

**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

Agronomy

Nur-Sultan, 2021

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

Brief description of elective disciplines of the educational program

Veterinary genetics with the basics of biostatistics

1	Name of course	Professional oriented foreign language
2	Code of course	POIYa 3205, POIYa 3230 (POIYa 3201, POIYa 3231, POIYa 3232)
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Foreign language, Professional foreign language
9	Postrequisites	Disciplines of the basic and profiling cycle in English
10	Course summary	The modern concept of agronomy combines a set of sciences of cultivation of plants at the lowest cost of labor and money, increasing their productivity, improving the quality of crop production, increasing soil fertility, rational use of agricultural land. Agronomic sciences include: general farming; crop production; breeding and seed production; agrochemistry; plant protection from pests, diseases and weeds. In this regard, these terms should be distinguished and used correctly agronomically. Lexical minimum of foreign special terms 2000-3000 units by sections. Grammar: basic parts of speech; structure of simple and compound sentences; basic word formation patterns. Reading: introductory, searching, exploring and viewing. Dialogical and monological speech. Development of skills in writing a coherent presentation of thought, reasoning, and information. Translation of professional texts from a foreign language into native language. Listening comprehension of informational and professional messages.
11	Learning outcomes	to know: a foreign language in the volume necessary for the possibility of obtaining information of professional content from foreign sources; a vocabulary in the volume of 4000 academic lexical units of general and terminological character; grammar of a foreign language; history and culture of the country of the studied foreign language; rules of speech etiquette; to be able to: read original literature on the specialty in a foreign language to obtain the necessary information; use knowledge of a foreign language in professional activities; have the skills: presentation in a foreign language to the extent necessary to obtain information from foreign sources; written argumentative presentation of his/her own point of view; public speaking, conducting discussions and polemics.

1	Name of course	The Python language and data analysis
2	Code of course	YaPAD 2231, YaPAD 2207 (YaPAD 2204, YaPAD 2235)
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Higher mathematics, biomathematics, physics, computer science
9	Postrequisites	Statistical analysis and data visualization
10	Course summary	The course is an in-depth study of Python data structure, examines classical programming paradigms and the Numpy library for solving linear algebra problems and implementing its algorithms; students use this knowledge to solve applied problems. Introduction to SQL queries and Web database applications.
11	Learning outcomes	- Development and consolidation of programming skills in Python. - Formation and development of skills to work with specialized libraries for data processing, visualization and analysis (pandas, numpy, scipy, sklearn, plotly, matplotlib). - Development of skills of work with data: collection, processing, visualization, exploratory analysis. - Mastering the terminology of machine learning and introduction to basic algorithms - Development of skills in setting the research problem and hypothesis testing using quantitative methods. - Development of presentation skills of the results obtained (preparation of the report on the work done and oral defense of the research). - Can apply in different branches of natural science, agriculture, forestry and biology, obtaining a systematic fundamental education

1	Name of course	Statistical analysis and visualization of data
2	Code of course	SAVD 3206, SAVD 3232 (SAVD 3203, SAVD 3236)
3	Cycle of course	BD
4	Amount of credits	3
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Higher mathematics, biomathematics, physics, computer science
9	Postrequisites	Special disciplines of the respective curricula
10	Course summary	The course focuses on working with databases using the Pandas data analysis library and the R programming language for statistical calculations, a geospatial data processing package, and using Scilab for numerical analysis, and using these tools to solve specific problems in agriculture and bioresources.
11	Learning outcomes	- Formation and development of skills to work with specialized libraries for data processing, visualization and analysis (pandas, numpy, scipy, sklearn, plotly, matplotlib). - Development of skills of work with data: collection, processing, visualization, exploratory analysis. - Development of presentation skills of the obtained results (drawing up a report on the work done and oral defense of the research). - Can independently analyze their data, basic calculation formulas related to both traditional statistical criteria and modern methods (different types of regression, smoothing algorithms, generalized and structural models, MGUA, models with mixed effects, etc.).

