

**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

Breeding and seed production

Nur-Sultan, 2021

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

Technology, hygiene and veterinary sanitary examination of meat and dairy products

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	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
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	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
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	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
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	BS
4	Amount of credits	2
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	4
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	General Biology of Organisms
2	Code of course	OBO 1212, OBO 2241, OBO 2242 (OBO 1229, OBO 2245, OBO 2246)
3	Cycle of course	BS
4	Amount of credits	7

5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	1, 2
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. Herbolgy, 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	BS
4	Amount of credits	2
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	1
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.

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 studies
6	Department	Farming and crop production
7	Year	3
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.
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1	Name of course	Methods of mathematical modeling
2	Code of course	MMM 3215, MMM 3234, MMM 3235 (MMM 3208, MMM 3239, MMM 3240)
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Higher mathematics, biomathematics
9	Postrequisites	Biometrics, mathematical modeling of complex biological systems, GIS technology in agriculture
10	Course summary	Fundamentals of error theory; numerical methods for solving systems of linear algebraic equations; numerical differentiation; numerical solution of ordinary differential equations; numerical methods for solving boundary value problems for partial differential equations; basic modeling concepts; models described by autonomous differential equation and systems of autonomous differential equations; living systems and active kinetic environments.
11	Learning outcomes	uses in the practice of scientific research concepts and methods of mathematical modeling, the study of general and private methods of mathematical description of natural phenomena; - has practical skills of applying the basics of mathematical apparatus for solving theoretical and applied problems, the ability to translate the solution of practical problems into the language of logic. - is able to compare, formulate problem statements, build his/her own method of solution, prove and justify the correctness of his/her reasoning; - in the field of communication - personality formation, development of intellect and abilities of logical and algorithmic thinking; - is able to apply methods of mathematical modeling in various branches of natural science, agriculture, forestry and biology, obtaining a systematic fundamental education.

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	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	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.

1	Name of course	Bioinformatics
2	Code of course	Bio 4205
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	Биология, Информатика, Генетика растений, Сельскохозяйственная биотехнология
9	Postrequisites	Bachelor's Degree Projects (Works)
10	Course summary	Introduction to bioinformatics. Subject, tasks and objects of bioinformatics. Recent advances in molecular biology and genetics that have necessitated the development of bioinformatics. Information technologies used in bioinformatics. Systems approach in bioinformatics.
11	Learning outcomes	Know: - History of bioinformatics development, principles and methods of gene, protein, and cellular engineering; - methods of basic and applied research in biological informatics; - Modern problems of molecular biology solved using computer programming and modeling. To be able to: - Process the experimental data obtained; - Utilize the accomplishments of previous historical stages; - Demonstrate a basic understanding of bioinformatics technologies and apply them in practice; - Critically analyze the information obtained and present research results. Have the skills to: - Critically analyze and evaluate current scientific advances, as well as methods of generating new ideas when solving practical problems, including interdisciplinary areas. - Create artificial genetic systems with given properties.

1	Name of course	Cell technologies in crop production and breeding
2	Code of course	KTRS 3303

3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	3
8	Prerequisites	Biology, cytology, plant genetics, crop breeding
9	Postrequisites	Bachelor's Degree Projects (Works)
10	Course summary	Cultivation of biological objects. Technology of clonal micropropagation of plants. Haploid technology of plants. Cell technologies in creation of genetic diversity of initial forms. Obtaining of somaclonal variants with valuable features. In vitro technologies accelerating traditional breeding. Overcoming pro- and post-gamma incompatibility. Embryoculture. Preservation of in vitro gene pool.
11	Learning outcomes	know: -modern methods and techniques for growing plant cell cultures; - features of differentiation and growth of cells, patterns of organo- and morphogenesis of plants; -the possibility of using cellular technologies in research work and in solving problems of an applied nature in agriculture. be able to: - to select the source material of plants, to apply schemes for obtaining genetically new plant forms from various plant organs; -select and compose nutrient media at different stages of cultivation; -compose selection and genetic programs using non-traditional methods of cell technology. own: - methods of cultivation of plant cells and tissues, obtaining regenerants; - the most important methods of cloning valuable genotypes and creating forms with altered properties and genetic characteristics.

