

**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

Soil science and agrochemistry

Nur-Sultan, 2021

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

Inorganic and organic chemistry

1	Name of course	Basis of Land regulation
2	Code of course	OZ4204
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Agrometeorology, soil science
9	Postrequisites	General geology, fundamentals of soil science, landscape science, Agrochemistry, regional system of agriculture, soil mapping, compilation of electronic-digital soil maps and agrochemical cartograms
10	Course summary	The doctrine of the earth as a natural resource, means of production and real estate. Land reform of the Republic of Kazakhstan. Land Fund of the Republic of Kazakhstan. The concept of a plan, profile, map. Methods for calculating areas. Instruments and devices for linear and angular measurements. Terrain. Modern land management. The concept, tasks and content, forms and principles of land management. Types of land management. Inter-farm land management. The concept of land use and land ownership.. Types of MXZ. Features of the design and formation of non-agricultural land use. (land allocation). On-farm land management. Components of the project of on-farm land management. Structure of the arable territory. Organization of the crop rotation system. Determination of types and types of crop rotations and the arrangement of their territory.
11	Learning outcomes	To know and understand the principles, requirements, methods and main ways of rational use of land, about land management, its tasks for the territorial organization of production, land relations and land cadastre, forms of land ownership and types of land use in the Republic of Kazakhstan, the concept of land use and land ownership, land management process – the composition and sequence of actions during land management.

1	Name of course	Mechanization of agricultural production
2	Code of course	MP3206
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	3
8	Prerequisites	Plant biology, fundamentals of soil science, landscape science
9	Postrequisites	Zonal system of agriculture, crop production, soil mapping, compilation of electronic-digital soil maps and agrochemical cartograms
10	Course summary	The general structure of tractors and cars. Working and auxiliary equipment. Technical and economic indicators of tractors and cars. The general structure of agricultural machines. Machines for tillage. Machines for applying fertilizers. Machines for sowing and planting crops. Organizational forms of the use of machinery in agriculture. Machine-tractor unit. Organizational and technological preparation of production of field mechanized works. Technology of cultivation of agricultural crops and its technical support. Harvesting and transport process in crop and vegetable growing. Features of the use of machines in soil protection agriculture.
11	Learning outcomes	The ability to assess the quality of work and the effectiveness of the use of technical means of mechanization.

1	Name of course	Integrated plant protection
2	Code of course	IZR3208
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	3
8	Prerequisites	Plant biology, inorganic and organic chemistry, plant physiology, microbiology, fundamentals of soil science
9	Postrequisites	Agriculture, fertilizer application system, compilation of electronic-digital soil maps and agrochemical cartograms
10	Course summary	The content of the discipline includes the general goals and objectives of the study of the discipline, the chemical method in the integrated plant protection system; the basics of agronomic toxicology, the physico-chemical basics of the use of pesticides; Chemical means of plant protection against pests, diseases and weeds, the biological method of plant protection; physical-mechanical and genetic methods of plant protection; agrotechnical method and phytosanitary monitoring of the development and spread of harmful organisms; plant quarantine.
11	Learning outcomes	Compliance with safety measures when using plant protection products; the use in practice of methods for identifying pests and pathogens of plant diseases, their diagnosis, the correct choice and application of a set of plant protection measures, work with scientific, technical, regulatory and other documentation in the field of plant protection.

1	Name of course	Biology of plants
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2	Code of course	BR2214
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	School education in biology
9	Postrequisites	Crop production, Fundamentals of soil science, Agrochemistry, Agriculture, Fertilizer application system
10	Course summary	Fundamentals of cytology and histology of plant organisms. The structure of vegetative and generative organs of plants. Morphology and anatomy of the root, stem and leaf. Reproduction. Vegetative, asexual and sexual reproduction and their biological significance. Types of reproduction; features of alternation of asexual and sexual generations of plants. Fundamentals of systematics of lower and higher spore gymnosperms and flowering plants. Department of Angiosperms. Distinctive features of the Dicotyledonous and Monocotyledonous classes, characteristics of families and their most important representatives.
11	Learning outcomes	Master the skills of plant morphological analysis

1	Name of course	General Geology
2	Code of course	OG2216
3	Cycle of course	BD
4	Amount of credits	5

5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Inorganic and organic chemistry, physcolloid and analytical chemistry, plant biology
9	Postrequisites	Fundamentals of soil science, landscape science, soil mapping
10	Course summary	Geology as the science of the Earth, its content and significance. Earth and space. The structure, composition, and age of the Earth. The material composition of the Earth's crust. Elements of the structure of the earth's crust and soil-forming sediments. Internal or endogenous processes. External or exogenous processes. Underground waters, their geological role and significance in agriculture. Relief and its significance in soil formation. The main stages of the history of the development of the Earth's crust and the earth's surface. Elements of geology in the countries of the Commonwealth of Independent States and the Republic of Kazakhstan. The main tasks of geology in agriculture
11	Learning outcomes	Have skills in communication about the origin of the Earth, its properties and composition, about minerals and rocks, endogenous and exogenous processes, weathering processes. Skills in the field of teaching about the influence of geological processes on soil formation and landscape formation; features of the development of the earth's crust in the Quaternary period, the study of geological maps

