Қазақ инновациялық гуманитарлық- заң университеті
Казахский гуманитарно-юридический инновационный университет
Kazakh Humanitarian Juridical Innovative University

Ақпараттық- технологиялар және экономика факультеті
Факультет информационых технологии и экономики
Department of Information and Technology and Economics

Қолданбалы биология кафедрасы
Кафедра прикладная биология
Economy and Management Department

5В070100 - БИОТЕХНОЛОГИЯ
ЭЛЕКТИВТІ ПӘНДЕР КАТАЛОГЫ
түскен жылы - 2018

5В070100 - БИОТЕХНОЛОГИЯ
КАТАЛОГ ЭЛЕКТИВНЫХ ДИСЦИПЛИН
год поступления - 2018

5В070100 - BIOTECHNOLOGY
THE CATALOGUE OF ELECTIVE SUBJECTS
Year of entrance - 2018

Семей, 2018 жыл
Семей, 2018 год

Academic Degree: Bachelor technic and technology
For the specialty "5V070100-Biotechnology"

Elective course №	The name of subject	Кол-во кредитов		Pre requisites	Post requisites	Short description of the content, the aims of education, expected results
		RK	ECTS			
GENERAL EDUCATIONAL DISCIPLINES						
Elective courses (EC)						
1	Ecology with the basics of safety	2	3	School courses: chemistry, biology, geography, , mathematics, physics	Disciplines according to the curriculum	**Purpose:** to form a holistic discipline views that the basic laws of sustainable development of nature and society. Contents: study of the basic laws of vzaymodeystviya system "biosphere - a technological society-environment", and the formation of ideas about the economic approaches to solving environmental problems. Expected results of the study: preparation of environmentally conscious professionals who are actively involved in the processes that use preservation and restoration of the environment.
1	Psychology	2	3	School courses: chemistry, biology, geography, , mathematics, physics	Disciplines according to the curriculum	**Purpose:** to form a holistic discipline views that the basic laws of sustainable development of nature and society. Contents: study of the basic laws of vzaymodeystviya system "biosphere - a technological society-environment", and the formation of ideas about the economic approaches to solving environmental problems. Expected results of the study: preparation of environmentally conscious professionals who are actively involved in the processes that use preservation and restoration of the environment.
2	Political Science	2	3	Modern history of Kazakhstan	Philosophy	**Objective:** familiarization with the current problems and the basic principles of Kazakhstan's model of interethnic tolerance. Tolerance - the key to inter-religious and inter-ethnic stability in Kazakhstan. **Knowledge:** the formation of inter-ethnic tolerance, Kazakhstan patriotism of the younger generation, as well as a competent understanding of the ethnic and political processes taking place in the modern world.
2	Sociology	2	3	Human and society (school course)	Philosophy	**Objective:** familiarization with the current problems and the basic principles of Kazakhstan's model of interethnic tolerance. Tolerance - the key to inter-religious and inter-ethnic stability in Kazakhstan. **Knowledge:** the formation of inter-ethnic tolerance, Kazakhstan patriotism of the younger generation, as well as a competent understanding of the ethnic and political processes taking place in the modern world.

2	Culturology	2	3	Modern history of Kazakhstan	Philosophy	**Objective:** To provide a methodology for the study of the formation and development of theological science; definition and structure of religion; typology of religions. **Knowledge:** the specifics of religion in comparison with other areas of the spiritual life of humanity; **Skill:** to give a general definition of religion; describe the place of religion in culture; **Skills:** knowledge has methods and comparative characteristics of religions; skills analysis and scientific interpretation of religious texts and religious studies.
2	Fundamentals of Anti-Corruption Culture	2	3	Modern history of Kazakhstan	Philosophy	**Objective:** familiarization with the current problems and the basic principles of Kazakhstan's model of interethnic tolerance. Tolerance - the key to inter-religious and inter-ethnic stability in Kazakhstan. **Knowledge:** the formation of inter-ethnic tolerance, Kazakhstan patriotism of the younger generation, as well as a competent understanding of the ethnic and political processes taking place in the modern world.
3	Religious	3	3	Political science	No	**Objective:** To provide a methodology for the study of the formation and development of theological science; definition and structure of religion; typology of religions. **Knowledge:** the specifics of religion in comparison with other areas of the spiritual life of humanity; **Skill:** to give a general definition of religion; describe the place of religion in culture; **Skills:** knowledge has methods and comparative characteristics of religions; skills analysis and scientific interpretation of religious texts and religious studies.
BASIC DISCIPLINES						
Elective courses (EC)						
1	Cytology and histology	3	5	School Course Biology	Human and Animal Physiology , Plant Physiology,	**Objective:** The study of the structure and functioning of cells, their chemical composition and functions of individual cellular components, knowledge of cell reproduction process of adaptation to environmental conditions, the study of the structural features of specialized cells. **Contents**: A brief history of Cytology, the main provisions of cell theory, the unity and the diversity of cell types, cell of the multicellular organism. Totipotency cells, modern methods used in cytology. The role of nuclear structures in the cell activity. Cell cycle of eukaryotes Cytoplasm. The plasma membrane. Golgi apparatus. Lysosomes. Mitochondria. Plastids. microfilaments General properties of microfilaments. Mikrotrubochki.Obschaya characteristic of microtubule