1	Name of course	Seed Science
2	Code of course	Sem 2305
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production

7	Year	2
8	Prerequisites	Biology, Plant Genetics, Agricultural Biotechnology, Soil Science, Agrochemistry, Farm Mechanization, Tractor Machines Operation, Crop Protection, Agrometeorology
9	Postrequisites	Crop Production, Horticulture, Feed 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 crops; - the role of seeds in increasing crop yields; yield and sowing qualities of seeds largely depend on growing conditions and farming techniques; - requirements for the quality of the seed of field crops. be able to: - analyze and argue the results of the evaluation of the yield potential of a variety, seed lot, seed quality prediction at the root. - form the basis for assessing the yield potential and sowing technology of the analyzed seeds. - Acquire practical skills to determine and control the sowing and yield properties of seeds. to possess: - ways to improve the quality of seeds, reducing their losses, as well as reducing the cost of labor and money for the cultivation of the crop; - to be competent: issues of legislative and regulatory framework of seed science, organization and implementation of seed control.

1	Name of course	Basics of Farming
2	Code of course	OZ 3314
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 Physiology and Biochemistry, Soil Science, Crop Protection, Herbology. Mechanization of Agriculture.
9	Postrequisites	Agrochemistry, Plant growing, Fruit and vegetable growing, Fodder production, Technology of storage and processing of plant growing products

10	Course summary	Farming - the main branch of agricultural production, its tasks and objectives. Farming as a science, objects and methods of research. The role of farming among other agronomic disciplines and its characteristics. Systems of farming, periods of development, links. Scientific basis of farming, laws of farming, their application. Soil regimes, ways of regulating them in farming. Soil erosion, types, harmfulness, pattern of development, zones of distribution in Kazakhstan, measures to combat. Scientific basis of crop rotation, the reasons for alternation of crops. The role of fallows and intermediate crops in the crop rotation, the zones of their use in the country, the principles of compiling schemes of crop rotations according to modern requirements. Classification of crop rotations. Zonal features of crop rotations. Introduction and adoption of crop rotations. Scientific basis of tillage, goals and objectives. Technological operations and technological properties of soils, their impact on the quality of cultivation. Methods and methods of the main, pre-sowing, post-sowing and special methods of tillage, technique and tools for carrying out. Peculiarities of the system of tillage of fallows and lands subjected to soil erosion. Zero, minimum and rapid tillage. Agronomic and economic evaluation of tillage quality.
11	Learning outcomes	know: -tasks, features and laws of farming, ways of reproduction of soil fertility and optimization of plant conditions; -Biological features, classification of weeds and measures to control them; -scientific basis of crop rotations, crop precursors, -Classification and organization of crop rotations; -scientific basis, methods, techniques and systems of tillage, indicators and evaluation quality of the main types of field work; -Basic types of soil erosion and protection measures; -scientific bases of farming systems; be able to: -compose and implement in practice a system of agrotechnical and special measures to improve soil fertility and protect it from erosion; -Determine the species composition of weeds, make a map of weed infestation, - develop and implement a system of weed control measures; -Create schemes of crop rotations, plans of their development, give an agro-economic assessment; - compose and implement a system of rational, energy and resource-saving tillage, erosion protection system, control the quality of tillage and other field works; -develop and master farming systems for farms; possess: -methods of extended reproduction of soil fertility and optimization of plant conditions; -Techniques for recording the weed infestation of crops and developing a system of weed control measures; -Techniques for recording the weed infestation of crops and developing a system of weed control measures; -Skills in developing the optimal structure of sown areas, making schemes of crop rotations, determining their number and taking measures for their introduction and development Methods of energy-saving systems of cultivation for different types of soils in crop rotations; -methods of improving the basic elements of farming systems.

