

**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

6B08201 Animal breeding

**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

Parasitology and invasive animal diseases

1	Name of course	Production management
2	Code of course	PM 3222
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Fundamentals of economics and law, philosophy
9	Postrequisites	Diploma work
10	Course summary	The role of medium and small enterprises in the economy of Kazakhstan. Organizational and legal forms of medium and small enterprises in the Republic of Kazakhstan. Problems of functioning of medium and small enterprises in modern conditions. Financial management of production activities of the enterprise. Organizational management structure in the enterprise. Product quality management in the enterprise in market conditions. Personnel management in medium and small enterprises.
11	Learning outcomes	As a result of studying this discipline, students should know the essence and characteristics of modern management, the history of its development; management features in the field of professional activity (by industry); be able to plan and organize the work of the unit; form organizational management structures; develop motivational policies of the organization; apply in professional activities techniques of business and managerial communication; own a decision making technique.

1	Name of course	Animal Physiology
2	Code of course	FZh 2219
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	School course in biology, zoology, genetics, biophysics
9	Postrequisites	Obstetrics and animal reproduction, breeding and selection of farm animals.
10	Course summary	Physiology of animals Theoretical and methodological foundations of physiology; mechanisms and patterns of activity of the autonomic functions of the body; qualitative differences in physiological functions in farm animals and birds; ethology of farm animals and birds; features and patterns of physiological processes and functions of individual body systems: nervous, sensory, endocrine, blood, blood circulation, respiration, etc.;
11	Learning outcomes	As a result of studying this discipline, students should know: the theoretical and methodological foundations of physiology; mechanisms and patterns of activity of the body's vegetative functions; qualitative differences in physiological functions in animals and birds; ethology of animals and birds; know: general biological patterns of application of physiological processes and mechanisms of regulation of function in animals, physiological constants of the body; to be able to determine the physico - chemical and morphological indicators of the internal environment and the functional state of the body, to investigate the functional state of the systems and organs of the whole organism, to produce conditioned reflexes in animals; have skills in the use of equipment for the clinical study of animals; in deciding on further therapeutic and prophylactic activities in the event of a change in the physiological functions of the body.

1	Name of course	Forage production with fundamentals of agronomy and botany
2	Code of course	KOAB 2218
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	Animal morphology; animal physiology; animal biochemistry.
9	Postrequisites	Feeding farm animals. Cultivation and selection of farm animals
10	Course summary	Feed production. Introduction Theoretical and practical fundamentals of fodder production as a science of obtaining high and stable yields of forage crops. Characteristics of the main natural forage lands. Improving natural grasslands and pastures. Technology of preparation and storage of feed. Botany. Plant cell Plant morphology. Plant reproduction. Basics of plant classification. Feed and feed additives. Evaluation of the nutritional value of feed and the scientific foundations of complete feeding of animals. Feed and feed additives. Basics of normalized feeding of animals of different species.
11	Learning outcomes	Students should be aware of the mechanical and physical properties of the soil, the intensive technology of cultivation of agricultural crops; main forage plants on hayfields and pastures; be able to identify harmful, poisonous and medicinal plants; to visually recognize plants of various economic-botanical groups and to have an idea of their basic biological, morphological, economic, feed properties and characteristics. Students should know: the origin, structure and principles of functioning of plant tissues; know and be able to use microscopic equipment to study the internal structure of organisms of various taxonomic groups; have the skills to prepare temporary and permanent preparations of organs and tissues and make their characteristics.

1	Name of course	Mechanization of livestock production
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2	Code of course	MPPZh 2220
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	Higher Mathematics, Biophysics, Mathematical Modeling in Animal Husbandry
9	Postrequisites	Feeding of agricultural animals, Production technology of animal husbandry products
10	Course summary	The course program is designed for the volume of teaching - 150 hours, of which: 50 hours - for classroom work and 100 hours - for independent work. Introduction General information about farms and complexes. Mechanization of water supply to livestock farms and pastures. Intrafarm transport. Mechanization of preparation and distribution of feed. Mechanization of milking. Machines and equipment for primary processing of milk. Mechanization of shearing and prophylactic sheep sale. Integrated mechanization of production processes. Maintenance of machinery and equipment on livestock farms and complexes. Electrified production processes in animal husbandry. Mechanization of animal husbandry in the conditions of farmer (peasant) farms.
11	Learning outcomes	As a result of studying the discipline, students should know: the classification, purpose, design, operation principle, technical characteristics, methods of using modern machinery and technological equipment of livestock farms, the prospects for their improvement in market conditions; be able to perform basic calculations of technological lines with the choice of machinery and equipment; manage the work of specific machines and devices; reasonably evaluate their technical and operational capabilities; organize the proper operation, maintenance and repair of technological equipment.

