

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN
"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"**

Approve
NJSC "Saken Seifullin Kazakh
Deputy Chairman of the Management
Board Academic Activity-Rector
_____ A.M Abdyrov.
« _____ » _____ 2021.

CATALOG OF ELECTIVE COURSES

For students in groups of educational programs

Agroecology

Nur-Sultan, 2021

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN
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Brief description of elective disciplines of the educational program

Zoology

1	Name of course	Sustainability and Agroecosystem Management
2	Code of course	URUA 4208
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	4
8	Prerequisites	General Ecology
9	Postrequisites	Pregraduation practice
10	Course summary	Own methods of analyzing ecological processes in agroecosystems, setting specific tasks and priorities for protecting the environment and society, knowledge on the laws of development of the biosphere and the conditions of anthropogenic and technogenic impact on nature and the agricultural sector; To be able to analyze the processes occurring in the components of the biosphere, agricultural sector and use the methods of detection and quantification of the main pollutants in the environment, to develop environmental measures for sustainable development and management of agroecosystems
11	Learning outcomes	Sustainable development and management of agroecosystems, the nature and specificity of methods for analysis, assessment and prediction of pollution in the agricultural sector. Features of the organization of monitoring of different hierarchical levels. Methodology for organizing the collection of environmental information for a comprehensive assessment of pollution in the agricultural sector. Determination of the degree of anthropogenic and technogenic impact on the environment. Determining the quality of the natural environment at the local, regional and global levels. Interpretation of information data using modern information systems for predicting environmental pollution with the goal of sustainable development and management of agroecosystems, rational nature management and environmental safety.

1	Name of course	Ecological safety of agricultural products
2	Code of course	EBS 4206
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	4
8	Prerequisites	General ecology, General chemistry
9	Postrequisites	Ecological monitoring, Ecological, Hygienic Rationing and Expertise in Agriculture
10	Course summary	Various pollutants of environmental objects (water, air and soil) and their impact on agricultural products. Features of the organization of environmental monitoring of different hierarchical levels. Methodology for organizing the collection of information for a comprehensive assessment of agricultural pollution. Assessment of the degree of anthropogenic impact on agricultural territories. Interpretation of information data and organization of forecasting pollution of agricultural land territories to ensure food and environmental safety.
11	Learning outcomes	To study the theoretical aspects and identify the nature of the pollution of agricultural land located near the agricultural sector. Own methods of analysis of the assessment of environmental objects (water, air, soil) of agricultural land located near the agricultural sector. To be able to analyze the processes occurring in the components of the biosphere. Use methods for the detection and quantification of major agricultural pollutants. To be able to practically apply knowledge on agroecological monitoring to assess the quality of the natural environment to predict changes in environmental sustainability to anthropogenic and technogenic effects..

1	Name of course	Integrated water resources management
2	Code of course	IUVR 3306
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	3
8	Prerequisites	General Ecology, Green Economy and Climate Change
9	Postrequisites	Organic farming, Economy of nature using
10	Course summary	The composition and structure of the hydrosphere. The value of the hydrosphere. The value of the oceans. Fresh water distribution. The formation of the chemical composition of natural waters. The state of water use by sectors of the economy in the world and Kazakhstan. Problems of anthropogenic pollution of the hydrosphere. Use and protection of water resources of the Republic of Kazakhstan. Prospects for sustainable water supply. Water quality and water uses. Classification of water treatment methods. The legal basis for the use of water resources of the Republic of Kazakhstan. Tasks and principles of water legislation of the Republic of Kazakhstan.
11	Learning outcomes	Know: the importance and functions of the hydrosphere, the distribution of fresh water on Earth, the chemical composition and structure of natural waters, the problems and sources of anthropogenic pollution of water resources, international water quality standards, the principles of environmental monitoring of surface waters in the Republic of Kazakhstan, methods of treating natural and waste waters and types of treatment facilities, the legislative framework for the protection and rational use of water resources, standards for the quality of natural waters, effective methods for treating industrial and waste water to comply with established of established environmental standards. To be able to: draw conclusions about the state and methods of protecting water resources, operate on acquired knowledge and apply them in the process of professional activity, determine substances that pollute natural waters. Own: methods for determining the composition and properties of natural and wastewater, rules for standardizing water quality and water consumption

