AGROECOLOGY

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

"Agroecology" involves various approaches to solve actual challenges of agricultural production. Though agroecology initially dealt primarily with crop production and protection aspects, in recent decades new dimensions such as environmental, social, economic, ethical and development issues are becoming relevant. Today, the term "agroecology" means either a scientific discipline, agricultural practice, or political or social movement. Here we study the different meanings of agroecology. It aims to increase the interaction between plants, animals, and the environment for food security and nutrition.

Learning objectives are aspects are studying belongs acquaintance with the harmful action of pesticides, contamination of environment, as result of mineral fertilizers application, and agricultural produce – by nitrates. The special attention is devoted the degradation processes of soils: humus damages, wind and water erosion, updepressed. Topics are also consider in relation to the alternative ways of support of agriculture, bringing of organic| fertilizers and biological protection of plants, soil protection cultivation till and general ecological situation, in agrolandscapes and main tasks of "Agroecology" studies.

Lectures:

1. Ecosystem and agroecosystem.
2. Progress and Effects of Agriculture.
3. Patterns and processes in ecosystems.
4. Agroecology and pest management.
5. Biodiversity and agrobiodiversity.
6. Crops and Their Environment.
7. Management of unwanted organisms.
8. Ecological succession.
9. Agroecological aspects of global change.

Classes:

(practical, laboratory classes)

1. Analysis of features of historical stages of the interaction of society and nature.
2. Types of nutrition and types of relationships in agrobiocenosis.
3. Ecological factors and their interaction in agrobiocenosis.
4. Analysis of schemes of circulation of basic substances in nature for the change of their links by anthropogenic activity.
5. The existing and optimal structure of nature management in Ukraine.
6. Analysis of the peculiarities of the development of the protected area network of Ukraine.
7. Assessment of chemical pollution of soils in settlements.
8. Assessment of the state of aquatic environments.
9. Research of successional changes in the agrobiocenosis.
10. Determination of the level of food pollution by nitrates.

BIODIVERSITY AND CONSERVATION

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	**3**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

Biodiversity is one of the fundamental phenomena that characterizes the manifestations of life on the planet. The diversity of biological structures and processes is the basis for the organization of the biosphere in all its global manifestations. Biodiversity is the basis for the structural and functional organization of the living matter of the biosphere and its ecosystem components, which determines the stability and resilience of the latter to external influences.

The purpose of the course "*Biodiversity and conservation*" is to acquaint students with the principles of using biological knowledge and mastering the methodology of quantitative and qualitative assessment of biodiversity, mastering the techniques of modern ecosystem analysis, which are basic in studying population and interpopulation relationships.

The task of the course is to study the main principles of modern ecology and biology, the evolution of living organisms in the biosphere, environmental problems of today and ways to solve them. An integral part of the course is the study of some important systematic groups of organisms in connection with the role that the latter play in natural and artificial ecosystems.

Lectures:

1. Biodiversity. Introduction and definition.
2. Biodiversity levels of organization.
3. Natural and artificial biocenoses. Biocoenoses – examples.
4. Threats to biodiversity.
5. Conservation biodiversity.
6. Connectivity: ecological corridors are key to protecting biodiversity.
7. Protect River Corridors and Floodplains.
8. Conservation of biodiversity in agricultural landscapes.
9. General approaches to assessing and reducing threats to biodiversity.
10. Ecosystem functions of biodiversity and ecological concept of nature management.

Classes:

(practical, laboratory classes)

1. Biodiversity as an objective factor in assessing the state of the environment and the stability of ecosystems.
2. Biodiversity of Ukraine and principles of protection.
3. The main causes of biodiversity loss.
4. Footprint and assessment.
5. Rare and endangered species of flora and fauna in Ukraine.
6. Characteristics and assessment of threats to biodiversity.
7. The main provisions of environmental legislation in the field of biotic and landscape diversity.
8. Study of the structure of the state cadastre of flora in Ukraine.
9. Status and prospects of development of the protected area in Ukraine.
10. Criteria for the formation of the ecological network inUkraine.
11. Determining the amount of damage caused by the illegal destruction of wild animals.

BIOLOGY (BOTANY)

Education and Research institute of forestry and landscape-park management

Specialty 101 Ecology

Lecturer	**Andrii Churilov, PhD in botany**
Term	**Year of study1, semestr 2**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

Aim is to study the features of development of plants as major components of biosphere.

Cource tasks are:

– to study botanical terminology and methods of investigation of plants that are necessary to study

– plants on practice; to form for student's general vision of the plant world.

– to learn, to analyze and to work with the literature and botanical objects;

– to learn a technique of experimental research of botanical objects in laboratory and in practice;

– to learn the laws of morphological and anatomical structure and development of plants and microorganisms;

– to learn a technique of identification of plants, their taxonomy;

– to learn and to analyze the botanical phenomena, changes and to form the appropriate conclusions.

Competencies of the educational programme: *Integrative* (The ability to solve complex specialized problems and solve practical problems in the field of ecology, environmental protection and balanced nature management, which involves the application of basic theories and methods of environmental sciences, which are characterized by the complexity and uncertainty of conditions). *Professional* (Knowledge and understanding of theoretical foundations of ecology, environmental protection and balanced nature management. Ability to critically understand basic theories, methods and principles of natural sciences).

Lectures:

1. Introduction to botany: plant cytology.
2. Plant anatomy overview: types of tissues, their structure and functions in plant organisms.
3. Plant body: vegetative and generative organs, their role in reproduction and propagation of plants.
4. Introduction to taxonomy: slime molds, fungi, plants.
5. Features of higher sporous plants: from mosses to ferns.
6. Seed plants and their evolution: conifers vs flowering plants.
7. Introduction to geobotany and plant ecology.
8. Plant conservation and protection.

Classes:

(practical, laboratory classes)

1 The structure of the microscope and the technique of working with it. Plant cell structure. Plastids. Spare nutrients. Starch and aleurone grains. Movement of the cytoplasm. Vacuoles, cell juice, cell juice pigments.

2 Integumentary tissues. Primary cover fabric. Secondary and tertiary integumentary tissue.

3 Mechanical fabrics. Conductive fabrics. Conducting beams.

4 Organography. Root morphology and its metamorphosis. Zones of the root, the primary anatomical structure of the root.

5 Secondary anatomical structure of the root. Features of anatomical structure of root crops.

6 Morphological structure of the shoot. Anatomical structure of the stem. Monocotyledons.

7 Anatomical structure of the stem of herbaceous dicotyledonous plants. Beam type of structure. Anatomical structure of the stem of spinning crops

8 Macroscopic structure of a tree plant stem.

9 Anatomical structure of deciduous stems.

10 Leaf. Leaf morphology. Anatomical structure of a corn leaf and a Japanese camellia. Features of the structure of pine needles

11 Fungy. Division of chytridomycota. Class chytridiomyocetes Chytridiomyocetes. Department of oomycota. Class oomycetes. Department of zygomycot.

12 Division of Ascomycota. Class of marsupial fungi or ascomycetes (Assomyces).

13 Division of Basidiomycota. Class basidiomycetes or basidiomycetes (Basidiomycetes). Lichens, lichenized mushrooms (Lishenes).