1	Name of course	Information technologies in crop production
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2	Code of course	ITR 4203 (ITR 4253)
3	Cycle of course	BD
4	Amount of credits	2
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Fundamentals of Land Management, Soil Science, Agrochemistry, Agricultural Mechanization, Tractor Fleet Operation, Agrometeorology, Plant Production, Biology, Fruit and Vegetable Production, Forage Production.
9	Postrequisites	Graduate projects (works) Bachelor's Degree
10	Course summary	Technological approaches to the implementation of precision farming in agricultural enterprises. Positioning systems. Features of the application of GIS in agriculture, the main functions and examples of geographic information systems. Parallel driving systems. Multifunctional display. Steering device. Mapping of fields in the precision farming system. Conducting an agrochemical survey. Application of fertilizers in precision farming. Differentiated fertilizer application. Plant protection in precision farming. Normalized Difference Vegetation Index NDVI (Normalized Difference Vegetation Index). Application of information and communication technologies in crop production. Agronomist's chart. Calculation of the cost and payback period of implementation of precision farming technologies in the agricultural enterprise.
11	Learning outcomes	- Formation and development of skills to work with specialized libraries for data processing, visualization and analysis (pandas, numpy, scipy, sklearn, plotly, matplotlib). - Development of skills of work with data: collection, processing, visualization, exploratory analysis. - Development of presentation skills of the obtained results (drawing up a report on the work done and oral defense of the research). - Can independently analyze their data, basic calculation formulas related to both traditional statistical criteria and modern methods (different types of regression, smoothing algorithms, generalized and structural models, MGUA, models with mixed effects, etc.).

1	Name of course	Basics of Agribusiness and Entrepreneurship
2	Code of course	OAP 4204 (OAP 4316)
3	Cycle of course	BD
4	Amount of credits	4

5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Basics of Economic Theory and Law, Political Science, Mechanization of Agriculture, Soil Science, Agrochemistry, Operation of Tractor Machines, Basics of Land Management, Agrometeorology, Crop Production, Fruit and Vegetable Production, Feed Production, Information Technology in Crop Production.
9	Postrequisites	Graduate projects (works) Bachelor's Degree
10	Course summary	Agribusiness: the concept, the essence, the main types and organizational forms. Resource provision of entrepreneurial activity in the agricultural sector. Business planning in the system of agribusiness. Features of marketing research of the agrarian market. Risks in agricultural business. Financing in agribusiness. Leasing and factoring. Staffing in entrepreneurial activity. Organization of service of agribusiness. Organizing business deals. Responsibility of agribusiness entities. Culture and ethics of entrepreneurship. Analysis and evaluation of the effectiveness of entrepreneurial activity. State support for agribusiness and infrastructure. Termination of entrepreneurial activity.
11	Learning outcomes	To know: mechanisms of functioning of firms and enterprises of various organizational-legal forms, which is an integral part of his professional education, which will allow making more effective decisions in the implementation of entrepreneurial activity; be able to: apply the acquired knowledge to build an effective system of business creation and have the competence necessary to develop arguments and solve problems in the field of study; have practical skills in organizing entrepreneurship; to organize entrepreneurial activity and evaluate its effectiveness.

1	Name of course	General Biology of Organisms
2	Code of course	OBO 1212, OBO 2241, OBO 2242 (OBO 1229, OBO 2245, OBO 2246)
3	Cycle of course	BD
4	Amount of credits	7
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Basic school knowledge of biology

9	Postrequisites	Microbiology, Plant Physiology and Biochemistry, Plant Systematics, Botany, Agricultural Biotechnology, Agrometeorology, Ecology and Fundamentals of Life Safety, Crop Protection. Herbology, Farming, Crop Production, Fruit and Vegetable Production, Forage Production.
10	Course summary	Basics of cytology and histology of plant organisms. Structure of vegetative and generative organs of plants. Morphology and anatomy of root, stem and leaf. Reproduction. Vegetative, asexual and sexual reproduction and their biological significance. Types of reproduction; peculiarities of alternation of asexual and sexual generations of plants. Basics of systematics of lower, higher sporadic gymnosperms and flowering plants. The Division of the Covered Seeds Plants. Distinguishing features of the Dicotyledonous and Monocotyledonous classes, characteristics of families and their most important representatives. Phytocenology. The concept of phytocenosis. Agrophytocenosis. The concept of flora and vegetation. Elements of plant ecology phytogeography and geobotany.
11	Learning outcomes	know: the peculiarities of the structure, importance, origin, location and distinctive features of the cell structure of plant tissues; structure and importance of vegetative and reproductive organs of plants; distinctive features of plant divisions and biological features of their most important representatives; characteristic of the families of angiosperms, widely distributed and important in Kazakhstan; features of flora and vegetation of Kazakhstan; be able to: describe and analyze the structure of vegetative and reproductive organs of plants; identify plant species by the set of diagnostic features; determine the species structure and condition of phytocenoses; know: the methods of morphological analysis of plants.