1	Name of course	The fundamentals of Veterinary science
2	Code of course	OV 2221
3	Cycle of course	BS
4	Amount of credits	4

5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	Zoology, animal biochemistry
9	Postrequisites	Cattle breeding, Poultry farming, Sheep breeding, Horse breeding
10	Course summary	Basics of veterinary medicine. Basics of pathology. Fundamentals of pharmacology. Methods for the clinical diagnosis of internal non-communicable and surgical animal diseases. Surgery. Basics of internal non-communicable diseases of animals and birds. Diseases of the breast. Obstetrics and gynecology. Infectious diseases. Basics of epizootology and parasitology. Organization of veterinary. Introduction Fundamentals of international activities in the field of livestock. Veterinary legislation of the Republic of Kazakhstan. Entrepreneurship in veterinary medicine. Veterinary funding. Basics of veterinary economics. Organization of state veterinary supervision. Veterinary office work. Planning veterinary activities.
11	Learning outcomes	students should know the legislative documents regulating veterinary activities; actual, more significant, non-communicable, some especially dangerous infectious diseases, their etiology, clinical picture, basis of diagnostics, preventive measures and the provision of first-aid assistance to animals; to be able to carry out veterinary, sanitary measures at the farm, aimed at preventing animal diseases and their treatment, at producing high-grade and safe veterinary products for animal husbandry; master the techniques of handling animals and the general methods of clinical research of a sick animal.

1	Name of course	Obstetrics and biotechnology of reproduction
2	Code of course	ABR 3224
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Animal morphology; animal physiology; animal biochemistry.
9	Postrequisites	Feeding farm animals; Cultivation and selection of farm animals

10	Course summary	Basics of obstetrics. The basics of animal reproduction. Fertilization, pregnancy and its diagnosis. Childbirth and the postpartum period. Pathology of pregnancy, childbirth and the postpartum period. Physiological features and diseases of the newborn. The doctrine of infertility and barrenness.
11	Learning outcomes	As a result of studying this discipline, students should know the structural and physiological characteristics of the sexual apparatus of females and males, during the sexual cycle; necessary conditions for the normal course of pregnancy, childbirth and the postpartum period, the causes of infertility, diseases of the mammary gland and newborns, as well as the technology of artificial insemination and embryo transfer; be able to identify sexual phenomena, the quality of sperm and embryos, artificially inseminate animals, determine pregnancy, diagnose infertility, prevent obstetric and gynecological diseases, assist with difficult births, independently solve and organize many issues related to animal reproduction; possess the technique of artificial insemination of animals, diagnosis of pregnancy, childbirth, prevention of obstetric and gynecological pathology, animal diseases.

1	Name of course	Informational system in animal husbandry
2	Code of course	ISZh 3225
3	Cycle of course	BS
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Feeding farm animals. Cultivation and selection of farm animals
9	Postrequisites	Work practice, thesis
10	Course summary	General information about the system IAS. Registration of zootechnical events in the IAS. Tribal reporting forms. Automated workplace
11	Learning outcomes	As a result of studying this discipline, students should know the information technologies in the production of animal products, methods for their integrated assessment and effective use, keeping zootechnical accounting and entering into the database in the IAS, computer programming of breeding work; be able to collect, process, analyze, synthesize and systematize scientific information, advanced domestic and foreign experience in the field of information technologies in animal husbandry in order to use new achievements in practical professional activities.