1	Name of course	Crop production with basic biology
2	Code of course	ROB 3311
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 Physiology and Biochemistry, Soil Science, Crop Protection, Herbology. Mechanization of Agriculture. Agrochemistry, Farming
9	Postrequisites	Horticulture, Fodder production, Technology of storage and processing of agricultural products

10	Course summary	Plant growing is the most important agronomic discipline, the main branch of agricultural production. Biology - the theoretical basis of crop production. Ecological and economic principles of the placement of major field crops in Kazakhstan. Seed material - one of the main means of production in crop production. Grain crops. The importance of spring and winter crops in increasing grain production. Morphological structure, biological characteristics, cultivation and harvesting technology. The main areas of grain production. Grain legume crops and their importance in increasing the production of vegetable protein. Biological characteristics, cultivation technology and peculiarities of harvesting grain legumes. Root crops, tuber crops and melons, their importance, distribution, biological features and technology of cultivation. The importance and use of oil-bearing and essential oil-bearing crops in agriculture. Morphobiological features and cultivation technology. Spinning crops, their diversity and use. Peculiarities of biology and cultivation technology. Tobacco and licorice. Features of the methods of cultivation.
11	Learning outcomes	know: -methodological approaches to the development of modern technologies of cultivation of field crops; -Methods of economic analysis of crop production.

1	Name of course	Biochemistry
2	Code of course	Bio 3209
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, Inorganic and Organic Chemistry, Microbiology, Plant Systematics
9	Postrequisites	Crop Protection. Herbiology, Farming, Plant growing, Fruit and vegetable growing, Forage production, Technology of storage and processing of plant products.
10	Course summary	Introduction. Aims and objectives, subject and methods of study, history. The general concept of plant biochemistry. Biochemistry of the plant cell. Biochemistry of accumulation of nutrients of cereal crops. Adaptation and resistance of plants to adverse factors. Biochemistry of crop formation.
11	Learning outcomes	know: the general laws of plant life and their dependence on environmental conditions; chemical composition of plants, properties and exchange of the main chemical components of cells, their biological and energy value; physiological and biochemical features of crop yield formation; mechanisms of plant resistance to cold, frost, drought, toxic gases, salinity, pesticides, radioactive radiation, biotic factors; be able to: explain and predict the course of physiological and biochemical processes depending on environmental conditions; manage the processes of plant life; determine the viability of plant tissues under the influence of various factors. Have the skill: skills of physiological and biochemical research; ways of increasing plant resistance to adverse environmental conditions.

1	Name of course	Modern methods of chemical analysis in breeding
2	Code of course	SMHAS 4310
3	Cycle of course	AS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	4
8	Prerequisites	Inorganic and organic chemistry, mathematics, physics, related disciplines in the specialty.
9	Postrequisites	Special disciplines of relevant curricula
10	Course summary	Introduction. Tasks and methods of chemical analysis in breeding. Qualitative and quantitative analysis. Modern methods of chemical analysis in breeding. Mathematical processing of the results of measurements. Methods of chemical analysis. Gravimetric (weight) method of analysis. Titrimetric (volumetric) method of analysis. Volumetric method of analysis by precipitation. Methods of oxidation-reduction in volumetric analysis (redoximetry). Perманганатометрия. Iodometry. Chromatometry and other methods.
11	Learning outcomes	know; -about modern methods of selection; -The meaning of the initial material, to master the breeding methods, methods of evaluation of varieties, testing and implementation in production and preparation of high quality varietal material; -organization of variety testing and use; -schemes and methods of getting the elite seeds. be able to; -to create a collection of source material, to work and set the task of obtaining more valuable varieties, to be directly involved in the study of methods and techniques of breeding; -Select the source material of plants for breeding and seed production works.