1	Name of course	Introduction to the specialty
2	Code of course	VS 1229 (VS 1230)
3	Cycle of course	BD
4	Amount of credits	2
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Chemistry, Fundamentals of Ecology, Fundamentals of Life Safety
9	Postrequisites	Crop production, farming
10	Course summary	Agronomy. History and development of agronomy. Soil fertility and yield. Conditions of plant life and methods of regulating them. Systematics of plants. Weed plants and measures to control them. Scientific bases of soil cultivation. Nourishment of plants and system of fertilizers in crop rotations. Technology of cultivation of agricultural crops. Crop cultivation technology. Scientific basis of crop rotation. Improvement of steam cultivation technology in Northern Kazakhstan. Ameliorative measures in cropping system.

11	Learning outcomes	To know: general principles of farming, theory and practice of field crops in all their variety taking into account soil-climatic and economic conditions of zone, on agrotechnical requirements to processes of mechanization of production; to be able: to conduct independent search, analysis and estimation of professional information, ability to be creative in professional activity. To have skills: application of farming techniques, contributing to the preservation and improvement of soil fertility and efficiency of fertilizer application, soil protection from erosion allowing to increase the crop yields of agricultural crops.
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1	Name of course	Forage production
2	Code of course	Kor 4307
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Biology, Microbiology, Plant Systematics, Plant Genetics, Soil Science, Agrochemistry, Mechanization of Agriculture, MTP Operation, Crop Protection, Crop Production, Farming, Agrometeorology.
9	Postrequisites	Crop Breeding and Seed Production, Crop Storage and Processing Technology, Fundamentals of Agribusiness and Entrepreneurship, Bachelor's Degree Projects (Works)

10	Course summary	Forage production as a section of science and branch of agriculture, its tasks in creating a fodder base. Economic and botanical groups of fodder crops. Requirements of fodder grasses to moisture, heat, light, air and soils. Renewal and herdability of plants. Phases of vegetation. Nutritive value of plants and their assessment by chemical composition. Edibility, digestibility and assimilability of grasses by domestic animals. Phytotopological classification. Fluctuations and succession. Inventory and passportization of natural forage lands. Conservation measures. Conditions for surface improvement. Conditions for making radical improvement. Selection of species of grass for grass mixtures, taking into account environmental conditions and the nature of their use, their sowing. Care for grass seeding. Cover and no cover grass sowing. The importance of pastures and pasture forage. Basic requirements for pastures. Systems of pasture use and methods of grazing. Creation of cultural pastures, their equipment and use. Green conveyor and its types. Technologies of preparation of loose, crushed and pressed hay. Technology for making haylage. Technology for making silage. Preparation of grass meal, pellets and briquettes. Quality grass meal and storage.
11	Learning outcomes	To know: the main species of fodder plants and their economic characteristics; types of forage lands and features of their operation; systems of improvement of forage lands and equipment used to carry out these activities; principles of grass mixtures for hay and pasture use; current care of grasslands of hay and pastures; physiological and biochemical processes occurring in the preparation of different types of forages - hay, silage, haylage; be able to: organize cattle grazing (pasture rotation); organize a green conveyor in terms of a particular farm; forage harvesting for the period of stabling animals; have skills: advanced technologies of fodder preparation; knowledge of preparation of vitamin meal, briquetted grass cutting, cellular hay, twig silage, twig meal.