1	Name of course	Plant physiology and biochemistry
2	Code of course	FBR2218
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Plant biology, inorganic and organic chemistry, analytical and physcolloid chemistry
9	Postrequisites	Agrochemistry, crop production, agriculture

10	Course summary	Goals and objectives, subject and methods of study, history. Plant cell physiology. Metabolism and the role of enzymes in it. ATP pathways of formation and use. Vitamins. Synthesis and breakdown of proteins, carbohydrates, and lipids. Plant respiration. Water regime of various ecological groups of plants: hygrophytes, mesophytes, xerophytes. Adaptations of plants to the extraction of water. Carbon nutrition of plants. Photosynthesis. Influence of external conditions on the intensity of photosynthesis of an aquatic plant. Root nutrition of plants. Methods of studying mineral nutrition. Plant growth and development. Physiological bases of plant resistance. The relationship and regulation of physiological processes in the plant. . General concept of plant biochemistry. Plant cell biochemistry. Biochemistry of nutrient accumulation of grain crops. Adaptation and resistance of plants to unfavorable factors. Biochemistry of crop formation.
11	Learning outcomes	Be able to justify the values of physiological and biochemical phenomena as a theoretical basis for a system of techniques aimed at increasing plant productivity, improving the quality of agricultural products, independent search, analysis and evaluation of research, the ability to be creative in professional activities, the ability to continue training in the field of plant physiology and biochemistry in the educational programs of the master's degree.

1	Name of course	Microbiology
2	Code of course	M2220
3	Cycle of course	BD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Plant biology, inorganic and organic chemistry, analytical and physcolloid chemistry.
9	Postrequisites	Soil microbiology, soil biology, biochemistry, soil bioremediation
10	Course summary	Systematics, morphology, and reproduction of bacteria. Genetics and selection of microorganisms. Microorganisms and the environment. Physiology, metabolism, and energy in microorgan-isms. Nutrition of bacteria. Mechanisms. Conversion of carbon compounds by microorganisms. The main fermentation and oxidation processes. Conversion of carbon compounds by microorganisms. The main fermentation and oxidation processes. Participation of microorganisms in the cycle of nitrogen, phosphorus, iron, and potassium. Soil microbiology. The influence of agricultural practices on soil microorganisms. The relationship of soil microorganisms and plants. Microbiological earth-fertilizing preparations and plant protection products. Micro-biology of feed.

11	Learning outcomes	Have the ability to compare, formulate conclusions, build their own arguments, express and justify their position. Be able to analyze the key problems of microbiology and effectively use the beneficial properties of microorganisms in different areas of production.
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1	Name of course	Compilation of electronic soil maps and cartograms
2	Code of course	SEPKK4304
3	Cycle of course	BD
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	4
8	Prerequisites	Fundamentals of Soil Science, Agrochemistry, Soil mapping, Agro-soil science, General Geology, Landscape science, Computer science, information and communication technologies
9	Postrequisites	Agroecological assessment of land, Application of fertilizers in irrigated agriculture, System of application of fertilizers
10	Course summary	The importance of geoinformation systems in soil science and agrochemistry; soil mapping; study and creation of a database in geoinformation systems; interpretation of materials from remote sensing of the Earth; preparatory stage of large-scale soil survey and agrochemical survey; organization of work on soil and landscape mapping and agrochemical survey; mapping of the structure of soil cover; conducting small-scale and medium-scale soil mapping; creation of electronic soil maps; features of soil mapping in different natural zones; creation of electronic agrochemical cartograms; creation of a soil sketch and a register of agrochemical data.
11	Learning outcomes	Master the skills to discuss issues and conduct work on digital technologies in soil science and agrochemistry; be able to use innovative processes in soil science and agrochemistry; practical skills in complex analysis of remote sensing data, using geoinformation (GIS) technologies in soil science and agrochemistry; acquire practical skills in analyzing remote sensing data, using modern software packages.

1	Name of course	Fundamentals of soil science
2	Code of course	OP2219
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Inorganic and organic chemistry, General Geology, Plant Biology
9	Postrequisites	Agro-soil science, Soils of Kazakhstan and soil protection, Agrochemistry
10	Course summary	History of the development of soil science in the CIS and Kazakhstan. The general scheme of the soil-forming process and the factors of soil formation. Mineralogical, granulometric, and chemical composition of soils. General physical and physico-mechanical properties of the soil. Soil structure, and their impact on soil fertility. The organic part of the soil and its origin. Soil colloids and soil absorption capacity. Water, air, and thermal properties and modes of soils. Soil solution and redox processes and soil fertility. Genesis, nomenclature, and classification of soils. Characteristics of the main types of soils of the Republic of Kazakhstan (chernozems, chestnut, saline, brown, gray-brown, gray-earth and mountain soils), and ways to increase fertility.
11	Learning outcomes	Correctly identify the soils and give them an accurate name according to the accepted classification. Know the characteristics of agronomically valuable properties of soils and methods of their assessment; optimal parameters of soil regimes for the preservation and extended reproduction of organic matter. Be able to: lay sections on the ground and highlight soil contours, make cartograms, soil sketches. Develop agro-production grouping of farms and the basics of soil protection from erosion. To give a comparative assessment of the impact of traditional and innovative moisture-saving technologies on the soil.