14 Division of green algae (Chlorophyta). Department of Charophyta. Class choral (Charophyceae).

15 Class liverworts (Marchantiopsida). Class deciduous, or true mosses (Bryorsida).

16 Ferns. The structure of sporophytes and gametophytes of the male thyroid, floating salvinia.

17 Angiosperms. Class pine, or coniferous (Pinopsida).

18 Flower morphology. Flower formula and diagram. Types of inflorescences.

19 Flower anatomy. The structure of the anther, ovary and seed germ.

20 Fetal formation. Structure Classification of fruits. Fertility.

21 Methods of plant herbarium. Morphological analysis plan and technique for determining flowering plants. Identification of plants from the families Ranunculaceae.

22 Identification of plants from the families Boraginaceae, cabbage (Brassicaceae) Definition of plants from the families Rosaceae, legumes (Fabaceae). Identification of plants from families of families lily (Liliaceae), fine-legged (Poaceae), sedge (Cyperaceae).

23 The structure of the phytocenosis and its functioning (on the example of forest groups of NPP "Holosyivskyi").

BIOSAFETY

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	***Alla Klepko, Doctor in Biology***
Term	**3rd course (6th semester)**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical classes – 30 hours)**

Subject overview

The purpose of the discipline "Biosafety" is to form students' professional competence in production, educational and research activities, as well as the formation of fundamental knowledge in the field of biological safety and biological risks to prevent the impact of various factors on the biological structure and functions of living organisms, as well as irreversible negative impact on biological objects of the natural environment (biosphere) and agricultural plants and animals. The objectives of the "Biosafety" course are to acquire theoretical knowledge, practical skills to protect against dangerous biotic factors and abilities to carry out organizational, engineering and technical measures aimed at protecting of working personnel, the population and the environment from the impact of biological origin risks.

Lectures:

1. The concept of biosafety. The essence of the terms biosafety and biosecurity.
2. Biosafety system in Ukraine: subject, concepts, principles, directions of formation and functioning; biological danger, biological risk, biological weapons.
3. International and Ukrainian normative-legal biosafety acts.
4. Bioterrorism and countermeasures. History of the pathogenic biological agents use by humans.
5. Mechanisms of self-defense of the body human body from the effects of toxicants of biogenic origin.
6. Laboratory safety overview: Common lab hazards and basic safety.
7. Viruses, bacteria and fungi as biological agents.
8. Poorly understood biological threats: nanobacteria, viroids, prions, mycoplasmas.

9. Biological threats of parasitic origin (trichinosis, echinococcosis, dirofilariasis etc.). Mycotoxins.
10. Genetically modified organisms: scientific and practical significance.
11. Biological and medical risks of using genetically modified plants and food derived from them.
12. World and Ukrainian legislation in the field of GMO circulation.
13. Poisons and toxins of biological origin.
14. Antibiotic resistance and the spread of genes resistance genes as a biological threat.
15. Basic principles of bioethics.

Practical classes:

1. General safety rules for laboratory works.
2. Methods of disinfection of the workplace (chemical treatment, UV irradiation) in the laboratory. Work in the box biological safety. Zoning of the work surface.
3. Requirements for laboratory facilities and equipment. Basic laboratories – biological safety level 1 and 2 according to the according to the WHO classification. Principles of planning, premises, flows of media, materials. Equipment.
4. Isolated laboratories – biosafety level 3 and 4 according to the WHO classification. Principles of planning, premises, flows of media, materials. Differences from previous levels.
5. Biological safety cabinets, classes, features design and application.
6. Personal protective equipment.
7. Methods of working with biological material.
8. Managing animal-related biorisks.
9. Methods of sowing microorganisms on nutrient media. Rules of work for parasitological research.
10. Mycotoxins and phytotoxins as a biological threat. Research methods.
11. Sampling and sample preparation.
12. Introduction to DNA extraction techniques. Isolation of DNA from products by sorption.
13. Qualitative determination of GMOs by PCR.
14. Methods for determining antibiotic resistance of cultures of microorganisms.
15. Preparation of an application for authorization to work with living objects (animals, humans).

CHEMISTRY (ANALYTICAL)

Department of Analytical and Bioinorganic Chemistry & Water Quality

Agrobiological faculty
Specialty 101 Ecology

Lecturer	**Larysa Voitenko**
Term	**The 3rd**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**75 hours (of them: lectures – 30 hours, laboratory classes – 45 hours)**

Subject overview

Analytical chemistry (chemical analysis) is the area of chemistry responsible for characterizing the composition of matter, both qualitatively (what is present) and quantitatively (how much is present). Analytical chemistry is the main tool for the environmental assessment. It investigates how to use modern chemical theory and advanced experimental techniques to identify and determine the types, components, amounts, and chemical forms of substances in the environment, including both naturally occurring chemicals and anthropogenic contaminants. Course includes: (1) the qualitative tests of cations and anions; (2) methods of identification of soluble and insoluble substances; (3) gravimetric analysis; (4) volumetry (neutralization, RedOx methods, precipitation titrimetry; complexonometry). The important part of a course is the studding of concentation units and their recalculation.

Lectures:

1. Subjects and objects of the chemical analysis (analytical chemistry). Methods of quantitative analysis.
2. Qualitative analysis of cations and anions. Analytical signals and their characteristics.
3. Analytical purity of reagents. Ukrainian and international degrees of purity. The methodology of cation mixture analysis. Partial and Systematic analysis. The strategy of cation mixture separation
4. Expression of Concentration in chemical and environmental analysis. Formulas of recalculations of concentration units. Preparation of solutions. Calculation in quantitative analysis.
5. Heterogeneous equilibrium. Molar and mass solubility. Factors effecting solubility.
6. Theoretical foundations and calculations in gravimetric analysis.

7. Ionic product of water. pH notion. Biological function depending pH. Measuring pH. pH calculations of strong acids and bases, weak acids and bases. pH calculations of different salts solutions. Buffer solutions. Calculate of a pH of buffer solutions. Titration curves, equivalent points, titration jump. Acid-base indicators. Choice of indicators. Equivalent law in volumetry.

8. Neutralization method. Standard and working solutions, possibilities of method. Determination of water temporary hardness.

9. RedOx volumetry. Nernst equation. Electrode potential of redox systems. Electromoving force (EMF) of redox systems. RedOx indicators. Bases of permanganatometry and iodometry.

10. Complexonometry. Bases of method. Standard and working solutions, possibilities of method. Metallochromic indicators. Determination of total temporary hardness.