1	Name of course	Horticulture
2	Code of course	Plo 4309
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Biology, Plant Genetics, Agricultural Biotechnology, Soil Science, Agrochemistry, Farm Mechanization, Tractor Fleet Operation, Crop Protection, Agrometeorology.
9	Postrequisites	Crop Breeding and Seed Production, Crop Storage and Processing Technology, Fundamentals of Agribusiness and Entrepreneurship, Bachelor's Degree Projects (Works)
10	Course summary	History, importance of fruit growing, the classification of morphological, biological and productive, peculiarities of growth and fruiting of fruit plants, the biological basis of their reproduction, fruit nursery, the value and their structure, the technology of laying a fruit garden. Shaping the crown of fruit trees, pruning, types of pruning. Features and objectives of vegetable production, biological characteristics of vegetable crops, vegetable crop rotations and crop rotations, seeds and methods of pre-sowing treatment, methods of growing seedlings, cropping patterns of vegetable plants, agrotechnics of growing vegetable plants, machinery and tools for growing and harvesting of vegetable plants.

11	Learning outcomes	Know: the way of development of fruit crops, production-biological and morphological classification, features of growth and fruiting, technology of planting an orchard, organization of fruit nursery, pruning and formation of fruit trees; role of vegetables in the national diet, biological and morphological features of vegetable crops, methods of pre-sowing seed preparation, vegetable crop rotations and crop rotations, construction of buildings in the protected ground; be able to: distinguish fruit crops according to biological and morphological features, make a plan for establishing a fruit garden, multiply fruit crops, do pruning and form the crown of fruit trees; prepare seeds for sowing, grow seedlings, calculate the area of plant nutrition, care for vegetable crops and harvesting; have skills to organize agro-technical work in the orchard and fruit nursery, control the work being done, determine the quality, plan the amount of work, improve knowledge; pre-sowing seed preparation, seedling growing methods, sowing seeds, care of vegetable crops.
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1	Name of course	Technology of storage and processing of crop products
2	Code of course	THPRP 4308
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Biology, Microbiology, Plant Systematics, Crop Protection, Crop Production, Farming, Agrometeorology.
9	Postrequisites	Bachelor's Degree Projects (Works)
10	Course summary	Requirements for the quality of crop products. General principles of storage of agricultural products. Theory and practice of storage of seed grain and food and forage funds. Processing of grain and oilseeds. Storage of potatoes, vegetables and fruits. Processing of potatoes, vegetables and fruits. Storage and processing of sugar beets. Basics of mixed fodder production. Basics of storage and primary processing of plant fibers. Demonstrate knowledge of quality requirements for crop products and methods of their evaluation, use modern methods and modes of primary processing, storage, storage and processing of crop products
11	Learning outcomes	Know: the main objectives in the field of storage and processing of crop production; the requirements for the quality of crop production; ways to improve the quality of crop production during storage and processing; methods of quality assessment of crop production; modes and methods of storage of crop products used in agriculture; basics of crop production processing. to be able to: make a plan for the placement of crop production in the storage facilities taking into account the quality; work with processing and processing machines of agricultural type; analyze samples of agricultural products according to state standard requirements; determine the quality of crop products; keep quantitative records of crop products during storage; sell crop products taking into account the qualitative indicators.

1	Name of course	Basics of thermodynamics and electromagnetism
2	Code of course	OTE 2210, OTE 2237, OTE 2238 (OTE 2206, OTE 2241, OTE 2242)
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	2
8	Prerequisites	Basics of physics, chemistry, mathematics in high school, basics of mechanics, elements of mechanics of liquids and gases
9	Postrequisites	Agrometeorology, Soil Science, Ecology and Fundamentals of Life Safety, Atmospheric Air Protection, Rational Use of Natural Resources in Agriculture.
10	Course summary	Basic concepts, research methods and parameters of thermodynamic systems. Equilibrium and nonequilibrium processes. Reversible and irreversible processes. Polytropic processes. Entropy. Second beginning of thermodynamics. Transfer phenomena. Basic problem of electrostatics. Gauss theorem. Capacitors. Electric and magnetic fields. Ohm's laws. Electromagnetism. Elements of geometric and wave optics. Elements of quantum optics. Elements of atomic and nuclear physics.
11	Learning outcomes	Ability to summarize, analyze, perceive information, set goals and select ways to achieve them, use basic laws of soil physics in solving the problems encountered. Ability to collect and analyze scientific and technical information, consider modern development trends and use achievements of domestic and foreign science, engineering and technology in professional activity.

