 N HCl

18. Saline soils are those that have:	
1	H^+ leached horizon and an underlying Na^+ horizon
2	exchangeable Na > 5% from CEC
3	$pH_{H_2O} < 6.0$
4	soluble salts > 0.6% from a soil weight
5	Ca^{2+} as a dominant cation

19. Liming rate is computed by the formula:	
1	$(1-d_v/D) \cdot 100$
2	$(FC-PWP) \cdot h \cdot d_v$
3	$0.086\ (Na-0.05CEC) \cdot h \cdot d_v$
4	$0.05 \cdot Hh \cdot h \cdot d_v$

20. The pH_{H_2O} reaction of soil solution in very acid soils is:	
1	2.5
2	3.5
3	4.5
4	5.5

21. The decreasing order of injurious salts is:	
1	$MgCl_2$
2	Na_2CO_3
3	$MgSO_4$
4	NaCl

22. The total dissolved solids (TDS) are determined by:	
1	$\frac{a \times 100}{b}$ %,
2	$\frac{a \times V \times 100 \times K_{H_2O}}{P \times V_2}$,
3	$\frac{100 + W_h}{100}$,
4	$\frac{a_1 \times 0.1 \times K_{NaOH} \times 2 \times 100 \times K_{H_2O}}{P}$

23. Which crops are more tolerant to an exchangeable sodium presence?	
1	beans
2	deciduous fruits, nuts, citrus, avocado
3	wheat, cotton, alfalfa, barley, tomatoes, beets
4	clover, oats, tall fescue, rice, dallisgrass

24. Moderately saline soils are those that have soluble salts in amount of (g l^{-1}):	
1	0,5
2	2,5
3	5,5
4	10,5

25. Dominant cations of soddy-podzolic soils are:	
1	$Ca^{2+}+Na^+$
2	H^++Al^{3+}
3	$Ca^{2+}+Mg^{2+}$
4	$Al^{3+}+Fe^{3+}$

26. Please express in moles/liter (moles L^{-1}) the concentration of active H^+ ions in a soil solution if pH parameter equal to 4

27. Find a sum of equivalent weights for soil exchangeable cations, in meq/100 g (milliequivalents of elements per 100 g of dry soil):

Element	Na	K	Ca	Mg	Al	Fe
Valence	1	1	2	2	3	3
Atomic wt.	23	39	40	24	27	56
Equivalent wt.						
MEQ wt.						
Sum of MEQ wt.						

28. Estimate the: total CEC, BEC, base and hydrogen saturation percent (see table below).

29. Calculate the amount of $CaCO_3$ t ha^{-1} which must be added to 0-20 cm soil layer with a bulk density 1.2 g cm^{-3} per 1 ha^{-1} to raise the soil's base saturation to 90% (see table below).

Table for ques: 28-29.

Element	Na	K	Ca	Mg	Al	H
meq/100g	6	8	20	6	5	13
$CaCO_3$ g/meq	0.05					
total CEC meq/100g						
total BEC meq/100g						
% base sat						
% hydrogen sat						
$CaCO_3$ t ha^{-1}						

30. Estimate the: total CEC, extent of soil sodicity (%Na^+ from total CEC), active Na^+ (*a*Na^+ = Na^+-0.05CEC) (see table below).
Calculate the amount of gypsum ($CaSO_4 \cdot 2H_2O$) t ha^{-1} which must be added to 0-20 cm soil layer with a bulk density 1.2 g cm^{-3} per 1 ha^{-1} to sodicity affected soil (see table below).

Element	Na	K	Ca	Sr
meq/100g	6	3	26	1
total CEC meq/100g				
%Na^+ from total CEC				
aNa^+ (Na^+-0.05CEC)				
$D_{CaSO_4 \cdot 2H_2O}$				

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE			
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FINAL EXAM			
1. **Soil texture**. Classification of soil texture, particles and their properties. Mechanical analysis. Texture of Ukrainian soils. Extent of soil profile differentiation by texture, granulometric factor of soil aggregation.			
2. **Soils of the Forest zone of Ukraine**. Classification, genesis, properties, management.			

Test block

1. How many processes are in general scheme of soil formation?	
1	3
2	12
3	8
4	5

2. The content of which fractions are needed to determine:			
a	Group after Kachinsky classification	1	Phisical clay
		2	Gravel
		3	Clay
b	Full (Group and Subgroup) after Kachinsky classification	4	Coarse silt
		5	Sand
		6	Fine sand
c	Group and Subgroup after Godlyn classification	7	Medium silt
		8	Fine silt
		9	Colloids

3. Point into specific humic substances:	
1	Fulvic acids
2	Humic acids
3	Proteins
4	Tannins

4. Put in missed words in the sentences:	
1	They define…… soil acidity which is determined by pH of soil solution
2	It is defined…….acidity in soils caused by exchangeable ions H^+ and AI^{3+} located in soil adsorbing complex
3	Reserved soil acidity is divided into…… and ……

5. Base saturation percent (BSP) is computed by the formula:	
1	BSP=S*100/S+Hh
2	BSP=S+ Hh /S x 100
3	BSP=S-Hh
4	BSP= S/Hh x 100

6. Which infiltration rate (mm/hr) is the best for the mineral soils?	
1	500-100
2	Over 500
3	Over 1000
4	60-30

7. By the energy of cation adsorption sequence is:	
1	Na^+
2	F_e^{3+}
3	Ca^{2+}
4	K^+

8. Match soil parameters and productivity characteristics according to the scale A.I.Siry (1974)			
1	SOM stores in 0-100 cm	a	Essential criteria
2	Salinity		
3	Extent of erosion		
4	Active soil moisture (AMD) in 0-100 cm	b	Correction coefficient
5	Bulk density		
6	Climate		

9. Soddy – podzolic soils of sub Ukrainian Polissya may have the following horizons:	
1	HE + E + I +P
2	Ho + He + Hi + Pi + Pk
3	He + Hi + I + Pi + Pk
4	H + Hp + Ph + Pk

10. Match soil types with the natural zones of Ukraine:			
a	Forest	1	Typical chernozem soil
		2	Gleyed soddy soil
b	Forest-steppe	3	Soddy-podzolic soil
		4	Ordinary chernozem soil
c	Steppe	5	Dark chestnut soil
d	Arid steppe	6	Grey forest soil