1	Cell biotechnology	3	5	School Course Biology	Phytoresources in biotechnology	**Objective:** The study of the structure and functioning of cells, their chemical composition and functions of individual cellular components, knowledge of cell reproduction process of adaptation to environmental conditions, the study of the structural features of specialized cells. **Contents**: A brief history of Cytology, the main provisions of cell theory, the unity and the diversity of cell types, cell of the multicellular organism. Totipotency cells, modern methods used in cytology. The role of nuclear structures in the cell activity. Cell cycle of eukaryotes Cytoplasm. The plasma membrane. Golgi apparatus. Lysosomes. Mitochondria. Plastids. microfilaments General properties of microfilaments. Mikrotrubochki.Obschaya characteristic of microtubule Mitotic cell division. Cell death: necrosis and apoptosis Expected results of the study: preparation of temporary agents, ready to analyze the slides drugs micropreparations recognition.
2	Phytoresources in biotechnology	3	3	Cytology and histology	Plant Physiology	**Objective:** training in modern methods of vegetation studies, the development of skills of independent work with plant facilities. Biological laws of development of the vegetable world; practical value of the properties of plants of different groups, meeting with representatives of start-ups of flora, especially their structure and reproduction, the value of the plants to ensure all of the organic world with oxygen, organic and mineral substances. **Contents:** a detailed study of the structure of botanical objects; work independently with the special literature; produce technical drawings of objects of research. Expected results of the study: to distribute the plants in groups, to create a clear picture of the place in the system of certain plants; proyzvodstvo to use, practical, economically important properties of representatives of the various groups of plants.

2	Fundamentals of plant growing	3	5	Cytology and histology	Plant Physiology	**Objective:** training in modern methods of vegetation studies, the development of skills of independent work with plant facilities. Biological laws of development of the vegetable world; practical value of the properties of plants of different groups, meeting with representatives of start-ups of flora, especially their structure and reproduction, the value of the plants to ensure all of the organic world with oxygen, organic and mineral substances. **Contents:** a detailed study of the structure of botanical objects; work independently with the special literature; produce technical drawings of objects of research. Expected results of the study: to distribute the plants in groups, to create a clear picture of the place in the system of certain plants; proyzvodstvo to use, practical, economically important properties of representatives of the various groups of plants.
3	Zooresursy in biotechnology	3	5	Cytology and histology	Human and Animal Physiology	**Objective:** training in modern methods of research, the development of skills of independent work of objects allowed. identify animals; use the simplest methods of morphological research facilities; usually working with a microscope and the slides; work with animals determinants. Biological laws of development of the animal world. Contents: the diversity of the animal world; all levels of life, and the organization and the main stages in the evolution of invertebrates; knowledge of all the taxonomic rank of animals. **Expected results of the study:** actively improving the quality of education, knowledge of all levels of organization of life and the main stages in the evolution of invertebrates and vertebrates; knowledge of all taxonomic ranks of invertebrate and vertebrate animals, practical skills to identify animals; mastery of the simplest methods of morphological research facilities.
3	Perspective directions of ecological biotechnology	3	5	Cytology and histology	Human and Animal Physiology	**Objective:** training in modern methods of research, the development of skills of independent work of objects allowed. identify animals; use the simplest methods of morphological research facilities; usually working with a microscope and the slides; work with animals determinants. Biological laws of development of the animal world. Contents: the diversity of the animal world; all levels of life, and the organization and the main stages in the evolution of invertebrates; knowledge of all the taxonomic rank of animals. **Expected results of the study:** actively improving the quality of education, knowledge of all levels of organization of life and the main stages in the evolution of invertebrates and vertebrates; knowledge of all taxonomic ranks of invertebrate and vertebrate animals, practical skills to identify animals; mastery of the simplest methods of morphological research facilities.