1	Name of course	Ecological methods of analysis in the agricultural sector
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2	Code of course	EMAA 4207
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	4
8	Prerequisites	General ecology, General chemistry
9	Postrequisites	Environmental monitoring, Ecological, hygienic rationing and expertise in agriculture
10	Course summary	Introduction to environmental analysis methods. Methods of controlling the degree of environmental pollution. Methods for determining the quality of agricultural and industrial products. Modern physicochemical methods. General characteristics of environmental analysis methods in the agricultural sector. Optical analysis methods. Absorption spectroscopy. Refractometric and polarimetric methods of analysis. Emission spectral analysis. Conductometry. Potentiometry Coulometry Polarography. Chromatography.
11	Learning outcomes	To have an idea of each the features of each method, the intricacies of the operation of modern devices, for which it is necessary to know the device structure and the principles of their operation. To know and understand the basics of qualitative and quantitative analysis, natural and human impacts on the environment of the agricultural sector. To be able to conduct laboratory experiments with environmental objects, for which you need to master the instrumental methods of analysis. To acquire practical skills in the preparation of solutions of acids, salts and alkalis, the selection and preparation of samples for analysis; perform quantitative chemical analysis.

1	Name of course	GIS technology in agriculture
2	Code of course	GTSH 4308
3	Cycle of course	AS
4	Amount of credits	5

5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	4
8	Prerequisites	General ecology
9	Postrequisites	Ecological, hygienic rationing and expertise in agriculture, Methods of processing and recycling agricultural waste
10	Course summary	Introduction to GIS technology. GIS and agriculture. The basics of cartography. Maps and agroecology. Volumes and variety of cartographic products. Large-scale and small-scale maps. Thematic cartographic materials. Remote shooting. Modern directions of ecological and geographical research for the agricultural sector. Agroecotourism and cartographic training
11	Learning outcomes	As a result of studying the discipline, students should know the features and specifics of the main cartographic projections and distortions characteristic of small-scale ecological and geographical maps. Features of the creation and use of environmental maps. To be able to apply methods of studying and using ecological-geographical maps. Perform basic cartometric and graphical work on cards. Build and analyze plans, profiles, cartographic grids and maps using various construction methods. Own methods of processing, analysis and synthesis of field and laboratory environmental information and use theoretical knowledge in practice.

1	Name of course	Protection and rational use of biological resources in rural areas
2	Code of course	ORIBRST 3205
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	3
8	Prerequisites	General ecology, Ecology of plants, animals and microorganisms
9	Postrequisites	Economy of nature using, Environmental Laws and Documentation in Agriculture

10	Course summary	The phenomenon of biodiversity, species richness and factors of its formation. The concept of biodiversity and its interpretation. Modern views on biological diversity. Convention on Biological Diversity. Modern areas of research on the assessment, conservation of biological diversity. The concept of a systematic approach to the study of the organization of living. Levels of biological systems: species - population - ecosystem - biome. The idea of the interconnectedness and interaction of living systems at different levels. Genetic diversity. View as a universal biodiversity unit. Species diversity. Ecosystem diversity. Aspects of biodiversity conservation. Tasks in the field of biodiversity conservation. The concept of agrobiodiversity. Cartagena Protocol on Biosafety. Nagoya Protocol. Man-made biodiversity. Ex situ and in situ conservation. Centers of origin of crops. Food Security and Agrobiodiversity of Kazakhstan. Sustainable agrobiodiversity under climate change. Strengthening human and technical capacity to preserve valuable agrobiodiversity. Monitoring as a system for obtaining information on the state of biodiversity in all its manifestations in order to assess its change. Biodiversity monitoring as part of environmental monitoring. Key Trends in Biodiversity.
11	Learning outcomes	As a result, the student must: know: - about the terminological apparatus and the basic concepts of discipline; - theoretical and methodological foundations of resource science; - main groups, types of agricultural resources (economically useful plants, mushrooms, animals); - synanthropic plant bioresources of Kazakhstan; - measures for the conservation and rational use of agricultural resources of Kazakhstan; be able to: - correctly apply the basic terms and concepts; assess the status and dynamics of biodiversity, predict changes in diversity under the influence of natural and man-made factors; - determine and justify operating standards for various groups of plant and animal resources, measures for environmental optimization of sustainable use of natural resources; - apply modern experimental methods of working with agrobiological objects in the field and laboratory conditions. own: - independently determine the types of agricultural resources of the area: - carry out the counting of plants and animals of agricultural significance. - methods of analysis and assessment of biodiversity at different levels of the organization of the biosphere; methods for monitoring and protecting biodiversity; own methods of search and exchange of information in global and local computer networks.