1	Name of course	Bee keeping
2	Code of course	Pche 3223
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Animal morphology; animal physiology; animal biochemistry.
9	Postrequisites	Feeding farm animals. Cultivation and selection of farm animals
10	Course summary	Introduction Biology of bees and their structure. The composition of the bee colony and its structure. Beehive and the structure of the bee family. Feeding bees. Breeding bees. Cultivation of bees in homestead farms. Breed bees. Pollination of agricultural plants. Diseases and pests of bees. Beekeeping organization.
11	Learning outcomes	As a result of studying this discipline, students should know the biological characteristics of honey bees, breeds and their productivity, breeding and keeping bees, honey resources of bees, bee-house buildings, beehives and beekeeping equipment, diseases and pests of bees, technology of beekeeping; be able to determine the structure of the beehive, the structure of the apiary and the equipment; master the skills of nectar in honey.

1	Name of course	Rabbit breeding.
2	Code of course	Kro 3226
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Animal morphology; animal physiology; biochemistry
9	Postrequisites	Feeding farm animals; Cultivation and selection of farm animals
10	Course summary	Introduction The value of rabbit breeding for the national economy, the history of the development of rabbit breeding, the state and prospects of development of rabbit breeding, the origin of domestic rabbits, the economic and biological characteristics of rabbits. Reproduction of a herd of rabbits. Breeding work in rabbit breeding. Feeding the rabbits. Breed rabbits. Rabbit products.
11	Learning outcomes	As a result of studying this discipline, students should know the characteristics of rabbits, the breed and their productivity, breeding and keeping rabbits, the technology for producing rabbit breeding products; be able to use the technology of growing rabbits of different breeds, to carry out breeding work in the rabbit breeding; have skills in determining the fatness of rabbits.

1	Name of course	Goat breeding, production technology of milk, meat, wool and cashmere
2	Code of course	KTPMMSHP 3306
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Animal morphology; animal physiology; animal biochemistry
9	Postrequisites	Feeding farm animals. Cultivation and selection of farm animals
10	Course summary	Introduction Biological features of goats. Exterior, constitution and fatness goats. Classification and characterization of the main breeds of goats. Goat production. Reproduction of the herd and rearing. Feeding goats Breeding work in goat breeding. Economic efficiency of goat production.
11	Learning outcomes	students should know the main areas of goat breeding, breed and pedigree groups of goats, exterior and constitutional features and types of goat breeding, methods of breeding and breeding and breeding work, technology of growing young stock in goat breeding, breed standards depending on the direction of productivity, issues of formation, accounting sales of products; master the technology of cutting and fluffing down goats, classifying wool, and classifying and standardizing goat raw materials, organizing goats and insemination of goats.

1	Name of course	Sport horse breeding
2	Code of course	SK 4309
3	Cycle of course	AS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	4
8	Prerequisites	Animal morphology; Animal physiology
9	Postrequisites	Feeding farm animals. Cultivation and selection of farm animals
10	Course summary	Breed sports horses. General training of horses. Natural and artificial gaits. Training and training of sports horses. Maintenance, feeding and care of sport horses. Veterinarian control of sport horses. Equestrian sport abroad and in Kazakhstan. Training horses. The general basis of training horses. The basis of preparation. Improving lateral flexion. Further development of jogging and bearing forces. Exercise and elements of medium and difficult levels. Transitions and added allures. Pirouette on step. Swing. Lateral movement.
11	Learning outcomes	students should know the history of equestrian sports in Kazakhstan and abroad, the biological and distinctive features of the main horse breeds for equestrian sports, the livestock, sports and biomechanical characteristics of horses, feeding rations, conditions of maintenance and training of sports horses, classic equestrian sports and national equestrian games; be able to determine the relationship of exterior features with the performance of the horse, to plan the training process in the preparation of riders and horses; own methods of training and testing horses, organize competitions in classical types of equestrian sport.

1	Name of course	Technical regulation of animal husbandry products
2	Code of course	TRPZh 2310
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	Chemistry, microbiology, animal morphology,
9	Postrequisites	Commodity research and examination of animal raw materials, technology of primary processing of raw materials of animal origin, technology of processing and storage of milk and meat, thesis
10	Course summary	Mastering ND and research methods for various types of products, independently determine product standards and perform tasks for documenting them. Be able to characterize trends in the technical regulation of livestock products and analyze the degree. Control over the implementation of the order and implementation of the rules of technical regulation.
11	Learning outcomes	Students ' mastery of the basic provisions of technical regulation systems, scientific and methodological foundations of standardization.