4	Microbiology and Virology	4	6	Cytology and histology	Biotechnology microorganisms	**Purpose:** to introduce students to the most important features for biotechnology prokaryotes and eukaryotes. Show general biological significance of achievements in the field of microbiology and virology, highlight the role of microorganisms in the development of biotechnology, the food industry. **Contents: Subject and tasks of microbiology and its place and role in the** development of microorganisms biotehnologii.Otkrytie A.van Leeuwenhoek. The role of Louis Pasteur in the formation of microbiology. The value of works Kluyver, Koch, Fleming, Shaposhnikova, Jerusalem. Mikrorganizmy and their classification. Viruses. Prokaryotes. The morphology of microorganisms. The structure and composition of the cells. Reproduction and differentiation. The growth and cultivation of microorganisms. Antimicrobial factors. Metbolizm microorganisms. Food. Enegeticheskie processes. Fermentation. Biosynthesis. **Expected results of the study:** the structure and morphological characteristics of the microorganisms; the impact of external factors on the microbial composition of the environment; Genetically modified microorganisms; microflora of the environment; mode of action of various drugs on the microorganisms; modern requirements for enterprises of biochemical and microbiological profile; safe methods of work in the microbiology laboratory. Finished products and fixed the living organisms; comparative analysis of different groups of organisms; compare production data microflora with valid regulations.

4	General Microbiology	4	6	Cytology and histology	Biotechnology microorganisms	**Purpose:** to introduce students to the most important features for biotechnology prokaryotes and eukaryotes. Show general biological significance of achievements in the field of microbiology and virology, highlight the role of microorganisms in the development of biotechnology, the food industry. **Contents: Subject and tasks of microbiology and its place and role in the** development of microorganisms biotehnologii.Otkrytie A.van Leeuwenhoek. The role of Louis Pasteur in the formation of microbiology. The value of works Kluyver, Koch, Fleming, Shaposhnikova, Jerusalem. Mikrorganizmy and their classification. Viruses. Prokaryotes. The morphology of microorganisms. The structure and composition of the cells. Reproduction and differentiation. The growth and cultivation of microorganisms. Antimicrobial factors. Metbolizm microorganisms. Food. Enegeticheskie processes. Fermentation. Biosynthesis. **Expected results of the study:** the structure and morphological characteristics of the microorganisms; the impact of external factors on the microbial composition of the environment; Genetically modified microorganisms; microflora of the environment; mode of action of various drugs on the microorganisms; modern requirements for enterprises of biochemical and microbiological profile; safe methods of work in the microbiology laboratory. Finished products and fixed the living organisms; comparative analysis of different groups of organisms; compare production data microflora with valid regulations.
5	Plant Physiology	3	5	Phytoresources in biotechnology	Plant Biotechnology	**Objective:** To conduct experiments on the basic physiological processes; determine the osmotic pressure, transpiration rate, photosynthesis, respiration, chlorophyll allocate and determine its physico-chemical properties and quantity to determine the effect of different mineral elements on the growth and development of plants, individual growth rates, plant resistance. Contents of plant cell physiology. Objects Plant Physiology. The main structural elements of the plant cell. Water exchange. The importance of water, water movement mechanism for the plant. Transpiration. Photosynthesis. Meaning of photosynthesis. Light stage of photosynthesis Photosystem I and II. Dyhanie.Znachenie respiration in plant life. Respiratory chain and its components. Mineral nutrition. Macronutrients and micronutrients. The physiological basis for the use of fertilizers. Expected results of the study: to apply this knowledge to further enhance the level of training in theory and in practice.

5	Anatomy and morphology of plants	3	5	Phytoresources in biotechnology	Plant Biotechnology	**Objective:** To conduct experiments on the basic physiological processes; determine the osmotic pressure, transpiration rate, photosynthesis, respiration, chlorophyll allocate and determine its physico-chemical properties and quantity to determine the effect of different mineral elements on the growth and development of plants, individual growth rates, plant resistance. Contents of plant cell physiology. Objects Plant Physiology. The main structural elements of the plant cell. Water exchange. The importance of water, water movement mechanism for the plant. Transpiration. Photosynthesis. Meaning of photosynthesis. Light stage of photosynthesis Photosystem I and II. Dyhanie.Znachenie respiration in plant life. Respiratory chain and its components. Mineral nutrition. Macronutrients and micronutrients. The physiological basis for the use of fertilizers. Expected results of the study: to apply this knowledge to further enhance the level of training in theory and in practice.
6	Human and Animal Physiology	3	5	Zooresursy biotechnology	Animal Biotechnology	The aim of physiology of humans and animals - to equip the future specialist - biotechnology knowledge about the laws of life processes taking place in the human and animal organisms; to give students an idea of the animal life processes and of its constituent parts (cells and subcellular structures, tissues, organs, organ systems) in their unity and the relationship with the environment. **Contents:** Physiology. Methods and physiology studies. General physiology. Physiology of excitable tissues. Mechanisms and regulation of body functions. The internal environment of the body. System vnuternnih bodies and their regulyatsiya.Sistema krovi.Fiziologiya heart and blood vessels. Regulation of breathing. Physiology of the immune system. The physiology of digestion. Bienergetika. Osmoregulation and excretion. Biotechnological methods of regulation and Lactogenesis laktopoeza animals. **Expected results of the study:** the student must possess some methods of evaluating functional elastase derived organism; theoretically apply the knowledge and skills in practical and research activities. explain the principle of the most important methods for studying functions of the body; work independently with scientific and educational literature; independently carry out the work and carry out experiments on animals; be yourself and solve test problems, prepare scientific reports.