1	Name of course	Ecology of plants, animals and microorganisms
2	Code of course	ERZhM 2204
3	Cycle of course	BS
4	Amount of credits	7
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	2
8	Prerequisites	General ecology
9	Postrequisites	Ecological biogeography

10	Course summary	<p>The history of the study of ecologists of plants, animals and microorganisms. The main methods for studying the ecology of plants, animals and microorganisms. Ecological classifications of organisms. Life form of plants, animals and microorganisms. General issues of the stability of organisms. Some patterns of environmental factors. The body's defensive reaction against stressors. Light as an environmental factor. Lighting mode. Quantitative and qualitative characteristics of lighting accepted by organisms. Ecological groups of plants in relation to light. Anatomical and morphological characteristics of plants in relation to light. The influence of light on the structure, growth, development, photosynthesis, transpiration of plants. Ecological groups of animals in relation to light. Photoperiodism and its environmental significance. Heat as an environmental factor. The temperature regime of the habitat. The effect of temperature on the vital functions (growth, development, photosynthesis, respiration, transpiration) of plants. Ecological plant groups according to Ellenberg. The effect of temperature on the livelihoods of animals. Ecological groups of animals in relation to temperature. Poikilothermic and homeothermic organisms. Adaptation of plants, animals and microorganisms to extreme temperatures. The rules of K. Bergman and D. Allen. Water as an environmental factor. The main properties of the aquatic environment. Morphological, anatomical and physiological adaptation of plants to water deficiency. Ecological groups of plants in relation to humidity. The environmental significance of transpiration. Factors affecting transpiration. Ecological groups, adaptive features of aquatic organisms. Air as an environmental factor. Environmental values of oxygen and carbon dioxide. The effect of pollution on plants. Assessment of pollution by vegetation. Anemophilia, anemochoria, draining by the wind, mechanical injuries. Methods of movement of animals in the air and in the soil. Soil as an environmental factor. The main properties and ecological significance of the soil. Ecological groups of plants in relation to soil pH. Salinization of the soil. Psammophytes and lithophytes. Methods of movement of soil organisms. The spread of microorganisms. The importance of microorganisms in ecosystems. Biological rhythms of organisms. Inner and outer loops. Daily, seasonal rhythms and rhythms of ebb and flow. Biotic environmental factors. The relationship of organisms in the biocenosis. Ecological niche. Gause principle. Ecological succession. Anthropogenic environmental factors. Anthropogenic habitat change. Features of agrocenoses and ruderal communities.</p>
11	Learning outcomes	<p>The student must know: - the place and role of the ecology of plants, animals and microorganisms, as a science; - resistance to exposure to plants, animals and microorganisms to the effects of adverse factors; - temperature, light, air, water, soil, biotic and anthropogenic factors as an environmental factor affecting plants, animals and microorganisms; - Features and patterns of distribution of plants, animals and microorganisms; - the use and diversity of resources of the plant, animal world and microorganisms. be able to: - understand the mechanisms of the influence of environmental factors on plants, animals and microorganisms; - understand the processes of interaction of organisms with each other; - determine the necessary resources and conditions for the comfortable functioning of living organisms; - collect, process and interpret using modern technologies the data necessary for understanding the discipline being studied. own: - methods of searching for information in the field of ecology of plants, animals and microorganisms; - skills of a meaningful discussion of the problems that are reflected in this discipline; - the skills of students to form ideas about the processes of interaction of organisms with each other and with the environment; - skills of using theoretical and practical knowledge on the ecology of plants, animals and microorganisms in professional activities.</p>

1	Name of course	Economy of nature using
2	Code of course	EP 4305
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	ecology
7	Year	4

8	Prerequisites	General ecology
9	Postrequisites	Methods of processing and recycling agricultural waste, Pre-graduation practice
10	Course summary	Introduction to environmental economics. Natural science and economic foundations of environmental economics. General characteristics of the natural resource potential of the Republic of Kazakhstan. The main environmental problems of the Republic of Kazakhstan. The content of existing economic mechanisms for environmental management. Problems and prospects of development of the environmental management system of the Republic of Kazakhstan. Environmental protection in the Republic of Kazakhstan. Natural resource potential of the Republic of Kazakhstan. Fuel and energy and mineral resources of the Republic of Kazakhstan. Effective ways of rational use of natural conditions and resources. Environmental protection and economics. Consideration of environmental, socio-economic consequences of the interaction of nature and society.
11	Learning outcomes	Have an idea of the negative effects caused by industrial enterprises. Ecologization of technological industrial enterprises, the use of knowledge gained in their activities. Assess the environmental status of industrial sites. Use the basic methods of environmental assessments of the state parameters of natural-technical systems. Carry out calculations and predict changes in environmental sustainability to anthropogenic impact. Ecology as a theoretical basis for nature conservation and rational nature management. To be able to analyze the processes occurring in the components of the biosphere; identify, identify and anticipate the negative impact caused by industrial enterprises; greening technological industrial enterprises. Fundamentals of nature management and environmental protection, methods of economic assessment of natural resources, basic concepts and categories of environmental economics. Comprehensive economic assessment of natural resources, taking into account environmental protection. Effective management of natural resources and the use of income from the primary sector of the Republic of Kazakhstan. The use of an integrated approach in the study of economic problems of environmental management.