Laboratory classes:

1. Introduction. Lab Safety rules. Semimicro qualitative lab techniques. Basic characteristics of Qualitative tests (sensitivity, selectivity).
2. Qualitative classification of cations. Qualitative tests of the Ist cation group (NH_4^+, K^+, Na^+).
3. Qualitative tests of the IInd cation group (Mg^{2+}, Ca^{2+}, Sr^{2+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, and Al^{3+}). Action of group, selective, and specific reagents.
4. Qualitative tests of the IIIrd cation group (Zn^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+}), and the IV^{d} cation group (Ag^+, Pb^{2+}). Action of group, selective, and specific reagents.
5. Partial and Systematic analyses of cation mixture. Idea of cation separation. Experimental test. Determine the composition of cation mixture.
6. Qualitative classification of anions. Qualitative tests and methods of separations of anions.
7. Experimental module test. Qualitative analysis of soluble salt, and insoluble substance (salts, free metals, oxides).
8. Experimental module test. Determination of barium content in the barium chloride hydrate.
9. Neutralization method. Standard and working solutions, possibilities of method. Experimental module test. Determination of alkali content in solution, and water temporary hardness.
10. RedOx volumetric methods. Permanganatometry method. Standard and working solutions, possibilities of method. Experimental module test. Determination of iron(II) content in Mohr's salt solution.
11. Iodometry method. Standard and working solutions, possibilities of method. Experimental module test. Iodometric determination of copper content in copper vitriol.
12. Complexonometry. Bases of method. Standard and working solutions, possibilities of method. Experimental module test. Complexonometric determination of Calcium content in solution.

CHEMISTRY (INORGANIC AND ANALYTICAL)

Department of Analytical and Bioinorganic Chemistry & Water Quality

Agrobiological faculty
Specialty 101 Ecology

Lecturer	**Larysa Voitenko**
Term	**The 1st**
Major	**Bachelor degree**
ECTS credits	**5**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 60 hours, laboratory classes – 60 hours)**

Subject overview

Inorganic chemistry studies the theoretical foundations of the modern inorganic chemistry, including the chemical properties and transformations of macronutrients, micronutrients, toxic elements and their compounds. Chemical properties are described in terms of atomic-molecular studies, acid-base chemistry, redox processes and complexation. The laboratory course involves the preparation and study of a number of types of inorganic and complex compounds.

Analytical chemistry (chemical analysis) is the area of chemistry responsible for characterizing the composition of matter, both qualitatively (what is present) and quantitatively (how much is present). Course includes: (1) the qualitative tests of cations and anions; (2) methods of identification of soluble and insoluble substances; (3) gravimetric analysis; (4) volumetry (neutralization, RedOx methods, precipitation titrimetry; complexonometry).

Lectures:

1. Chemistry as the science that deals with the properties, composition, and structure of substances.
2. Atomic structure of chemical elements.
3. Periodicity of changes in structure and properties of elements and their compounds.
4. Chemical bonding and molecular structure.
5. Chemical kinetics and equilibrium.
6. Solutions and their properties. Electrolytes and electrolytic dissociation. Ionic equations.
7. Hydrolysis of salts. Notion of a pH.
8. RedOx processes.
9. Complex (coordination) compounds.

10. Subjects and objects of the chemical analysis (analytical chemistry). Methods of quantitative analysis. Subjects of qualitative and quantitative analyses. Methods of qualitative analysis. Analytical reactions and requirements to analytical reactions.
11. Chemical-analytical properties of the cations on the examples of s-elements belongs to IA and IIA groups, p- elements belongs to IIIA and IVA groups, and d-elements of the IIIB and VB groups.
12. Chemical-analytical properties of the cations on the examples of p-elements belong to VIIA, VIA, VA, and IVA groups. Qualitative analysis of inorganic substances (salts, acids, bases, oxides).
13. Equilibrium in heterogeneous and homogeneous systems. Precipitation and sediment dissolving reactions; their application for qualitative and quantitative analysis
14. Theoretical foundations of measurement and processing of results in chemical analysis. The essence and task of quantitative measurements and calculations.
15. Titrimetric methods of quantitative analysis (volumetry). The application of volumetric methods in environmental analysis. Neutralization method.
16. RedOxmetry in quantitative analysis.
17. Complexonometry in quantitative analysis.

Laboratory classes:

1. Introduction. Lab Safety rules. Semimicro qualitative lab techniques. The introduction testing.
2. General chemical properties of main classes of inorganic substances. Chemical naming.
3. Electron formulas compiling. Determination of valence and oxidation number of the chemical elements as a function of their electron configuration. Electron configuration simulation.
4. Periodicity as an expression of electron shell structures. Visualisation of the periodicity.
5. Qualitative assessment of chemical bonding types and molecular structure of acids, bases, salts, oxides. Virtual simulation of chemical bonds and visualization of molecules.
6. Experimental studding of strong and weak electrolytes from viewpoint of Avogadro's electrolytic dissociation theory. How to compile the ionic equations. How to use the net ionic calculator.
7. Experimental studding of hydrolysis of salts in water medium. How to predict and to measure of a pH. How to use a Hydrolysis calculator.
8. Experimental studding of RedOx processes; chemical nature of Reducing and oxiding agents. RedOx potential and its measuring in water medium. Electron balance and half-reaction methods. How to use a RedOx calculator.

9. Experimental studding of complexing processes. How to isolate and decompose the coordinative compounds. IUPAC nomenclature of coordinate compounds.

10. Introduction to qualitative analysis. Classification of cations, qualitative tests of cations.

11. Studding of chemical-analytical properties and qualitative tests of anions belongs to p-elements of VIIA, VIA, VA, IVA and IIIA groups.

12. Analytical classification of the main bioactive cations. Separation and identification of I-IV cation groups according to the ammine-phosphate classification.

13. Analytical classification of the main bioactive anions. Separation and identification of anions.

14. The identification methods of the inorganic substances qualitative analysis. Two experimental control tasks for the analysis of chemical composition.

15. Experimental strategies of quantitative analysis: weighing, measuring vessels, filtering. Volumetric analysis. Calculations in volumetric analysis. Neutralization method. Preparation of primary and secondary standard solutions.

16. Experimental control tasks: Concentration of alkali in water solution; Determination of temporary water hardness of water sample.

17. RedOx volumetric methods of quantitative analysis. Preparation of primary and secondary standard solutions of Permanganatometry and Iodometry. Experimental control tasks: The permanganatometric determination of Fe(II) concentration in water solution of Mohr's salt; The iodometric determination of Cu(II) content in solid copper vitriol.

18. Complexonometric volumetric method of quantitative analysis. Preparation of primary and secondary standard solutions of Trilonometry method. Experimental control tasks: Determination of total water hardness of water sample; Determination of Calcium content in water solution.

CHEMISTRY (ORGANIC, PHYSICAL AND COLLOID)

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	***Andrii Halstian, Doctor in Chemistry***
Term	**1rd course (2th semester)**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical classes – 30 hours)**

Subject overview

The purpose of the discipline "Chemistry (organic, physical and colloid)" is to form students' theoretical foundations of organic, physical and colloidal chemistry, practical abilities and skills in working with various types of organic compounds, study of specific features of their behavior in chemical reactions, acquisition of work experience in a chemical laboratory to solve specific practical tasks, formation of a scientific outlook and a scientific view of nature and protection of the environment.

Lectures:

1. Introduction. The most important theoretical provisions of organic chemistry. Hydrocarbons. Aromatic hydrocarbons, terpenes.
2. Alcohols, phenols. Aldehydes and ketones.
3. Carboxylic compounds. Fats.
4. Carbohydrates.
5. Nitrogen-containing organic substances. Heterocyclic compounds.
6. Basics of physical chemistry.
7. Basics of colloidal chemistry.

