

**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

6B05102 Biotechnology

Nur-Sultan, 2021

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

Veterinary microbiology

1	Name of course	Professionally-oriented Foreign Language
2	Code of course	POIYa 3221
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	6
5	Level of preparation	Undergraduate
6	Department	Department of Microbiology and Biotechnology
7	Year	
8	Prerequisites	"Foreign language" in undergraduate
9	Postrequisites	Disciplines in a specialty in a foreign language
10	Course summary	It is aimed at mastering the future masters' language for professional and academic purposes at an advanced level, which will allow you to freely operate the scientific and conceptual apparatus of the specialty, expand the scientific and information base, master the skills of interpreting scientific information, argumentation, persuasion, scientific debate, academic writing.
11	Learning outcomes	To own skills: oral communication in the specialty in the forms of monologue, dialogue / polylogue (report, message, discussion, debate, round-table discussion); preparation of written forms for the presentation of information material in the specialty of communication, poster report, annotation); work with lexicographic sources in a foreign language (traditional and on-line); extract the necessary information from academic texts; understand the main idea of academic texts and texts in the specialty; the use of modern approaches to the study of a foreign language (national corps of foreign languages).

1	Name of course	English for special purposes
2	Code of course	AYaDSC 4229
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	4
5	Level of preparation	Undergraduate
6	Department	Department of Microbiology and Biotechnology
7	Year	
8	Prerequisites	“Foreign language” in undergraduate level B1-B2
9	Postrequisites	Disciplines in a specialty in a foreign language
10	Course summary	In-depth study of a foreign language and carry out foreign language interpersonal and intercultural communication with native speakers.
11	Learning outcomes	According to the results of mastering the program, the student, depending on the level of training, the student at the time of completion of the course reaches the level of B1- (IELTS 4.0-5.0) or B2- (IELTS 5.5-6.0) and the formed skills for solving tasks of professional, interpersonal and intercultural interaction.

1	Name of course	Inorganic and organic chemistry
2	Code of course	NOH 1216
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	1
8	Prerequisites	Basic school knowledge of biology, chemistry
9	Postrequisites	To study basic and core disciplines.
10	Course summary	Theoretical foundations, basic laws and concepts of chemistry. The structure of the atom, substance. State of aggregation. Chemical bond. The basic laws of a chemical reaction. Reactions in the aquatic environment. Complex compounds. Redox process. Chemistry of bioactive elements. Fundamentals of Organic Chemistry. The relationship between the structure and property of substances. Methods of preparation, properties and use of organic substances.
11	Learning outcomes	To be able to use the experience of theoretical, experimental research and safe work with chemicals, solve design problems. Know the natural sources of organic raw materials; classification and principles of the nomenclature of organic compounds; know the methods of preparation and chemical properties of the main classes of organic compounds; The use of certain classes of organic compounds as indicators; methods for the isolation and purification of organic compounds (extraction, recrystallization, distillation, sublimation); construct the structural formula of an organic compound by its name and vice versa.

1	Name of course	Higher mathematics
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2	Code of course	VM 1217
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	1
8	Prerequisites	School course of mathematics
9	Postrequisites	Information and communication technologies, entrepreneurial activity
10	Course summary	Elements of linear algebra and analytic geometry; The limit, derivative and integral of a function of one variable; Functions of several variables; Numeric series. Theory of Probability and Mathematical Statistics.
11	Learning outcomes	To own the technique of solving various types of calculation problems, analyze theoretical data, be able to apply the knowledge gained in solving applied problems in the study of biology, biotechnology, veterinary medicine and medicine; in the formalization of tasks, the construction of mathematical models and the selection of the most acceptable methods of solution; acquire skills in the implementation of algorithms in relation to specific tasks; in solving practical problems, in using the achievements of fundamental science for the successful study of general theoretical and special disciplines of the specialty, the development of mathematical thinking and logic for use in mathematical modeling.

1	Name of course	Analytical and physical and colloid chemistry
2	Code of course	AFH 1230
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	5

5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	1
8	Prerequisites	Inorganic chemistry, organic chemistry, Physics, Mathematics.
9	Postrequisites	To study basic and core disciplines
10	Course summary	Equilibrium in a homogeneous system. Stages of analytical processes: selection and preparation of samples for analysis, measurement steps, evaluation of measurement results. Buffer capacity. Chemical thermodynamics and equilibrium. Chemical kinetics and electrochemistry. Volumetric analysis. Two, three and multicomponent systems. Gravimetric analysis. Colloid chemistry. Dispersed systems. The structure of the micelle. Physico-chemical methods of analysis.
11	Learning outcomes	Know the main sections of analytical and physical colloid chemistry: the metrological basis of chemical analysis, the gravimetric method (weight) analysis, the titrimetric method (volumetric) analysis, physico-chemical methods of analysis, the basics of chemical thermodynamics, phase equilibrium, solutions, the basics of electrochemistry, chemical kinetics and catalysis. To be able to prepare and set the titer of solutions, determine the content of ions in the solution and their concentration, justify proposals for improving the ongoing technological operations.