1	Name of course	Landscape Studies
2	Code of course	Lan 3221
3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	3
8	Prerequisites	Biology, Botany, Ecology, Physics, Geography, Chemistry, Soil Science, General geology
9	Postrequisites	Plant physiology and biochemistry, soil geography, soil mapping, soil-agrochemical mapping. Compilation of electronic and digital soil maps and agrochemical cartograms, soils of Kazakhstan and soil protection
10	Course summary	Subject, methods and tasks of landscape science; Geosystem concept; Factors of differentiation of landscape environment; Morphological structure of geosystems and landscapes; Functional and dynamic aspects of landscape development; Systematics and classification of landscapes; System of taxonomic units; Landscape physical and geographical zoning; Anthropogenic landscapes; Landscapes of Kazakhstan; Geoecological assessment of landscapes at the regional and local level.
11	Learning outcomes	Have the skills to discuss the state of the soil cover and ways to improve soil fertility; classification and ecology of the main types of soils, to express their own point of view on the peculiarities of the use of soil resources in the national economy. Identify the main types of modern landscapes; to determine the factors of landscape differentiation of the earth's surface and the patterns of integration of elementary structural units (facies) into more complexly organized physical and geographical complexes (geocomplexes) and to show their variability over time through dynamic categories (development, state, natural regimes); the use of GIS technologies in landscape agriculture.

1	Name of course	Zonal farming system
2	Code of course	ZSZ2201
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Agriculture, soil science, botany, plant physiology, agrometeorology, agrochemistry, biology and machine use in agriculture
9	Postrequisites	When writing a thesis
10	Course summary	History of soil bonitization. Development of land resources accounting in the USSR. Soil bonification in foreign countries. Development of soil bonitization in Kazakhstan. Soil fertility. Potential and effective soil fertility. Principles and methods of soil bonification. Theoretical foundations of soil bonitization. Differential rent. Criteria of soil bonitization. Land cadastre. Methods for obtaining soil bonus points. Bonitization of non-irrigated soils. Bonitization of irrigated soils. Results of soil bonitization. Economic assessment of land. Soil and environmental assessment.
11	Learning outcomes	The student must master the skills to compare, form conclusions about the rational and efficient use of land, increase soil fertility and increase crop productivity. Be able to analyze and solve problems of agricultural production.

1	Name of course	Agriculture
2	Code of course	Z2213
3	Cycle of course	BD
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	2
8	Prerequisites	Fundamentals of Soil science, Inorganic and organic chemistry, Plant biology, Plant Physiology
9	Postrequisites	Fundamentals of Soil science, Inorganic and organic chemistry, Plant biology, Plant Physiology
10	Course summary	The main stages of the development of agriculture and relations with other sciences, Factors of plant life and their interrelation, laws of agriculture, Agrophysical properties of soil and methods of their regulation, Living conditions of agricultural plants and methods of their regulation, Water, air, food and heat regimes of soils and methods of its regulation. Soil erosion and control measures, Weeds and control measures, The scientific basis of crop rotation, the concepts and meaning of crop rotation. Classification of crop rotations and principles of constructing crop rotation schemes, Repeated crops and their significance. Introduction and development of crop rotations. Scientific basis of tillage. Tasks and technological operations, techniques and tools of tillage. Basic and pre-sowing tillage. Processing of steam fields. Resource-saving tillage system, advantages and application conditions. Modern farming systems: Precise, biological, adaptive landscape, resource-saving farming and their features. Soil protection agriculture and its theoretical foundations and practical techniques.
11	Learning outcomes	Correctly apply in practice measures to optimize the living conditions of plants, elements of the zonal system of agriculture, keeping a book of the history of fields, make reports on field work, analyze and summarize the results of the production process.

1	Name of course	Agrometeorology
2	Code of course	A3222

3	Cycle of course	BD
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Soil science and agrochemistry
7	Year	3
8	Prerequisites	Plant biology, Fundamentals of soil science, Soil biology
9	Postrequisites	Agrochemistry, Fertilizer application system, Compilation of electronic-digital soil maps and agrochemical cartograms
10	Course summary	The main methods of the research object. The influence of meteorological factors on the development of agriculture. The main meteorological elements and their influence on the growth and development of agricultural crops. Observations of meteorological elements, methods of their implementation. Overview of meteorological elements. Weather forecast. Adverse meteorological phenomena and control methods for agriculture. Agrometeorological observations, forecasts and their use in agriculture. Features of the climate in Kazakhstan.
11	Learning outcomes	Master the methods of climatic and meteorological characteristics, assessment of the conditions of the growing season of plants and forecasting of adverse meteorological phenomena, as well as methods of effective use of climate and microclimate resources when performing mechanized work in agriculture.