Practical classes:

1. Qualitative elemental analysis of organic substances.
2. Obtaining and studying the properties of methane, ethylene, acetylene. Halogen derivatives of hydrocarbons.
3. Arenas. Studying the properties of benzene, toluene, naphthalene. Terpenes.
4. Study of properties of alcohols, phenols.

5. Aldehydes and ketones. Production, chemical properties. Carboxylic acids. Study of properties. Lipids. Saponification of fat.
6. Carbohydrates.
7. Nitrogen-containing organic substances. Amines and amides.
8. Amino acids and proteins.
9. Heterocyclic compounds.
10. Determination of the heat of reaction of the formation of crystal hydrate of salt and the heat of the reaction of neutralization.
11. Acid-base properties of solutions. pH-metry.
12. Study of acetic acid adsorption on activated carbon.
13. Preparation, purification and properties of colloidal systems.

CHEMISTRY WITH THE FOUNDATIONS OF BIOGEOCHEMISTRY

Department of Analytical and Bioinorganic Chemistry & Water Quality

Agrobiological faculty
Specialty 101 Ecology

Lecturer	**Larysa Voitenko**
Term	**The 7th**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, laboratory classes – 30 hours)**

Subject overview

Discipline studies chemical, physical, geological and biological processes that are regulating the composition of the environment, biogeochemical cycles in their interaction with living matter through the biological systems of the Earth in time and space. The course includes the laws of the chemical composition formation of the ecosphere; principles of biogeochemical zoning, biogeochemical provinces and endemic diseases in them; theories of the origin of life, ways and types of biogenic and anthropogenic migration of chemical elements; methods for predicting chemical transformations of pollutants; mechanisms of isotope fractionation with living matter; the role of living matter in the geochemical processes of hypergenesis and crust weathering; biogeochemical patterns based on methods of chemical indication of the environmental state; transformation of xenobiotic.

Lectures:

1. Introduction. The object of research and the goal of the discipline. Life origin on the Earth: hypotheses and experimental.
2. The ecosphere, the chemical elements and biogeochemical laws.
3. Biogeochemical zoning. Biogeochemical chains.
4. Endemic diseases as result of abnormal distribution of chemical elements in biosphere.
5. The general notions of biogeochemical cycles. Biogeochemical cycles of gaseous (Nitrogen, Oxygen, Hydrogen) and Sedimentation types (Phosphorus, Sulfur). Biogeochemical barriers.
6. Biogeochemical cycles of micronutrients and toxic elements. Chemistry of preservatives and psychoactive compounds.

Laboratory classes:

1. Introduction. Safe rules in chemical laboratory. Qualitative methods of environmental chemical analysis. Probe sampling, conservation and storage of samples for analysis. Principles of statistic treatment of qualitative analytical results of environmental objects.
2. Express measuring of active residue chlorine (free, total) in chlorinated drinking water by photometric method using C-401 colorimeter.
3. Determination of nitrate content in natural fresh waters and drinking water by photometrical method according to DSTU 4078-2001 Water quality; determination of nitrate; part 3: spectrometric method using sulfosalicylic acid (ISO 7890 3:1998, MOD). Statistical treatment of analysis data.
4. Determination of ammonia content in natural fresh waters and drinking water by photometrical method according to DSTU ISO 7150-1-2003 Water quality - Determination of ammonium - Part 1: Manual spectrometric method. Statistical treatment of analysis data.
5. Determination of total iron content in tap water, buvette water and surface waters according to ISO 6332:1988 Water quality - Determination of iron - Spectrometric method using 1,10-phenanthroline. Statistical treatment of analysis data.
6. Determination of fluoride content in drinking water and a few sorts of tea leaves and packed according to ISO 10359-1:1992 Water quality - Determination of fluoride. Part 1: Electrochemical probe method for potable and lightly polluted water. Statistical treatment of analysis data.
7. General chemical properties of alkaloids. Sublimation method for the caffeine dry extraction from tea leaves. Qualitative test of caffeine.
8. Determination of active oxygen content in detergents and oxygen-contained bleaches according to DSTU 2207.2-93 Synthetic detergents. Methods to determine total mass fraction of active oxygen.

ECOLOGICAL BIOINDICATION

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Anna Salnikova**
Term	**2nd course (3rd semester)**
Major	**Bachelor's degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**75 hours (of them: lectures – 30 hours, practical classes – 45 hours)**

Subject overview

The purpose of the course «Ecological Bioindication» is to create prerequisites for the in-depth study of ecological research methods and biotic monitoring of the environment. The discipline is aimed at forming knowledge and skills about the indication of the quality of the environment using biota in natural conditions, as well as the assessment of the quality of environmental objects in laboratory conditions using living organisms (biotesting). Forms students' knowledge about environmental pollution and its components, and patterns of its influence on biocenoses to organize control of the state of the environment.

Lectures:

1. Concept of bioindication. Bioindication methods.
2. Ecological principles of bioindication. General principles of using bioindicators.
3. Bioindication at different levels of organization of living matter. Reactions of living organisms (biochemical, physiological, morphological, biorhythmic reactions).
4. Bioindication of atmospheric air quality using living organisms.
5. Bioindication of surface water quality using living organisms.
6. Bioindication of soil quality using living organisms.
7. Assessment of the impact on the population of living organisms. Effect of stressors on ecosystems, dynamics of biocenoses and landscapes.
8. Bioindication of the quality of the natural environment. Detection of contamination and selection of bioindication methods.
9. Biosensors as a modern method of determining the state of the environment.
10. The concept of biotesting. Test objects, and basic requirements for them.
11. Biotesting as a method of determining the acute toxicity of pollutants.
12. Microorganisms as test objects for biotesting.

13. Plants as test objects for biotesting.
14. Hydrobionts and animals as test objects for biotesting.
15. Soil biotesting is a method of controlling the quality of agricultural products.

Practical classes:

1. Methods of bioindication. Sampling for bioindication.
2. Requirements for bioindicators. Selection of indicator organisms during ecological studies.
3. Biotesting of water quality using higher aquatic plants and hydrobionts.
4. Assessment of atmospheric air pollution using plants.
5. Analysis and determination of the total microbial number in water as a criterion of bacteriological water pollution.
6. Determining the quality of soils according to the tests "Aberrantness of chromosomes", "Value of the mitotic index", and Allium test.
7. Assessment of the ecological state of soils based on changes in the species biodiversity of soil invertebrates and microorganisms.
8. Ecological indices used in the method of complex indication (Shannon index, dominance index, similarity index).
9. Analysis of modern sensor systems for determining the quality of the environment.
10. Methodological foundations of biotesting.
11. Biotests are used in the control of environmental objects to assess the level of toxic pollution.
12. Biotesting method for determining the toxicity of chemical substances using earthworms *Eisenia fetida* and soil microorganisms.
13. Use of higher plants for soil biotesting.
14. Biotesting method for determining the acute toxicity of water on crustaceans *Daphnia magna* Straus and algae *Scenedesmus quadricauda* (Turp) Breb.
15. Biotesting methods for determining soil contamination with heavy metals, pesticide residues, and oil products.