6	General physiology	3	5	Zooresursy biotechnology	Animal Biotechnology	The aim of physiology of humans and animals - to equip the future specialist - biotechnology knowledge about the laws of life processes taking place in the human and animal organisms; to give students an idea of the animal life processes and of its constituent parts (cells and subcellular structures, tissues, organs, organ systems) in their unity and the relationship with the environment. **Contents:** Physiology. Methods and physiology studies. General physiology. Physiology of excitable tissues. Mechanisms and regulation of body functions. The internal environment of the body. System vnuternnih bodies and their regulyatsiya.Sistema krovi.Fiziologiya heart and blood vessels. Regulation of breathing. Physiology of the immune system. The physiology of digestion. Bienergetika. Osmoregulation and excretion. Biotechnological methods of regulation and Lactogenesis laktopoeza animals. **Expected results of the study:** the student must possess some methods of evaluating functional elastase derived organism; theoretically apply the knowledge and skills in practical and research activities. explain the principle of the most important methods for studying functions of the body; work independently with scientific and educational literature; independently carry out the work and carry out experiments on animals; be yourself and solve test problems, prepare scientific reports.

7	Biotechnology of microorganisms	4	6	Microbiology and Virology	Basics of food biotechnology	**Objective:** To give an idea about the aims and objectives of biotechnology, principles and characteristics of microbial organisms, methods for obtaining highly productive industrial strains of microorganisms, methods of cultivation and storage. **Contents:** Fundamentals of microbial biotechnology. Modern methods of creation of industrial strains of microorganisms problem of preserving their valuable properties. Biotechnological production osnovannyena obtaining microbial biomass. Production of microbial protein. Production of organic acids netralnyh products. Preparation of organic acids. Spirotvoe fermentation. Aceto-butyl fermentation. Preparation microbiological synthesis products: amino acids, enzymes, vitamins, polysaccharides, lipids. Biotechnological production lekarstennyh and preventive medicines. **Ozhedaemye results of the study:** Students should know the basics kultvirovaniya microorganisms, processes biomass and microbial synthesis of thin products; predyavlyaemye demand for raw materials and final product, Working with cultures of microorganisms, to determine the purity and activity of crops and drugs, pin rolirovat producing growth, use zananiya of biotechnology microorganisms in practice, to work competently in the microbiology laboratory, observing the conditions of sterility, allocate elective microbial culture from a variety of media, to study the appearance and physiological especially dedicated culture.

7	Introduction to biotechnology	4	6	Microbiology and Virology	Basics of food biotechnology	**Objective:** To give an idea about the aims and objectives of biotechnology, principles and characteristics of microbial organisms, methods for obtaining highly productive industrial strains of microorganisms, methods of cultivation and storage. **Contents:** Fundamentals of microbial biotechnology. Modern methods of creation of industrial strains of microorganisms problem of preserving their valuable properties. Biotechnological production osnovannyena obtaining microbial biomass. Production of microbial protein. Production of organic acids netralnyh products. Preparation of organic acids. Spirotvoe fermentation. Aceto-butyl fermentation. Preparation microbiological synthesis products: amino acids, enzymes, vitamins, polysaccharides, lipids. Biotechnological production lekarstennyh and preventive medicines. Production of antibiotics. Getting the vaccine. metals Biotechnology. Biotechnology environment. Microbiological production of foods and beverages. **Ozhedaemye results of the study:** Students should know the basics kultvirovaniya microorganisms, processes biomass and microbial synthesis of thin products; predyavlyaemye demand for raw materials and final product, Working with cultures of microorganisms, to determine the purity and activity of crops and drugs, pin rolirovat producing growth, use zananiya of biotechnology microorganisms in practice, to work competently in the microbiology laboratory, observing the conditions of sterility, allocate elective microbial culture from a variety of media, to study the appearance and physiological especially dedicated culture.