1	Name of course	Biophysics
2	Code of course	Bio 3211 (Bio 3207)
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Basics of physics, chemistry, high school mathematics, mechanics, basics of thermodynamics and molecular physics, electromagnetism, optics.
9	Postrequisites	Ecology and Fundamentals of Life Safety, Atmospheric Air Protection, Agrometeorology, Soil Science Rational Use of Natural Resources in Agriculture.
10	Course summary	Physical processes in the soil and atmosphere. Elements of physics of the atom, atomic nucleus and elementary particles. Elements of quantum electronics. Radioactive radiation and its types. Nuclear reactions and their main types. Elements of elementary particle physics. Elements of dosimetry.
11	Learning outcomes	Ability to summarize, analyze, perceive information, set goals and select ways to achieve them, use basic laws of soil physics in solving the problems encountered. Ability to collect and analyze scientific and technical information, consider modern development trends and use achievements of domestic and foreign science, engineering and technology in professional activity.

1	Name of course	Soil science
2	Code of course	Poch 3219
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Biology, Microbiology, Inorganic and Organic Chemistry, Agrometeorology
9	Postrequisites	Agrochemistry, Mechanization of agriculture, Crop protection. Herbolgy, Farming, Crop Production, Fruit and Vegetable Production, Forage Production
10	Course summary	History of soil science development in CIS and RK. General scheme of soil formation process and factors of soil formation. Mineralogical, granulometric and chemical composition of soils. General physical and physical-mechanical properties of soil. Structure of soils, and their impact on soil fertility. Organic part of soil and its origin. Soil colloids and absorption capacity of soil. Water, air and thermal properties and regimes of soils. Soil solution and redox processes and soil fertility. Genesis, nomenclature and classification of soils. Characteristics of main types of soils of RK (chernozems, chestnut, saline, brown, gray-brown, gray-brown and mountainous soils), and ways to improve soil fertility.
11	Learning outcomes	know: characteristics of agronomically valuable properties of soils of regions of Kazakhstan and methods of their assessment, optimal parameters of soil regimes for preservation and expanded reproduction of organic matter be able: to define soils and give them exact name according to accepted classification; to lay out ground sections and mark out soil contours, make cartograms, soil sketches have skill: to develop agro-productive grouping of farm soils and basics of their protection from erosion.

1	Name of course	Machine usage in agriculture
2	Code of course	MSH 3222
3	Cycle of course	BS

4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Biology, Microbiology.
9	Postrequisites	Agrochemistry, Crop Protection. Herbology, Farming, Plant growing, Fruit and vegetable growing, Forage production, Technology of storage and processing of plant products
10	Course summary	Technological basics of mechanization of crop production. Machines and working tools for basic and surface tillage. Machines for sowing and planting crops. Combined units and machines. Machines with active working bodies. Machinery for fodder application, protection of plants from pests and diseases, fertilizers, for planting, cultivation, harvesting and storing of crops. Machines, units and complexes after harvesting and storage of crops. Land reclamation and irrigation machines.
11	Learning outcomes	know: the purpose, general structure, working principle and basic technical characteristics of basic models of tractors and cars, the purpose, general structure, working principle, preparation for work and evaluation of the quality of basic models of agricultural machinery. to be able to: organize the work and assess the quality of machines and units, determine the need for mechanization, labor and operating materials, know the principles of structure and operation of technical means used in the production of crop production; use modern agricultural machinery and equipment of domestic and foreign production; make a technological map of cultivation of crops, to calculate the need of the economy in seeds, fertilizers, pesticides, fuels and lubricants Have the skill to: staffing, planning and organizing the use of units and machine-tractor fleet; be able to choose energy and technical means, prepare them for work.