1	Name of course	Mathematical Methods in Biology
2	Code of course	MMB 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	Higher Mathematics
9	Postrequisites	Biomathematics, Mathematical Methods in Agriculture, Biometry, GIS Technology in Agriculture
10	Course summary	Functions of several variables; higher order differential equations; linear differential equations with constant coefficients; double and triple integrals; numerical series and their properties; alternating series; functional series; Fourier series; probability theory; mathematical statistics; discrete and continuous random variables.
11	Learning outcomes	- uses in the practice of scientific research concepts and methods of mathematical modeling, the study of general and private methods of mathematical description of natural phenomena; - has practical skills of applying the basics of mathematical apparatus for solving theoretical and applied problems, the ability to translate the solution of practical problems into the language of logic. - is able to compare, formulate problem statements, build his/her own method of solution, prove and justify the correctness of his/her reasoning; - in the field of communication - personality formation, development of intellect and abilities of logical and algorithmic thinking; - is able to apply methods of mathematical modeling in various branches of natural science, agriculture, forestry and biology, obtaining a systematic fundamental education.

1	Name of course	Statistical processing of experimental data
2	Code of course	SOED 4309
3	Cycle of course	AS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	Farming and crop production
7	Year	4
8	Prerequisites	Basics of Farming, Forage Production, Mechanization of Agriculture, Crop Protection
9	Postrequisites	Bachelor's Degree Projects (Works)
10	Course summary	Introduction (ueag overview). A general introduction to the content and composition of the ueag. Methods of statistical processing of the results of observations, analyses and accounts. Mean values. The general formula and properties of averages. Statistical characteristics of the sample population. Limits. Range of variation. Dispersion, standard deviation. Coefficient of variation. Differences between arithmetic mean. Error of variance. Ranked series of variation. Probabilistic analysis. Moda. Modal class. Histogram, polygon, cumulus, envelope. Asymmetry and kurtosis. Comparison of distribution curves. Transgression. Straight-line correlation. Coefficient of determination. Dot plot. Calculation of correlation ratio. Index of determination. Function and argument. Practical application of regression equations in agronomy and forestry.
11	Learning outcomes	Have an idea of:- of methods of selection of numerical indicators of varying objects of study, of obtaining statistical characteristics of a sample population for processing and analysis of numerical results of experiments, observations and accounts. Know: - Basic methods of mathematical statistics used in modern conditions in biology, scientific agronomy and breeding To be able to: - Apply the results of statistical processing, analysis of variance, correlation and regression for practical purposes. Have skills in: - Comparison, formulation of conclusions on the results of statistical processing of scientific data. Be competent: - In the field of agriculture, in the analysis of scientific data.

1	Name of course	Soil science and agrochemistry
2	Code of course	PA 3248
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, Mechanization of Agriculture, Crop Protection
9	Postrequisites	Farm Mechanization, Crop Protection. Herbology, Farming, Plant growing, Horticulture, Feed production, Technology of storage and processing of plant products. To give students theoretical knowledge and practical skills on regulation and management of the process of plant nutrition by scientifically based fertilizer application, taking into account soil properties, zonal farming systems, biological characteristics of crops, properties of fertilizers, climatic and other factors, in order to ensure a steady increase in productivity and quality of agricultural crops, increasing soil fertility, ensuring high efficiency and environmental safety of fertilizer application.
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 fertility. Chemical composition of plants and quality of yield. Nutrition of plants and methods of its regulation. Classification of mineral fertilizers, their production and use. 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 the use of fertilizers.
11	Learning outcomes	be able to: -define soils and give them an exact name according to the accepted classification; To be able to: -Locate soil sections on the ground and identify soil contours, make maps, soil sketches; -to use results of agrochemical studies in practical activities; -Organize storage and use of organic, mineral and lime fertilizers in specific production conditions; -develop and justify the system of application of fertilizers for the farm, crop rotation, land, crops; know: - characteristics of agronomic valuable properties of soils of regions of Kazakhstan and methods of their evaluation, -Optimal parameters of soil regimes for preservation and expanded reproduction of organic matter; -The role of the main elements of nutrition in the life of plants and the need for them for the formation of yield; -Agrochemical properties of soils and ways of increasing soil fertility; Peculiarities of nutrition and fertilization of field, fodder crops, vegetables and fruits; - Agrochemical properties of soils, ways of raising soil fertility vegetable, fruit crops, hayfields and pastures, methods of calculating the economic and energy efficiency of fertilizer application. possess: -develop agro-productive grouping of farm soils and the basics of protecting them from erosion; -soil and plant diagnostics of crop nutrition; - agrochemical methods of analyzing soils, organic and mineral fertilizers; -calculation methods of agronomic, economic and energy efficiency of fertilizers application.