8	Fundamentals of physical and chemical analysis	3	5	Biochemistry	Toxicological analysis of food products	**Purpose**: to study the classification of physical and chemical methods of analysis of substances, their brief description. Theoretical bases and practical application of optical and electrochemical methods of analysis. Determination of the equivalent titration point, emission photometry of the flame. **Content:** Types of analysis: isotopic, elemental, structural-group, molecular, phase. Methods of chemical analysis of substances. Basis characteristics of the method of analysis. Equilibrium in the solution-sediment system. Classification of methods of titrimetry. General characteristics of electrochemical analysis methods. Direct potentiometry. Coulometry, coulometric titration. **Expected results of the study:** fundamental concepts and laws of chemistry for solving various problems, including applied ones; Calculate the concentration of solutions of various compounds, use a periodic system of elements, determine the possibility and direction of the course of chemical reactions, Carry out experimental work and correctly formulate the results of the experiment. Use the acquired knowledge and skills in practical activities and daily life to explain the chemical phenomena occurring in nature, life and work, global problems, humanity; Determine the valence of chemical elements.
8	Physico-colloid chemistry	3	5	Biochemistry	Toxicological analysis of food products	**Purpose**: to study the classification of physical and chemical methods of analysis of substances, their brief description. Theoretical bases and practical application of optical and electrochemical methods of analysis. Determination of the equivalent titration point, emission photometry of the flame. **Content:** Types of analysis: isotopic, elemental, structural-group, molecular, phase. Methods of chemical analysis of substances. Basis characteristics of the method of analysis. Equilibrium in the solution-sediment system. Classification of methods of titrimetry. General characteristics of electrochemical analysis methods. Direct potentiometry. Coulometry, coulometric titration. **Expected results of the study:** fundamental concepts and laws of chemistry for solving various problems, including applied ones; Calculate the concentration of solutions of various compounds, use a periodic system of elements, determine the possibility and direction of the course of chemical reactions, Carry out experimental work and correctly formulate the results of the experiment. Use the acquired knowledge and skills in practical activities and daily life to explain the chemical phenomena occurring in nature, life and work, global problems, humanity; Determine the valence of chemical elements.

9	Plant Biotechnology	3	5	Physiology Plant	Biotechnology plant products	**Objective:** is to highlight the current state of knowledge about the biology of cultured plant cells as an object of biotechnology and all the main areas of biotechnology. **Contents:** Plant Biotechnology and its specificity. The cultured plant cells as an object of biotechnology. Preparation and cultivation of callus. Cellular technology biosynthetic romyshlennogo. Clonal micropropagation and recovery plants. Overcoming invitro progamnoy and postgamnoy incompatibility. The haploid technology. Cell selektsiya.Somaklonalnaya variabelnost.Kletochnaya inzheneriya.Geneticheskaya engineering of plants, construction of recombinant DNA. Preparation of the genes to be transferred into another organism. Saving invitro gene pool. **Expected results yzucheniya**: practical skills to work in sterile conditions with isolated cells, tissues, callus weight.
9	Biotechnology in plant protection	3	5	Physiology Plant	Biotechnology plant products	**Objective:** is to highlight the current state of knowledge about the biology of cultured plant cells as an object of biotechnology and all the main areas of biotechnology. **Contents:** Plant Biotechnology and its specificity. The cultured plant cells as an object of biotechnology. Preparation and cultivation of callus. Cellular technology biosynthetic romyshlennogo. Clonal micropropagation and recovery plants. Overcoming invitro progamnoy and postgamnoy incompatibility. The haploid technology. Cell selektsiya.Somaklonalnaya variabelnost.Kletochnaya inzheneriya.Geneticheskaya engineering of plants, construction of recombinant DNA. Preparation of the genes to be transferred into another organism. Saving invitro gene pool. **Expected results yzucheniya**: practical skills to work in sterile conditions with isolated cells, tissues, callus weight.
10	Animal Biotechnology	3	5	Human and Animal Physiology	Biotechnology products of animal origin	**Objective:** To develop the students' knowledge about the possibilities of gene and cell engineering of animals, the ways and methods of using animal cells in biotechnology. Contents: Overall biological bases of animal biotechnology. Animal biotechnology methods. Artificial insemination and embryo transplantation. Chimera mammals. Cloning of animals. Genetic transformation. Cryopreservation of gametes and embryos. Applied aspects of cellular and embryogenetic inzhenerii.Poluchenie transgenic animals. **Expected results yzucheniya:** to develop the students' knowledge about the possibilities of gene and cell engineering of animals, the ways and methods of using animal cells in biotechnology, general biological bases of animal biotechnology; experimental approaches to cell engineering and embryology.