1	Name of course	Agrochemistry
2	Code of course	Agr 3221
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3

8	Prerequisites	Biology, Microbiology, Inorganic and Organic Chemistry, Agrometeorology, Soil Science, Mechanization of Agriculture, Crop Protection
9	Postrequisites	Farming, Plant growing, Fruit and vegetable growing, Fodder production, Technology of storage and processing of plant growing products
10	Course summary	Chemical composition of plants and crop quality. Plant nutrition and methods of its regulation. Classification of mineral fertilizers, their production and application. Nitrogen, phosphorus, potassium, complex fertilizers, micro fertilizers. Organic fertilizers. Bacterial fertilizers. Technology of storage, preparation and application of fertilizers. Environmental problems of agrochemistry. The basic principles of the system of fertilizers and its objectives. Methods for calculating doses of fertilizers. The system of fertilizer crops in field, forage and vegetable crop rotations. Balance of nutrients in the soil. Economic and energy assessment of fertilizers..
11	Learning outcomes	know: the role of the main elements of nutrition in plant life and the need for them to form a crop; - agrochemical properties of soils and ways to improve soil fertility; features of nutrition and fertilization of field, forage, vegetable, fruit crops, hayfields and pastures, methods of calculation of economic and energy efficiency of fertilizers. to be able to: use in practice the results of agrochemical research; organize the storage and use of organic, mineral and lime fertilizers in specific production conditions; develop and justify a system of fertilizers for the farm, crop rotation, land, culture; have the skill: to use soil and plant diagnostics of crop nutrition; agrochemical methods of analysis of soil, organic and mineral fertilizers; method of calculation of agronomic, economic and energy efficiency of fertilizers application.

1	Name of course	Basics of Scientific Research
2	Code of course	ONI 3249
3	Cycle of course	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Biology, plant physiology and biochemistry, soil science, agrometeorology, technological disciplines (farming, agrochemistry, plant growing)
9	Postrequisites	Mechanization of Agriculture, Crop Protection, Crop Production, Horticulture, Forage Production.

10	Course summary	Experimental methodology as a subject. The importance of experiment for the solution of practical problems. Requirements imposed on the researcher. A brief historical sketch of s.-h. experimental business. Types of research institutions. Research methods used in scientific agronomy. Observation, experiment. Characteristics of research methods. Statistical method. The requirements for a field experiment. Natural and agro technical typicality. The basic elements of the methodology of the field experiment. Methods of placement of variants in experiments (statistical, randomized, method of Latin square, standard). Influence of elements of methodology on the accuracy of field experiment (number of variants, form and area of a plot. Number of repetitions, level of fertility of experimental plot, methods of placement of variants, orientation of plots in relation to relief, roads, forest belts. Planning of field experiment. Development of working hypothesis, setting the goal and objectives, research program and methodology, agrotechnics in the experience Schematic plan. Transferring the experience to the field. Working plan of experience Methods of yield record in field experiments. Features of yield accounting by crops (grain, silage, root crops, tuber crops, annual and perennial grasses.). Production experience. Tasks, peculiarities of laying and carrying out. Observations, yield accounting, economic and agro technical evaluation of the results Primary processing of yield data. Basic methods of static processing of experimental data. Statistical characterization of quantitative variability. Analysis of variance, correlation, regression. Analysis of variance on the data of a single-factor experiment. Straight-line correlation. Dot plot. Regression analysis Writing a scientific report on the results of field experience. Agro technical and economic evaluation of the results. Recommendations for production. Advocacy and implementation of the results of field experience. Agro technical and economic evaluation of the results. Recommendations for production Promotion and implementation of research results. Brief rules of presentation and design of scientific papers.
11	Learning outcomes	know: -modern methods of scientific agronomy; -basic elements of field experiment methodology; -basic principles of data processing of field experience -the influence of the methodology of the field experience on its error. To be able to: -rightly choose the land plot for the experiment; -plan, lay and conduct multi-year single-factor and multi-factor experiments; -keep documentation and reporting of field experience; know how to - Techniques for setting up a field experiment; Techniques for planning experiments; -How to plan an experiment Methods of yield record-keeping; -Methods of preliminary processing of experimental data; Principles of processing multi-year data of field experiments.