ECOLOGY OF BIOLOGICAL SYSTEMS (PLANT ECOLOGY)

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Anna Salnikova**
Term	**3rd course (5th semester)**
Major	**Bachelor's degree**
ECTS credits	**2**
Control	**Exam**
Class-room hours	**30 hours (of them: lectures – 15 hours, practical classes – 15 hours)**

Subject overview

Plant ecology is a course aimed at studying the relationships of plant organisms and their groups with the environment, and plant organisms in the biogenic cycle of substances and energy. The main tasks of the course are the assessment of ecological factors of the environment and their impact on plant organisms; the study of plants to compile the ecological characteristics of the species and describe its ecological niche; forecasting the consequences of the disappearance of certain plant species in a certain territory and the introduction of species into specific biogeocenoses; bioindication of the state of the environment.

Lectures:

1. Introduction to plant ecology. Basic concepts and the role of plant organisms in the circulation of substances and energy.
2. Life forms of plants. Adaptation and resistance of plants to environmental conditions.
3. Abiotic environmental factors and their influence on plant organisms.
4. Biotic factors affecting plant organisms.
5. Anthropogenic factors: the impact of economic activity on plant organisms.
6. The concept of phylogenesis and its properties.
7. Development of plant communities. Classification of different types of vegetation.
8. Cultural phytocenoses and features of their existence.

Practical classes:

1. Modern classification of representatives of the plant world.

2. Ecological groups of plants according to light and temperature requirements.
3. Ecological groups of plants according to water and soil requirements.
4. Biotic factors and their influence on plant organisms.
5. Analysis of anthropogenic impact on the surrounding natural environment based on the reaction of plant organisms.
6. Quantitative and qualitative relationships between species in phytocenoses.
7. Evaluation of the stratification of phytocenoses.
8. Study of zonation of plant formations.

ENVIRONMENTAL MONITORING

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	**Rakoid O.O., PhD**
Term	**3rd course (5th semester)**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

Environmental monitoring is a tool to assess environmental conditions and trends, support policy development and its implementation, and develop information for reporting to national policymakers, international forums and the public. Goal of course is to expand the object, methods and place of the discipline "Environmental monitoring" in the system of environmental knowledge as well as highlight its main principles of monitoring and promote ecological outlook for future environmentalists.

Objectives of the discipline is formation the theoretical knowledge and practical skills in the field of environmental monitoring, in particular on the modern problems of different components of the environment (surface and ground water, oceans and seas, atmospheric air, soils etc.), estimation of impact of anthropogenic stresses on them, prediction of changes in the state of environment as well as working out the scientifically-grounded recommendations for realization of nature protection measures.

Lectures:

1. Basic concepts of environmental monitoring.
2. The State Environmental Monitoring System of Ukraine.
3. Air pollution and air monitoring.
4. Monitoring of surface water.
5. Land and soil monitoring. Assessment of land degradation.
6. Climate change and climate monitoring.
7. Monitoring of biodiversity (Biomonitoring).
8. Global approaches for environmental monitoring.

Classes:

(practical, laboratory classes)

1. Definitions and historical background of monitoring. Classification of monitoring system.
2. Regulatory and policy framework of SEMS.
3. Analytical research methods of air condition.
4. Physical and chemical parameters of water quality monitoring.
5. Agroecological monitoring. Methods for determining the contaminant concentration in soils.
6. Characteristics and uses of climate observations at the global and national levels.
7. International approaches to biomonitoring. Indicators used to conduct monitoring biodiversity at the global and national levels.
8. World experience in organizing environmental monitoring systems.

ENVIRONMENTAL RISKS

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	**1**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30hours, individual work – 60 hours)**

Subject overview

This course is part of the Bachelor specialization within the educational program “Ecology”. The main aim of the course is to provide Bachelor students with knowledge about environmental risks in the world and their associated drivers and impacts. The main course objectives are (1) to discuss the environmental risks in relation to natural disasters, climate change, pollution (air, soil and water), human activities and biodiversity loss; (2) to identify the most relevant environmental risks in a specific continent in the world and their drivers and impacts; (3) design a flowchart that shows the most relevant interactions between drivers and impacts for the environmental risk of a continent. The main pre-requisite to take this course is that the students follow the following two disciplines: “Introduction to the Specialization”, and “The Basis of the Environmental Education and Culture”. This course serves as the basis to take the next disciplines such as “General Ecology”, “Environmental safety” and “Landscape ecology”.

Lectures:

1. Definition of environmental risks.
2. Principles of environmental risks.
3. Classifications of environmental risks.
4. Natural disasters.
5. Climate chang.
6. Pollution.
7. Biodiversity loss.
8. Human activities.
9. Interactions and overall impacts.
10. Methodology for quantifying environmental risks.

Classes:

(practical, laboratory classes)

1. Definition of environmental risks.
2. Principles of environmental risks.
3. Classifications of environmental risks.
4. Climate change.
5. Pollution: students will continue working in their groups and on the same continent. In this topic, the focus will be on air, water and soil pollution of that continent.
6. Biodiversity loss: students will continue working in the same group and on the same continents as was assigned in the previous topics.
7. Human activities: Students continue working in the same group and on the same continent.
8. Interactions and overall impacts: students will be asked to reflect back on the outcomes of their group work.
9. Methodology for quantifying environmental risks.

ENVIRONMENTAL TOXICOLOGY

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

Environmental toxicology is an integrated science that is directly related to environmental protection, general ecology and toxicology, based on the use of the latest technologies to prevent and counteract the effects of harmful substances on biological objects of natural ecosystems.

The main objective of the discipline "Environmental Toxicology" is to provide students with knowledge of scientific and methodological support for ecotoxicokinetics, ecotoxicodynamics, ecotoxicometrics; classification of harmful substances by chemical composition and intended use; modern methods of assessing the ecotoxicological hazard of chemicals in the environment; methods of analyzing and predicting environmental changes when harmful substances enter the environment. Students should be able to assess the level of hazard of harmful substances for biological objects of ecosystems; determine dangerous levels of harmful substances in the environment; identify environmental risks and develop environmental forecasts in the event of environmental pollution by xenobiotics; develop measures to reduce the toxic effects of harmful substances on the environment.

Lectures:

1. Ecotoxicology: history, prominent scientists, scientific schools, basic concepts, terms, definitions.
2. Ecotoxicokinetics, behavior of toxicants in the environment in the natural environment.
3. Ecotoxicodinamic mechanisms and forms of toxic effects on biological objects.
4. Ecotoxicometery - a tool for assessing toxicity of chemicalsubstances.
5. Ecotoxicological assessment of pesticide hazards.
6. Ecotoxicological assessment of agrochemicals by their impact on the ecosystem.

7. General ecotoxicological characteristics of the main groups of toxic substances.
8. Ecotoxicological assessment of nanomaterials and nanotechnologies.

Classes:
(practical, laboratory classes)

1. Xenobiotic profile of the environment.
2. Assessment of substance hazard by indicators of behavior in ecosystem components.
3. Determination of the toxicity of a substance using the relationship dose - effect (concentration - effect) relationship.
4. Ecotoxicological hazard assessment of a chemical substance in relation to soil, water and terrestrial organisms.
5. Pesticide hazard forecast for biota of natural ecosystems.
6. Ecotoxicological assessment of agrochemicals by indicators of impact on the soil system.
7. Ranking of chemicals by the level of their ecotoxicological hazard.
8. Build a model of nanoparticle behavior in environmental components and determine their potential risk to living organisms.