1	Name of course	Basics of Biostatistics and Bioinformatics
2	Code of course	OBB 2220
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	2
8	Prerequisites	Computer science, molecular biology, general and molecular genetics, microbiology and virology, immunology
9	Postrequisites	Microorganism biotechnology, animal biotechnology, plant biotechnology, ecological biotechnology, breeding of industrial microorganism strains

10	Course summary	Biological information, statistical processing of measurement results in biological research. Sequencing technology. Microsoft Excel Excel package features. Main categories of statistical analysis in Microsoft Excel, Microsoft Access database. Processing the results of serological studies. Decoding the genetic code of electronic resources NCBI. Possibilities of using the BLAST program. Introducing the Galaxy Web Platform
11	Learning outcomes	To have skills in working with software used in the analysis of biological data; engage in research and biotechnological practice using methods of biostatistics and bioinformatics; be able to process and analyze the results of their own research in the implementation of term papers and dissertations. Know the methodological foundations of scientific knowledge; basic research methods used in the field of biological sciences; general guidelines for experimental research; the methodology of the final scientific processing of research materials

1	Name of course	General pharmacology
2	Code of course	OF 2223
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	2
8	Prerequisites	Organic and Inorganic Chemistry, Biochemistry, Physiology, Biology
9	Postrequisites	Pharmaceutical biotechnology, animal biotechnology, veterinary biotechnology, medical biotechnology
10	Course summary	General pharmacology. General recipe. Means that affect afferent innervation, efferent innervation, central nervous system, metabolic processes and homeostasis.

11	Learning outcomes	To Be able to: choose dosage forms, methods of using drugs; analyze the effect of drugs on the totality of their pharmacological properties; Recognize undesirable effects of drugs, prevent them and eliminate them in case of occurrence; choose medicines for emergency care; navigate the arsenal of new drugs, know their most common synonyms. Skills: prescriptions for essential essential drugs; search and processing of data on medicines for information of clinical and pharmacy workers; preparation of applications for medicines, taking into account their pharmacological properties.
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1	Name of course	Medical Biotechnology
2	Code of course	MB 3222
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	3
8	Prerequisites	Microbiology and virology, immunology molecular biology, molecular genetics and genetic engineering, biotechnology of microorganisms
9	Postrequisites	Microbiological basis in the production of biotechnological products, pharmaceutical biotechnology
10	Course summary	The importance of biotechnology in solving the problems of medicine and health. The use of human cells in biotechnology, fibroblasts, stem cells. IVF - problems and prospects. The technology for obtaining, fertilizing cells, replanting and storing invitro embryos. Requirements for sperm and egg donors. Banks of gametes and human embryos. The technology for producing antigens and hyperimmune serums for medicine. Production of diagnosticums of common diseases based on hybridoma technology and monoclonal antibodies.
11	Learning outcomes	To know: the basics of biosafety; features of the manufacturing technology of medicines, methods for their control, standardization and certification; genetic engineering methods used to create new generation diagnostic kits and vaccines. To be able to: carry out hyperimmunization, receive antibodies and antigens, conduct a preclinical test. To have: skills in obtaining phyto- and biological products, operations of hybridoma technology, DNA isolation and purification.

1	Name of course	Biotechnology of microorganisms
2	Code of course	BM 3232
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	7
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	3
8	Prerequisites	Morphology, physiology, biochemistry, molecular biology, molecular genetics and genetic engineering, microbiology and virology, the basics of biotechnology
9	Postrequisites	Microbiological control of biotechnological production, veterinary biotechnology, food biotechnology, environmental biotechnology, industrial biotechnology
10	Course summary	Strains producing the target products and requirements for their storage. Principles and methods for producing producer strains and super-producers. Methods for the cultivation of microorganisms. The study of the growth of microorganisms and the effect on it of pH and temperature of cultivation. The characteristics of the producers and the technology for producing microbial protein, organic acids and neutral products, primary metabolites of microorganisms, biologically active substances by microbiological synthesis.
11	Learning outcomes	To know the safety measures when working with biological material, the basics of classification, morphology, physiology, genetics and properties of producer strains; methods and approaches for the preparation, isolation and purification of primary and secondary metabolites of microorganisms; To be able to produce microbiological preparations, cultivate microorganisms by surface and deep methods, isolate pure cultures and identify them, maintain and store industrial cultures of microorganisms. The ability to solve problems of economic efficiency and the feasibility of using a particular producer strain; analyze data, draw up a production protocol.

1	Name of course	General Immunology
2	Code of course	OI 3231
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	6
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	3
8	Prerequisites	Morphology, physiology, biochemistry.
9	Postrequisites	Microbiology and virology, veterinary biotechnology, molecular genetics and genetic engineering, animal biotechnology.
10	Course summary	The concept of natural resistance and species immunity, acquired immunity. Modern ideas about antigens, protective mechanisms of a macroorganism, regulation of the immune response and applied immunology. The functioning of the immune system is normal, laws and principles of functioning. Knowledge of immunological methods for the determination of T and B lymphocytes, as well as methods for the isolation and study of immunoglobulins.
11	Learning outcomes	Know: basic immunological concepts and terms; the structure of the immune system, the mechanisms of formation of the humoral and cellular immune response; molecular genetic basis of immunological reactions and their regulation; features of the formation of various types of non-infectious and infectious immunity; main pathologies of immunity. be able to: apply scientific knowledge in the field of immunology in educational and professional activities; search and analyze scientific information on relevant immunological issues; own: a wide range of methods and approaches of immunological studies. Practical skills in using immunological tests to detect antigens and antibodies.

1	Name of course	Business activities
2	Code of course	PD 4227
3	Cycle of course	cycle of basic disciplines
4	Amount of credits	5
5	Level of preparation	Undergraduate studies
6	Department	Department of Microbiology and Biotechnology
7	Year	4
8	Prerequisites	Fundamentals of Economics, Fundamentals of Agribusiness
9	Postrequisites	Organization of production, professional activity
10	Course summary	Concept, essence, basic types and organizational forms. Rationing and remuneration. Costs and financial performance of the organization (company). Economic efficiency of the organization (company) and entrepreneurial projects. Marketing and organization management. State support for entrepreneurship and its infrastructure.
11	Learning outcomes	To own: skills in applying various techniques and tools in a business management system; personnel assessment methods; risk management methods; methods for assessing the effectiveness of entrepreneurial activity.