1	Name of course	Primary processing technology of animal origin raw materials
2	Code of course	TPOSZhP 4307

3	Cycle of course	AS
4	Amount of credits	10
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	4
8	Prerequisites	chemistry, microbiology, animal morphology, biochemistry, mechanization of the production of livestock products, zoohygiene with the basics of designing livestock facilities
9	Postrequisites	Diploma work
10	Course summary	Primary processing of raw materials of animal origin; development of progressive methods of primary processing, canning, storage and use of animal raw materials, processing of by-products and technical raw materials, beekeeping products, processing of fish products.
11	Learning outcomes	The student must have practical experience: accepting livestock, primary processing of livestock, placing meat in the chambers of the refrigerator; operation and maintenance of technological equipment for the primary processing of livestock; be able to: determine the fatness of livestock, monitor the preparation and transfer of livestock to processing shops; to conduct the processes of primary processing of cattle and small ruminants, to keep records of raw materials and processed products; know the requirements of the current standards for the processed livestock, own the method of technological calculations for carcass cutting processes.

1	Name of course	Processing and storage technology of milk and meat
2	Code of course	TPHMM 4308
3	Cycle of course	AS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production

7	Year	4
8	Prerequisites	Animal morphology; physiology of animals; biochemistry.
9	Postrequisites	Feeding farm animals; Breeding and selection of farm animals
10	Course summary	Milk and meat processing and storage technology Acquaintance with the technology of milk production. Acquaintance and study of the organization of milking cows. Solving problems in milk and beef production technology. Feeding animals. Livestock breeding methods. Bonitization of cattle. Selection and breeding work. Dairy business. Chemical composition of milk and properties of its components. Biochemical properties of milk. Physical properties of milk. Factors affecting the composition and properties of milk. Milk hygiene. Getting milk. Milk processing on the farm. Separator device and milk separation. Drinking milk, cream and fermented milk products. Butter-making. Cheese making. Canned milk. Milk processing by-products. Whole milk substitutes.
11	Learning outcomes	The student should know: general information about dairy and meat cattle breeding; physico-chemical, organoleptic and technological properties of milk and meat, their connection with the composition of milk and meat; microbiological and biochemical parameters of milk and meat; changes in the chemical composition and properties of milk and meat; be able to: take samples of milk and meat; prepare samples for analysis; determine the mass fraction of fat, proteins and casein, lactose, milk solids by instrumental methods; calculate the energy value of milk and meat; own the requirements for the quality of milk and meat, the current standards for harvested milk and meat;

1	Name of course	Chemistry
2	Code of course	Him 1215
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	1
8	Prerequisites	School Chemistry course
9	Postrequisites	Animal Biochemistry

10	Course summary	Theoretical foundations of chemistry, fundamental laws of chemistry and chemistry of elements. Protein substances. Carbohydrates. Classification. The functions of carbohydrates in the body and the composition of food products. Lipids (fats and oils). Mineral substances. Vitamins. Organic acids as pH regulators of food systems. Enzymes. Water in food products. Food raw materials as a biological object. Food and dietary supplements. Food safety. Fundamentals of rational nutrition.
11	Learning outcomes	The student should know: periodic law and its use in predicting the properties of elements and compounds; chemical properties of elements of a number of groups, the main processes; chemical properties of metals; be able to: apply the methods of experimental research in practical and research activities; own: the key theoretical and applied questions of chemistry.

1	Name of course	Zoology
2	Code of course	Zoo 1216
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	1
8	Prerequisites	School course of biology
9	Postrequisites	Breeding farm animals, Zoohygiene with the basics of designing livestock facilities, Fundamentals of veterinary medicine
10	Course summary	The kingdom is unicellular, or protozoa. General characteristics and systematics. Type Sarcomastigofor. Type Ciliates or Ciliated. Type Intestinal. Type Flatworms. Type Roundworms. Type Ringed worms. Type Arthropods. Type Molluscs. Type Chord. Subtype Uncranial. Subtype Vertebrates, or Cranial. Nadklass Pisces. Class Amphibians. Class Reptiles. Class Birds. Class Mammals.
11	Learning outcomes	As a result of studying this discipline, students should know: the main directions of the evolution of animals; causes and factors of evolution, biological features of the main species of animals, systematics of animals. Possess: biological methods of analysis, methods of monitoring animals, ways to assess and control the morphological features and animal organism.