FUNDAMENTALS OF GIS
Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Maryna Ladyka, Candidate of Science (Agriculture), Associate Professor**
Term	**4**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**36 hours (of them: lectures – 13 hours, laboratory classes – 26 hours)**

Subject overview

In the study of the course “Fundamentals of GIS” students get theoretical knowledge and practical skills in GIS for professional activity. GIS can be used to obtain the information necessary for making decisions about the state of agricultural landscapes, for landscape and ecological zoning of the territory, creating maps of the state of soils, forecasting the productivity of crops, etc.

The students acquire such skills as: choosing the necessary conditions for creating a GIS project, taking into account the customer's requirements for GIS for various purposes, developing a scheme and methodology for the optimal solution of the given task, and database constructing that is necessary for a specific GIS project, use software such as QGIS, ArcView, WinGIS, etc. for the implementation of the project.

Lectures:

1. The course's subject, purpose and tasks “Fundamentals of GIS”. The history of the development of GIS and their application in ecology.
2. Geographic coordinates and map projections. Spatial models and data structures. Raster and vector data models.
3. Attributive information in GIS. Spatial database.
4. Elementary spatial analysis and measurement in GIS. Overlaying in GIS.
5. Statistical surfaces in GIS.
6. Analytical possibilities of modern GIS tools. Use of spatial analysis in ecology and environmental protection

Laboratory classes:

1. Basics of working with GIS software – QGIS 3.1.
2. Search and download free space imagery for use in QGIS
3. Georeferencing of maps and satellite images.
4. Vectorization (digitization of raster data).
5. Overlay operations and calculations in GIS.
6. Working with attributive information (search, input, analysis, visualization). Mapping.
7. Spatial analysis. Interpolation methods.

GENERAL ECOLOGY

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	
Major	**Bachelor**
ECTS credits	**5**
Control	**Exam**
Class-room hours	**150 hours (of them: lectures – 30 hours, practical or laboratory classes – 45 hours, individual work – 75 hours)**

Subject overview

This course is part of the Bachelor specialization within the educational program “Ecology”. The study of the discipline "General Ecology" contributes to the formation of basic ecological knowledge, ecological thinking of a future specialist who is able not only to use and protect nature competently and scientifically, but also to contribute to the formation of mass environmental awareness of the population, make a significant contribution to the formation of mass environmental awareness of the population, acquire the necessary skills to make the right decisions, etc.

In studying this discipline, students must learn the history of environmental science and determine its place in the system of biological sciences and determine its place in the system of biological sciences, environmental phenomena, systems, laws; levels of organization of living systems, ecological phenomena, systems, laws; levels of organization of living systems of species and superspecies rank, subdivisions ecology: autecology (ecology of organisms), demecology (ecology of populations), synecology (biocenology), ecosystemology (biogeocenology), biosphereology (global ecology); environmental factors and their impact on the vital activity of organisms, problems of environmental pollution environmental pollution, formation of ideas about the state and prospects of using the natural resource potential of the planet.

After studying the course, students gain knowledge of the fundamental ideas of environmental science: the doctrine of the biosphere and ecosystems, sources and shortages of energy in ecosystems, patterns of influence of environmental factors, biotic relationships between bionts, species and populations; skills in determining the natural resource potential of ecosystems and socio-economic analysis of their macroecological activities.

Lectures:

1. Introduction to Ecology.
2. Habitat. Environmental factors.
3. Adaptation of plants to the environment.
4. Interactions between members of one species.
5. Structure of biosphere.
6. Water cycle.
7. Nitrogen cycle in nature.
8. Carbon cycle.
9. The environmental pollution.
10. Air pollution.
11. Water pollution.
12. Soil contamination. Global ecological effects.

Classes:

(practical, laboratory classes)

1. Terrestrial habitat. Adaptations of organisms to the terrestrial and aerial habitat.
2. Adaptations of species to aquatic habitat.
3. Life forms by Raunkiaer system.
4. Evaluation of plants and animals size, density and population.
5. Competitive relationships.
6. Competition of two species for limited resources.
7. Predator – prey cycles.
8. Structure and dynamic of ecosystem.
9. Examining the stages in ecological succession.
10. Biosphere and its components.
11. Hydrosphere.
12. Water cycle.
13. Nitrogen cycle.
14. Sulfur cycle.
15. Phosphorus cycle.
16. Carbon cycle.
17. Air pollution.
18. Car pollution.
19. Assessment of car pollution on the main street (carbon monoxide concentration).
20. Water pollution.
21. Determination of noise pollution.
22. Estimation of environment contamination on a base of lichen indication.

INTRODUCTION TO THE SPECIALIZATION

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vita Strokal**
Term	**3**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

This discipline ensures knowledge of the main environmental competences for future fields. The main outcomes are developed of ecological and environmental principles, facilitated of communication and interactive skills, improved of implementing potential practices. This discipline includes the concept of the course with professional fields and competencies, the history of the ecological and environmental sciences, the challenges of Climate Change impacts on the environment, biomes and ecological factors, environmental issues, interactions between human activities and footprint.

Lectures:

1. Introduction to the course, principles of obtaining professional competences.
2. History of ecological and environmental sciences.
3. Challenges of Climate Change impacts on the ecological levels of the organizations.
4. Climate Change influences biodiversity, the principles of rewilding.
5. Biomes and ecological factors.
6. Environmental issues: sources and responsibilities.
7. Green Deal and Sustainable Development Goals: main implications for Ukrainian environmental legislations.
8. Ukrainian environmental government and non-profit.

Classes:

(practical, laboratory classes)

1. Introduction to obtaining professional competencies.
2. Contributions of scientists to the development of ecology and environmental studies.
3. Ecologist: your future actions.
4. Environmental rights and responsibilities of environmentalists.
5. Explore the causes, consequences, and solutions of environmental issues.
6. Waste issues: identify implications and approaches.
7. Environmental Justice: identify possibilities to implement.
8. Calculate footprint: green, blue, gray, carbon.

LANDSCAPE ECOLOGY

Department of Ecology of Agrosphere and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Evgeniy Beregniak**
Term	
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 15 hours, practical classes – 30 hours)**

Subject overview

The goal of the course "Landscape ecology" is the formation of student's scientific knowledge, skills and abilities to study the characteristic processes of interaction between organisms inside landscapes, study of the general structure and the main ones the principles of landscape formation, their properties, the effects of various activities on landscapes and the specificity of their transformations due to the action of anthropogenic factors. Main tasks: methodical - to develop methodical foundations of management in student's scientific research in different types of landscapes. Cognitive - students should to know and evaluate the anthropogenic load on landscapes, to forecast the possible the consequences of these changes for society and the environment, understand the criteria and indicators for evaluation of the processes of their development and transformations.

Lectures:

1. History the subject of development and study task landscape ecology.
2. Properties and structure of geosystems.
3. Geochemical classification of facies. The concept of a geotope.
4. Vertical landscape structures.
5. Characteristic energy processes in the landscape.
6. Moisture circulation and substance circulation in landscapes.
7. Macroclimate and microclimate landscapes.
8. Characteristic of anthropogenic landscapes.