1	Name of course	Basics of Seed Science in Field Crops
2	Code of course	OSPK 3315, OSPK 3305
3	Cycle of course	AS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Biology, Plant Genetics, Agricultural Biotechnology, Soil Science, Agrochemistry, Farm Mechanization, Tractor Machines Operation, Crop Protection, Agrometeorology
9	Postrequisites	Crop Production, Fruit and Vegetable Production, Fodder Production, Crop Selection and Seed Production
10	Course summary	The importance of seed science in the development of agricultural production. The subject and objectives of seed science, its relationship with other disciplines. The process of formation, filling and maturation of seeds. Post-harvest ripening, respiration of seeds, germination. Resting of seeds. Biological and economic longevity of seeds. Influence on the quality of seeds of environmental conditions: agricultural technology, postharvest treatment and other reasons. Standards (GOSTs) for the sowing qualities of seeds. Storage conditions and methods to improve the quality of seeds. Field germination and ways to improve it. Economic and environmental effectiveness of seed quality in agricultural production..

11	Learning outcomes	Know: the role of seeds in increasing the yield of agricultural crops; yield and sowing qualities of seeds largely depend on growing conditions of plants and their agrotechnics requirements to the quality of seeding material of field crops; issues of legislative and regulatory base of seed science, organization and implementation of seed control to be able to: analyze and argue the results of the evaluation of productive potential of a variety, batch of seeds, seed quality prediction on the root; form the basis for assessing the productive potential and technology for sowing of analyzed seeds, to acquire practical skills of identification and control of sowing and yielding properties of seeds have skills: to improve the quality of seeds, reducing their losses
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1	Name of course	Crop Breeding and Seed Production
2	Code of course	SSSK 4306
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	4
8	Prerequisites	Biology, Plant Genetics, Agricultural Biotechnology, Soil Science, Agrochemistry, Farm Mechanization, Tractor Fleet Operation, Crop Protection, Agrometeorology, Plant Production, Fruit and Vegetable Production, Forage Production.
9	Postrequisites	Bachelor's Degree Projects (Works)
10	Course summary	Variety. Source material and methods of its creation. Analytical selection. Synthetic selection. Experimental mutagenesis and its use in breeding. Polyploidy and haploidy in plant breeding. Heterosis and its use in plant breeding. Inbreeding. The use of biotechnology in plant breeding. Methods of selection and evaluation of breeding material. Organization of the breeding process. State variety testing and zoning of varieties and hybrids. Seed production. Organization of seed production of individual crops in modern conditions. Variety and seed control in seed production of field crops. Variety change and variety renewal.

11	Learning outcomes	To know: about modern methods of breeding; the value of source material, master breeding methods, methods of evaluation of varieties, testing and introduction into production and preparation of high-quality variety material; organization of variety testing and use; schemes and methods of obtaining elite seeds; be able to: create a collection of source material, work and set the task of obtaining more valuable varieties, be directly involved in the study of methods and techniques of breeding; select the source material of plants for breeding and seed works; conduct approbation of crops, fill out documents in breeding and seed production; grow elite seeds of field crops; have skills: to select source material, conduct selection in hybrid generation, conduct scientific research according to the methods used in plant breeding; use methods of haploid and cellular breeding, cell and chromosomal engineering to get the source material for creating new varieties and hybrids.
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"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"

Brief description of elective disciplines of the educational program

Biotechnology of microorganisms

1	Name of course	Physico-chemical methods of research
2	Code of course	FHMI 3217
3	Cycle of course	AS
4	Amount of credits	3
5	Level of preparation	Undergraduate
6	Department	Farming and crop production
7	Year	
8	Prerequisites	Mechanics, continuum physics, inorganic and organic chemistry, analytical and physical chemistry, higher mathematics, biomathematics, cytology, general biology of organisms, genetics, ontogeny and phylogeny
9	Postrequisites	Agrometeorology, Soil science, Agrochemistry, Plant protection against pests and diseases, Farming, Crop production, Crop storage and processing technology
10	Course summary	Methods of separation and concentration, chromatographic methods of analysis. Spectroscopic methods of analysis. Electrochemical methods of analysis. Kinetic, biochemical and biological methods of analysis. Fundamentals of chemometrics and chemical metrology, Analysis of real objects.
11	Learning outcomes	As a result of mastering the material of the year the student should be competent to orient in the main modern methods of separation and concentration used in chemical analysis; to represent the meaning and areas of application of these methods; the main ways of their improvement. He should have a clear idea of which methods of separation and concentration are appropriate for sample preparation and analysis of various objects.