1	Name of course	Higher mathematics
2	Code of course	VM 1217
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	1
8	Prerequisites	Basic school knowledge
9	Postrequisites	Higher mathematics, biomathematics, mathematical methods in agriculture, biometrics, GIS technologies in agriculture
10	Course summary	Elements of mathematical logic and number theory; linear algebra and analytic geometry; vectors; differential and integral calculus of a function of one variable; differential function; function research and function graphing; complex numbers; differential equations of the first order; expansion of the function according to the Taylor formula; use of computer programs
11	Learning outcomes	The student should know: the method of applying the methods of matrix algebra and analytical geometry in solving specific problems; the method of application of the apparatus of a single variable function, the methods of differential calculus of a function of one or several variables in solving mathematical and applied problems; methods of processing and analyzing statistical data; be able to: solve formal and applied problems of matrix algebra, analytic geometry and mathematical analysis, build mathematical models and solve problems with economic content; apply probabilistic and statistical methods in solving applied problems, carry out the collection and processing of statistical data, apply methods of analyzing the data obtained.

1	Name of course	Python language and data analysis
2	Code of course	YaPAD 2228
3	Cycle of course	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	2
8	Prerequisites	Information and communication technologies
9	Postrequisites	Statistical analysis and data visualization
10	Course summary	Editing and managing Python source code. Dictionaries. Dictionary methods. Iteration and recursion. Indexed loops. Conditional loops. Introduction to sorting. Sorting algorithms: sorting by selection, sorting by insertion, bubble sorting. The complexity of the algorithms. Search and sort. Effective sorting methods: binary or dichotomous studies, merge sorting, quick sorting. The NumPy package. Two-dimensional arrays. Indexing and iteration. Changing the shape of the array. Nested arrays. The Numpy.linalg module. The method of the reference element for solving a system of linear equations. The Gauss method. Databases: a relational model, the concept of storage and indexing. Introduction to SQL. Interaction with databases in Python.
11	Learning outcomes	As a result of mastering the discipline, students should: know Python data structures, classical programming paradigms, Numpy library functions for an approach to linear algebra and its algorithms, as well as basic SQL queries. Be able to: list the main properties of the algorithm; types of algorithmic constructions: consequence, branching, cycle; the concept of an auxiliary algorithm; build and execute basic algorithms; describe the syntax of the Python programming language; the main classes from the Python programming language libraries; develop programs in the Python programming language, creating your own classes, as well as using classes and modules from the libraries of this language; use a set of Python libraries for scientific computing and scientific visualization; apply the acquired knowledge and skills to solve specific problems.

1	Name of course	Physical and chemical research methods
2	Code of course	FHMI 3234
3	Cycle of course	BS
4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Mechanics, Solid State Physics, Inorganic and Organic Chemistry, Analytical and Physico-colloidal Chemistry, Higher Mathematics, Biomathematics, Cytology, General Biology of Organisms, Genetics, Ontogenesis and Phylogeny
9	Postrequisites	Ecology and fundamentals of life safety, Agrometeorology, Soil Science, Agrochemistry, Plant protection from pests and diseases, Agriculture, Crop production, Technology of storage and processing of crop products
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 course material, the student must competently navigate the main modern methods of separation and concentration used in chemical analysis; represent the meaning and scope of these methods; the main ways of their improvement. He should clearly understand what methods of separation and concentration it is advisable to use for the preparation of samples and analysis of various objects. The competencies and skills acquired during the course will allow the specialist to competently choose methods for separating and concentrating the components of the analyzed samples in accordance with the task, to assess the feasibility and effectiveness of their use. The student should be able to optimize the methods chosen for analysis and correctly apply them in practice