Classes:

(practical, laboratory classes)

1. Study of the components of natural complexes of the region.
2. Methods of evaluating landscapes based on their images.
3. Analysis of the diversity of landscapes of different regions of Ukraine.
4. Characteristics of the spread of natural and anthropogenic changed landscapes at the local level.
5. Use of indicators of biological diversity landscape ecosystems.
6. Analysis of diversity and fragmentation of landscapes ecosystems.
7. Construction of an environmental profile along a gradient redistribution of moisture and solids on the catenary.
8. Altitude clarity of mountain landscapes.
9. Methods of studying landscape ecosystems in the neighborhood.
10. Methods of analysis of anthropogenic transformation landscape ecosystems.
11. Methods of analysis of hemeroby of landscape ecosystems on based on the classification of H. Sukopp.
12. Analysis of the ratio of natural and anthropogenic landscape ecosystems of the region and the district where they come from student and their comparison with optimal indicators.
13. Monitoring of landscape ecosystems: planning and collecting primary information.
14. Study of landscape and characteristic components processes directly in natural conditions (for example Holosiiv forest).
15. Determination of ecological sustainability of agricultural landscapes and their optimization by afforestation.

MATHEMATICS AND PHYSICS

Department of Physics

Education and research institute of Energetics, Automatics and Energy saving

Specialty 101 Ecology

Lecturer	**candidate of physical and mathematical sciences, associate professor Oksana Godlevska**
Term	**1**
Major	**Bachelor**
ECTS credits	**2**
Control	**Exam**
Class-room hours	**30 hours (of them: lectures – 15 hours, practical classes – 15 hours)**

Subject overview

The discipline "Mathematics and Physics" is one of the main parts of the theoretical training of bachelors in the specialty 101 "Ecology, Environmental Protection and Balanced Nature Management", that is, the basis without which a full study of the disciplines of the cycle of professional and practical training of such specialists is impossible.

The Purpos**e** of studying the discipline "Physics" is the consistent study by students of the basic laws and provisions of physics in order to understand the general regularities of natural phenomena; the use of these laws in the prompt resolution of problems; illumination of possible applications of physical methods and devices in practical activities.

The tasks of the academic discipline "Physics" are as follows:

Providing students with sufficiently broad training in the field of physics, mastery of fundamental concepts and theories of classical and modern physics, which provides them with effective mastery of special subjects and the further possibility of using physical principles. This also includes teaching students methods and skills for solving specific problems and familiarizing them with measuring equipment.

Formation of students' scientific outlook and modern physical thinking. This task should also be considered as an essential part of the humanitarian training of the future specialist, since most issues of the history of science and philosophy can be demonstrated during the teaching of a physics course. As a result of studying the academic discipline "Mathematics and Physics", the student should know:

-basic physical quantities, units of their measurements, basics of error theory and rules for processing measurement results, modern means of measuring physical quantities

- fundamental concepts and theories of classical and modern physics in order to effectively master special educational disciplines and use knowledge of physical laws in future work;

- methods of solving practical physical problems and problems;

- principles of operation of devices;

be able to: - use measuring tools, perform mathematical and statistical processing of measurement results;

- using physical conditions, laws and theories, apply the acquired theoretical and practical knowledge after studying special disciplines in the future work in the specialty;

- explain physical processes and phenomena that occur in the natural environment, as well as during the operation of various types of equipment.

Lectures:

1. Mathematical data processing.
2. Kinematics and dynamics of a material point.
3. Work and energy. Dynamics of rotary motion
4. Fundamentals of molecular kinetic theory. Basics of thermodynamics. Basics of hydrodynamics
5. Electrostatics. Direct current.
6. Magnetic field. The phenomenon of electromagnetic induction. Harmonic oscillations.
7. Geometric optics. Waves.
8. .Physics of the atom and atomic nucleus (1 h.)

Practical classes:

1. Introduction to practical works. Determination of errors for direct measurements Practical work 1 "Determining the acceleration of free fall using a mathematical pendulum".
2. Practical work 2 "Determining the moment of inertia by the method of torsional oscillations".
3. Practical work 3 "Determination of the coefficient of internal friction by the Stokes method."
4. Practical work 4 "Research of the electrostatic field".
5. Practical work 5 "Determining the horizontal component of the induction of the Earth's magnetic field."
6. Practical work 6 "Determining the refractive index using a microscope."
7. Final topic.

NATURE RESERVE

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	**2**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

This course is part of the Bachelor specialization within the educational program “Ecology”. The *aim* is to train bachelors of ecology who will be able to work in the territories of the nature reserve fund, to apply their knowledge for scientific activities, organisation of environmentally balanced management, forestry and its effective environmental control.

The *objectives* of the discipline are to provide students with theoretical and practical knowledge, developing their professional need for the need to improve the environmental situation in the country in accordance with the constitutional right of the population to a clean environment by creating a geographically representative network of protected areas;

Awareness of the need to switch to a balanced ratio of nature reserve fund lands with other categories of forest lands and recognise it as a mandatory component of the sustainable development of the state; consolidation of the stereotype of the priority of conservation biotic and landscape diversity through the formation of a national ecological network of Ukraine, introduction of the organisation of a system of environmental monitoring of protected areas and management of protected areas, raising the level of environmental and conservation awareness of future foresters.

Lectures:

1. Stages of the historical development of nature reserves.
2. Issues of creation, expansion and protection of the nature reserve fund in the environmental policy of Ukraine.
3. Convention on Biological Diversity, international legal documents – studying international and Ukrainian experience in the field of nature protection.
4. Classification of protected areas and objects: natural areas and objects, artificially created objects.

5. Formation of a network of protected areas.
6. Characteristics and assessment of threats to biodiversity.
7. Red Data Books in the system of biodiversity conservation.
8. Nature and biosphere reserves.
9. National parks and regional landscape parks, nature reserves, naturel monuments, protected tracts (I part).
10. National parks and regional landscape parks, nature reserves, naturel monuments, protected tracts (II part).
11. Artificially created territories and objects of the nature reserve fund of Ukraine.

Classes:

(practical, laboratory classes)

1. Determination of the characteristics of forest plantations in the territory of the projected nature reserve fund
2. Phenological observations on the territory of the projected facility
3. Vertebrate fauna (impacts of activities) on the territory of the projected protected area
4. Inventory of the insect fauna on the territory of the projected or existing object of the Nature Reserve Fund
5. Accounting and inventory of the flora of the territory of the projected object of the Nature Reserve Fund
6. Objects of the Nature Reserve Fund of local importance of the settlement
7. Objects of the Nature Reserve Fund of national importance of the settlement
8. Determination of the protection status of flora representatives of the existing object of the Nature Reserve Fund
9. Determination of the conservation status of fauna representatives of the existing object of the Nature Reserve Fund
10. Preparation of proposals for the protection obligation of the territory proposed for granting the protected status
11. Determination of the type and status of the projected object of the Nature Reserve Fund

RADIOBIOLOGY AND RADIOECOLOGY

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	**Doctor in Biology Alla Klepko**
Term	**3rd course (6th semester)**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, laboratory classes – 30 hours)**

Subject overview

Radiobiology, also known as radiation biology, is the scientific study of the effects of ionizing and non-ionizing radiation on living systems at all levels of organization, including biomolecules, cells, tissues, organisms, and populations. It is a comprehensive field of knowledge that encompasses medical, agricultural, veterinary radiobiology, radiation ecology, radioecological monitoring, and other areas. Radioecology is a branch of radiobiology that arose at the junction of radiobiology and ecology. Radioecology studies the concentration and migration of radionuclides in the environment and their impact on living organisms and their communities. The study of the discipline 'Radiobiology and Radioecology' provides a comprehensive understanding of the nature of ionizing radiation and its impact on living organisms. It also covers the practical application of this knowledge to solve research and applied problems related to radiation safety.