1	Name of course	Seed breeding and varietal technology of crops
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2	Code of course	SSTSK 3315
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, Horticulture, Feed production, Crop cultivation
10	Course summary	Variety and its importance in agricultural production. The concept of variety and heterosis hybrid. Varieties of folk selection and breeding varieties. Classification of varieties by the method of derivation. The requirements of producers to the varieties creation of the model of the future variety. Technology of breeding process. State testing of agricultural crops. The basic provisions of the methodology of the State Variety Testing Commission. Theoretical bases of seed production The main tasks of seed production. Variety change and variety renewal. Multiplication factor. Rights and duties of seed producers. Insurance and transitional funds. Standard documentation for seeds. Production of elite seeds. Requirements for the quality of elite seeds. Methods of elite seeds production, the scheme of cultivation of elite seeds. Features of technology of cultivation of field crops for seeds, varietal and seed control, harvesting, postharvest handling, storage, selling, seed preparation for sowing. Organizational and agronomic precautions that contribute to the preservation of high varietal purity (typicality).
11	Learning outcomes	know: - The biological basis of seed formation and formation; - theoretical and experimental basics of seed production process organization - methods of singling out and using of varieties; - requirements to sowing and planting material; - requirements for seed and variety control; - requirements for calculations of seed growing areas; - the requirements for the registration of documents for variety crops; -State variety testing system, scheme of breeding State variety testing system, scheme of cereal crops breeding process, organization of primary and elite seed production; System of state service for quality control of seed and planting material; -System of state varietal testing; -System of state service for quality control of seed and planting material Basic techniques of post-harvest processing of seeds; - fundamentals of technology, management and economics of seed production in market conditions. to be able to: carry out varietal and seed control of seed-growing crops; -carry out calculations of seed growing areas; - work with documentation on varietal crops, seeds and planting material; - carry out individual and mass selection with evaluation of productivity elements, quality of production, variety and species weeding, phytopurification; - carry out cleaning, drying and sorting of seeds; - analyze and argue the results of evaluating the yield potential of the variety, seed lot, seed quality prediction at the root; - identify the reserves for improving the quality of the resulting seeds on the basis of comparing best practices. skills: - on methods and techniques for accelerating the seed production process, technology of high quality seed production, technology of post-harvest processing of seeds; Organization of work on growing high-quality varietal seeds and planting material, as well as the creation of the necessary amount of seed stock; Provide seed plots, agronomic measures for their care in order to obtain high quality seeds; - Provide approbation of variety seeds; - Involvement in the development of seed plots and agronomic measures for their care in order to obtain high quality seeds; -carry out approbation of variety crops; Organize timely harvesting of seed crops, backfilling of seeds, post-harvest processing of seeds, bringing them to high sowing conditions; -Organizes the proper storage and intended use of seeds. Organizes the production testing of new varieties; -Conduct work on variety replacement and varietal renewal of crop varieties, provide the accelerated introduction of new highly productive crop varieties and hybrids into production; -Keep records and established reports on seed production.