1	Name of course	Biophysics
2	Code of course	Bio 3222
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Fundamentals of physics, chemistry, mathematics in the volume of secondary school, mechanics, fundamentals of thermodynamics and molecular physics, electromagnetism, optics.
9	Postrequisites	Ecology and fundamentals of life safety, Atmospheric air protection, Agrometeorology, Soil Science Rational nature management in agriculture.
10	Course summary	Physical processes in the soil and atmosphere. Elements of the physics of the atom, the 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	The ability to generalize, analyze, perceive information, set goals and choose ways to achieve it, use the basic laws of soil physics in solving problems that have arisen. The ability to collect and analyze scientific and technical information, take into account current development trends and use the achievements of domestic and foreign science, technology and technology in professional activities.

1	Name of course	Methods of Mathematical Modeling
2	Code of course	MMM 3222
3	Cycle of course	BS
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Higher mathematics
9	Postrequisites	Biometrics, mathematical modeling of complex biological systems, biotechnology, bioinformatics, statistical methods of data processing
10	Course summary	The discipline will allow students to use mathematical modeling methods to study various processes. The course contains the following sections: fundamentals of error theory; numerical methods for solving systems of linear algebraic equations; numerical solution of ordinary differential equations; numerical methods for solving boundary value problems for partial differential equations; basic concepts of modeling; models described by an autonomous differential equation and systems of autonomous differential equations; living systems and active kinetic media
11	Learning outcomes	uses the concepts and methods of mathematical modeling in the practice of scientific research, the study of general and particular methods of mathematical description of natural phenomena; has practical skills in applying the basics of mathematical apparatus to solve theoretical and applied problems, the ability to translate the solution of practical problems into the language of logic. He is able to compare, formulate a statement of tasks, build his own method of solving, prove and justify the correctness of his reasoning; in the field of communication –the formation of personality, the development of intelligence and abilities for logical and algorithmic thinking; he is able to apply mathematical modeling methods in various branches of natural science, agriculture, forestry and biology, obtaining a systematic fundamental education.

1	Name of course	Statistical analysis and data visualization
2	Code of course	SAVD 3230
3	Cycle of course	BS

4	Amount of credits	3
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Python language and data analysis
9	Postrequisites	Informational technologies in animal husbandry
10	Course summary	Pandas as a tool for data analysis and processing. Cartopy package for processing and analyzing geospatial data. Basics of programming in R. The main objects of the R language. Data access operators. Functions and arguments. Loops and conditional operators. R as a DBMS. Debugging. Graphical functions. The Scilab application package. Numerical analysis: interpolation and regression, differentiation and integration, linear systems of equations, Fourier analysis, matrix calculations. Graphical functions.
11	Learning outcomes	As a result of mastering the discipline, students should: know the principles of working with Pandas and R databases, their cartographic representation, the functionality of the Scilab application package; be able to: work with Pandas databases; use the main features of the R language for statistical data analysis; work in the Scilab environment in an interactive mode and using a script editor; apply control constructs, basic functions in Scilab; use the studied tools for numerical analysis and solving specific problems in the main disciplines.

1	Name of course	Digital technologies in animal husbandry
2	Code of course	CTZh 3239
3	Cycle of course	BS
4	Amount of credits	4
5	Level of preparation	Undergraduate studies
6	Department	The Department of Technology and Processing of Livestock Production
7	Year	3
8	Prerequisites	Feeding of agricultural animals, Breeding and selection of agricultural animals

9	Postrequisites	Practical training, diploma work
10	Course summary	Digital technologies in animal husbandry make it possible to implement animal-oriented feeding, production and maintenance systems, remotely control production processes in real time, ensure continuous collection, analysis and use of information, ensure traceability of the origin and quality of products throughout the production chain, which prevents the spread of diseases and illegal trade in animal products
11	Learning outcomes	As a result of studying this discipline, students should know: information and communication systems; modern software products and technical means that ensure efficient use of resources and precise control of production processes in animal husbandry; be able to: collect, process, analyze, summarize and systematize information, advanced domestic and foreign experience in the field of digital technologies in animal husbandry in order to use new achievements in practical professional activities; to master: practical skills for the formation and solution of tasks in production activities using digital technologies.