10	Biotechnology in the protection of animal	3	5	Human and Animal Physiology	Biotechnology products of animal origin	**Objective:** To develop the students' knowledge about the possibilities of gene and cell engineering of animals, the ways and methods of using animal cells in biotechnology. Contents: Overall biological bases of animal biotechnology. Animal biotechnology methods. Artificial insemination and embryo transplantation. Chimera mammals. Cloning of animals. Genetic transformation. Cryopreservation of gametes and embryos. Applied aspects of cellular and embryogenetic inzhenerii.Poluchenie transgenic animals. **Expected results yzucheniya:** to develop the students' knowledge about the possibilities of gene and cell engineering of animals, the ways and methods of using animal cells in biotechnology, general biological bases of animal biotechnology; experimental approaches to cell engineering and embryology.
11	General and molecular genetics	3	5	Plant Physiology	Fundamentals of Genetic Engineering	**Objective:** To deepen and broaden the knowledge in the field of genetics; improving the use of information technology and self-organization of research, the current state of the problems of genetics, management capabilities of heredity and variation of organisms **Contents:** Branches and genetics techniques. The material basis of heredity. The main patterns of inheritance. Signs and inheritance principles. Monohybrid and poligibridnoe crossing. Linked inheritance and crossover. The variability of the genetic material. Basics of Molecular Genetics. Genetics development. population genetics. Genentika person. Genetic basis of breeding. Genetics and Biotechnology. **Expected results of the study:** the mechanisms, the current state of the problems of genetics, heredity and variability of possible control organisms to solve genetic problems competently carry out experiments on heredity and variation study and interpret the results, learn to use the techniques studied and genetics methods to the needs of biotechnology.
11	General genetics	3	5	Plant Physiology	Fundamentals of Genetic Engineering	**Objective:** To deepen and broaden the knowledge in the field of genetics; improving the use of information technology and self-organization of research, the current state of the problems of genetics, management capabilities of heredity and variation of organisms **Contents:** Branches and genetics techniques. The material basis of heredity. The main patterns of inheritance. Signs and inheritance principles. Monohybrid and poligibridnoe crossing. Linked inheritance and crossover. The variability of the genetic material. Basics of Molecular Genetics. Genetics development. population genetics**Expected results of the study:** the mechanisms, the current state of the problems of genetics, heredity and variability of possible control organisms to solve genetic problems competently carry out experiments on heredity and variation study and interpret

12	Basics of food biotechnology	4	6	Biotechnology of microorganisms	Biotehnology of fermentation production	**Objective:** To study the discipline is the acquisition of theoretical knowledge and development of skills and abilities in the field of modern food biotechnology. Content: Food biotechnology based on fermentation processes and other metabolic reactions. Yeast production. alcohol production. Brewing. Winemaking. Bakery. Dairy production. Organic acids. Food biotechnology on the basis of microbial synthesis. Protein Preparation. Getting vitamins. Getting enzymes. Preparation of amino acids. Getting bioloicheski active additives (BAA). The safety and health inspection of food products produktov.Problemy Biosafety modern biotechnological production. Contamination of food mikrorganizmami, toxic food and medoty combat these phenomena. Microbiological and hygienic control of food. **Expected results of the study"** student has to use the knowledge gained in the production of foodstuffs. in the laboratory, use of microorganisms in food products.
12	Isolation and purification of biotechnology products	4	6	microbial biotechnology	Biotehnology of fermentation production	Objective: To study the discipline is the acquisition of theoretical knowledge and development of skills and abilities in the field of modern food biotechnology. Content: Food biotechnology based on fermentation processes and other metabolic reactions. Yeast production. alcohol production. Brewing. Winemaking. Bakery. Dairy production. Organic acids. Food biotechnology on the basis of microbial synthesis. Protein Preparation. Getting vitamins. Getting enzymes. Preparation of amino acids. Getting bioloicheski active additives (BAA). The safety and health inspection of food products produktov.Problemy Biosafety modern biotechnological production. Contamination of food mikrorganizmami, toxic food and medoty combat these phenomena. Microbiological and hygienic control of food. Expected results of the study" student has to use the knowledge gained in the production of foodstuffs. in the laboratory, use of microorganisms in food products.
13	Engineering enzymology	4	6	Biochemistry	Biotechnology of biological active substances	**Content:** Introduction to Enzyme Engineering, industrial processes using immobilized enzymes and cells, enzymatic cellulose conversion to sugars biocatalysis in fine organic synthesis, bioelektroanaliz and use of enzymes in electrochemical systems, immobilized enzymes microanalysis, immunoassay and its use in medicine. basic concepts of engineering enzymology, basic methods of engineering enzymology. **Expected results of the study:** the student should use this knowledge in the development and use of biotechnologies in the field of engineering enzymology, have skills to apply the methods of immobilization of enzymes, determination of immobilization techniques, analysis of the results.