Lectures:

1. Introduction to radiobiology. History.
2. Physical basics of radiobiology.
3. Sources of radioactive substances and ionizing radiation.
4. Biological effects of ionizing radiation on plants and animals.
5. Radiosensitivity of plants, animals and other organisms.
6. Radiation protection and radiosensitization.
7. Post-radiation recovery of plants and animals.
8. Migration of radionuclides in the environment and objects of agriculture.
9. Measures to reduce the accumulation of radionuclides into crop and livestock products.
10. Application of ionizing radiation in agricultural production and other fields of human activity and method of isotope indicators in biology and ecology.

Laboratory classes:

1. Radiation safety standards and basic sanitary rules of radiation protection.
2. Determination of the flow of β-particles from the radiation source.
3. Determination of the β-radiation half-attenuation layer.
4. Determination of the dose rate of γ-radiation created by the reference source ^{137}Cs through protective materials.
5. Measurement of the γ-background in the premises and on the territory using the SRP-68-01 radiometer.
6. Measurement of the specific and volume activity of β-emitting radionuclides using the "Beta" radiometer.
7. Express determination by γ-radiation of cesium radionuclides in water, soil, food and agricultural products using the RUB-01-P6 radiometer.
8. Determination of ^{137}Cs contamination of the territory using the RUB-01-P6 radiometer.
9. Determination of the content of ^{137}Cs in the human body using the RUB-01-P6 radiometer.

SOCIAL ECOLOGY

Department of General Ecology, Radiobiology and Life Safety

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	**Rakoid O.O., PhD**
Term	**3rd course (6th semester)**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

The key objective of social ecology is to improve the coexistence of human beings and the natural environment on a systematic basis. This course presents a holistic view on social ecology, which studies the spatial and temporal characteristics of the interaction between society and nature.

Purpose of mastering the discipline "Social Ecology" is the study of the leading theories and concepts of sustainable development of modern society, formulated in the works of national and foreign authors; acquire a deep knowledge and true competence in the problems of socio-natural character, formation on this basis an ecological worldview and responsible attitude to the environment.

Objectives of social ecology are the laws of interaction between society and nature, mechanisms to reduce environmental pollution, maintaining ecological balance, as well as legal and socio-cultural conditions for sustainable development.

Lectures:

1. Social ecology: subject, methods, principles and laws.
2. Socio-ecological interaction and its subjects.
3. The history of the relationship between human and nature.
4. Causes and signs of the modern crisis of the Nature-Society system.
5. Human behaviour in the natural and social environment.
6. Human health as a comprehensive indicator of the state of human society.
7. Socio-demographic aspects of social ecology.
8. Ways to harmonize the relationship between human and nature.

Classes:

(practical, laboratory classes)

1. Sociological approach in the study of ecology. Social ecology laws.
2. The concept of the human environment and its main elements. Ecology of the living environment.
3. The relationship between society and nature in the history of civilization.
4. Environmental crisis: its meaning, development phases and signs. Socio-ecological problem and its contradictions. Development models and possible scenarios for overcoming the global environmental crisis.
5. The concept of behaviour. Biochemical, biophysical and informational levels of behaviour regulation. Characterization of environmental needs.
6. The impact of socio-environmental factors on human health. The concept of "healthy lifestyle".
7. Ecology and demography. Socio-demographic problems of Ukraine.
8. Ecological society as a type of social structure. The concept of sustainable development of nature and society.

SOIL SCIENCE WITH THE BASICS OF SOIL CONSERVATION

Soil Science and Soil Conservation Department

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Yuriy Kravchenko**
Term	**3**
Major	**Bachelor**
ECTS credits	**3**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

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.

Lectures:

1. The Earth and geological processes.
2. Soil formation and soil processes.
3. Soil classification, taxonomy and morphology.
4. Soil physics.
5. Soil chemistry.
6. Zonal soils of Ukraine.
7. Azonal and intrazonal soils of Ukraine.
8. Theoretical basics of soil conservation.
9. Mechanical degradation.
10. Physical degradation.
11. Chemical degradation.
12. Physico - chemical degradation.
13. Biological degradation.
14. Reclamation of technogenic degraded soils.
15. Soil conservational management.

Classes:

(practical, laboratory classes)

1. Diagnostics of Physical Properties of Minerals.
2. Forms (categories) of soil water. Soil hygroscopic moisture determination.
3. International pipette method of soil texture determination.
4. Soil organic matter determination.
5. Soil acidity and cations determination.
6. Soils of Ukraine.
7. Land degradation and its evaluation.
8. Water erosion evaluation.
9. Wind erosion evaluation.
10. Contour – ameliorative land management.
11. Calculations of CO_2 emission and humus balance.

URBAN ECOLOGY

Department of Agrosphere Ecology and Environmental Control

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Vagaliuk Liudmyla**
Term	
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours, individual work – 60 hours)**

Subject overview

This course is part of the Bachelor specialization within the educational program “Ecology”. Goal of the course will be to understand how interactions between humans and the environment drive and are driven by the built environment especially in the context of the physical and biological.

Learning objectives are physical and biological factors that drive the ecology of urban areas.

Learning outcome of course is the student's ability as a specialist: gain a wider understanding of urban ecological and environmental issues ranging from biodiversity to climate resilience and appreciate potential approaches for cities to deal with ecological and environmental challenges and threats of climate change. Enhance abilities and skills relating to evaluation of environmental and social impacts of urban development.

Lectures:

1. Urbanization. The urban environment.
2. Geographic environment of the city.
3. Soil structure.
4. Types of land and relief pollution.
5. The water environment of city.
6. Ground water of urban territory. Pollution.
7. Drinking water consumption of city.
8. Types of water pollution and sources of pollution of urban territory.
9. The air environment of city.
10. The air pollution of city.
11. Urban microclimate.
12. Plant improvement of city.
13. Classification of urban plantations of Ukraine.
14. Role flora and fauna in urban ecosystem and lives of urban population.
15. Anthropogenic and urban landscapes.

Classes:

(practical, laboratory classes)

1. Coal and environment.
2. Determination of the relationship between food, fuel and solar energy for certain regions.
3. Volume of municipal water supply.
4. The nitrogen containing compounds in waste water.
5. Determination of the effects of different doses of toxic hazardous metals on physiological parameters of plants.
6. Determination of water content in soil samples.
7. Sanitary and hygienic evaluation of green plants in populated territories.