13	Fundamentals of of Chemical Technology	4	6	Biochemistry	Biotechnology of biological active substances	**Content:** Introduction to Enzyme Engineering, industrial processes using immobilized enzymes and cells, enzymatic cellulose conversion to sugars biocatalysis in fine organic synthesis, bioelektroanaliz and use of enzymes in electrochemical systems, immobilized enzymes microanalysis, immunoassay and its use in medicine. basic concepts of engineering enzymology, basic methods of engineering enzymology. **Expected results of the study:** the student should use this knowledge in the development and use of biotechnologies in the field of engineering enzymology, have skills to apply the methods of immobilization of enzymes, determination of immobilization techniques, analysis of the results.
14	Basics of genetic engineering	3	5	General and molecular genetics	Engineering majors	**Objective:** to give future professionals, biotechnologists theoretical knowledge and practical skills in the analysis of public and molecular-genetic processes and phenomena in micro-organisms, plants and animals, and reveal their importance in modern biotechnology process. **Subject:** Genetic engineering - the section of molecular genetics associated with purposeful creation of new combinations of genetic material. Historical background and main achievements, predetermined the emergence and rapid development of genetic engineering. The basic principles upon which the genetic engineering technology. The main stages of the development of genetic engineering. Modern genetic engineering strategy. Typical scheme for obtaining and cloning of recombinant DNA experiment. **Expected results of the study:** the student must be the scheme design of organisms on the basis of reunification of DNA fragments in vitro, to identify a specific gene responsible for the synthesis of a particular protein in the preparation of mutations

14	Ctell enjineering	3	5	General and molecular genetics	Engineering majors	**Objective:** to give future professionals, biotechnologists theoretical knowledge and practical skills in the analysis of public and molecular-genetic processes and phenomena in micro-organisms, plants and animals, and reveal their importance in modern biotechnology process. **Subject:** Genetic engineering - the section of molecular genetics associated with purposeful creation of new combinations of genetic material. Historical background and main achievements, predetermined the emergence and rapid development of genetic engineering. The basic principles upon which the genetic engineering technology. The main stages of the development of genetic engineering. Modern genetic engineering strategy. Typical scheme for obtaining and cloning of recombinant DNA experiment. Using the methodology of genetic engineering in solving problems of various areas of biology. Genetic engineering and biotechnology. Using the achievements of genetic engineering in agriculture and medicine. **Expected results of the study:** the student must be the scheme design of organisms on the basis of reunification of DNA fragments in vitro, to identify a specific gene responsible for the synthesis of a particular protein in the preparation of mutations; basic concepts of microbiology and biotechnology, the main directions of biotechnology, the use of micro-organisms for food and beverages, amino acid production, enzymes, bacterial fertilizers, bio-pesticides and Bioherbicides, antibiotics and vaccines, biological wastewater treatment and air-gas emissions of the industrial enterprises, the reactivity of substances . chemical identification, ecology and genetic engineering techniques, which include mutagenesis, hybridization, conjugation, transduction, transformation, and protoplast fusion; to practice modern skills acquired in the study of the discipline; Hybridological conduct analysis; work with genetic maps; apply methods of statistical analysis in the study of genetic and Modification izmechivosti.
15	Fundamentals of Environmental	3	5	Basics of food biotechnology	Engineering majors	Gaining knowledge of students about the main environmental problems of the environment, pollution-related industrial and domestic waste water,
15	Science with the Basis of Biotechn	3	5	Basics of food biotechnology	Engineering majors	Gaining knowledge of students about the main environmental problems of the environment, pollution-related industrial and domestic waste water
MAIN DISCIPLINES						
Elective courses (EC)						

1	Biotechnology products of plant origin	4	6	Plant Biotechnology	Preparation for thesis work	**Objective:** To obtain knowledge of the subject area of activity of a specialist food industry, the ability to practically apply the knowledge in their future activities. Contents: Biotechnology of foodstuff (from raw materials of vegetable origin). Features traditional food biotechnology, fundamentals of modern biotechnological techniques, secondary resources and prospects of their use. Types of plant material, especially for food use. The physical, biochemical, biological and chemical processes occurring in the feed during processing in its intermediate and end products, as well as storage. Potatoes - the raw material for producing alcohol. Structure, chemical composition and the role of individual components in a biochemical process. **Expected results of the study** Know the basics of biotechnology processing of food products and raw materials to the extent necessary for the solution of industrial and research applications, as well as modern methods of control products of plant origin of raw materials and their individual components.
1	Biotechnology soil purification	4	6	Environmental Biotechnology	Preparation for thesis work	**Purpose:** consolidation and deepening of the knowledge gained in the study of the theoretical course. The ability to analyze the causes of changes in the properties and the spatial distribution of soils under the influence of natural factors and human activities. Contents: studies by mainly experiments such natural properties of soil that are nearest related to plant growth, almost no issues affecting the genesis of soils, their geography, etc. The position of soil biology, soil science in the system partition... History of soil biology. Soil biota. General characteristics, environmental characteristics, taxonomy. Higher plants. Soil algae. Soil animals. General characteristics. **Expected results of the** study on the basic principles of biological indication and diagnostics of soils; research methods of soil organisms in field and laboratory conditions.

2	Biotechnology of products of animal origin	4	6	Animal Biotechnology	Preparation for thesis work	**Objective:** To obtain knowledge of the subject area of activity of a specialist food industry, the ability to practically apply the knowledge in their future activities. Content: Biotechnology of food products (raw materials of animal origin). Features traditional food biotechnology, fundamentals of modern biotechnological techniques, secondary resources and prospects of their use. Forms of animal feed, especially for food use. The physical, biochemical, biological and chemical processes occurring in the feed during processing in its intermediate and end products, as well as storage. Factors affecting biotechnological processes affecting the intensification, quality and technological properties of food. **Expected results of the study** To develop students' knowledge about the possibilities of gene and cell engineering of animals, the foundations of biological processes in the processing of raw materials of animal origin.
2	Biotechnology of reservoirs water	4	6	Animal Biotechnology	Preparation for the diploma work	**Objective:** ability to analyze the causes of changes in the properties and spatial distribution of water under the influence of natural factors and human activities, control of the water status.
3	Toxicological analysis of food	3	5	Fundamentals of Food Biotechnology	Preparation for the diploma work	**Purpose:** formation of students' knowledge and skills, allowing to establish a structure and plan the synthesis of various classes of compounds with desired biological properties, to predict their possible biological, including toxicological activity Contents: types of enterprises. Principles for food biotech industries in a market economy. Stages and steps of designing, engineering design and business plan. Project work. **Expected results of the study:** znet t principles for the development of i technological schemes, technological o and technical documentation; criteria n for the selection and calculation of the main and auxiliary equipment; The f methods of heat and material balances o of biotechnological and chemical industriesr thesis work

3	Chemisty of food products	3	5	Fundamentals of Environmental Biotechnology	Preparation for the diploma work	**Purpose:** The possibility of using biological objects for the protection of animals, methods of biotechnology in animal protection Biotechnology of biologically active substances from food biotechnology Preparations for thesis work Objective: To provide students with knowledge about the biotechnological methods of production of biologically active substances and drugs with the help of microorganisms - producers. justification of the need and usage of food additives and dietary supplements; categorical (conceptual) apparatus; principles of classification and coding of food additives and dietary supplements; methodical approaches to the evaluation of the quality and safety of food additives and dietary supplements; registration procedure of food additives and dietary supplements **Contents: group of food additives and their functionality.** Codification, Basic information about the quality and nutritional supplements. BAS market development in Kazakhstan. Control safety of food additives and dietary supplements. find information about food additives and dietary supplements that are approved for use on the territory of Kazakhstan; use sanitary-hygienic and other normative documents on food additives and dietary supplements. **Expected results of the study:** the skills to find the information necessary for the effective and safe use of food additives and dietary supplements industry, commerce and households.
4	Biotechnology fermentation production	3	5	Biotechnology of microorganisms	Preparations for thesis work to form	**Expected results of the study** students' theoretical knowledge of the basics of biotechnology fermentation industries and the practical application of acquired knowledge in practice, to know the basics of biotechnology fermentation industries to raw materials requirements, materials and finished products
4	Biotechnology of air purification	3	5	Fundamentals of Environmental Biotechnology	Preparation for the diploma work	**Objective:**the ability to analyze the causes of changes in the properties and the spatial distribution of air under the influence of natural factors and human activities, control over the state of the atmosphere

5	Food Microbiology , sanitation and hygiene	3	5	Fundamentals sanitanaya food biotechnology	Preparations for thesis work	**Objective:** in-depth study of the fundamentals of general and industrial microbiology and microbiology of food production, the formation of a scientific outlook on the role of microorganisms in the different processes of processing and storage of food. This will allow future professionals to provide a high level of sanitary conditions of production, prevent losses and to obtain good-quality products, to take into account the basic laws of the development of a technically useful and harmful microflora in the development of new kinds of foods. **Contents:** Fundamentals of Industrial Microbiology. Modern methods of creation of industrial strains of microorganisms problem of preserving their valuable properties. Biotechnological production based on the preparation of the microbial biomass. Production of microbial protein. Production of antibiotics. Microbiological production of foods and beverages. **Expected results of the study:** to conduct microbiological testing of food, learn modern methods of obtaining and identification of pure cultures of microorganisms to determine the shelf life of food products for microbiological indicators; interpret the results of ongoing studies and evaluate the quality of products for microbiological indicators.
5	Technical Microbiology	3	5	Fundamentals of Environmental Biotechnology	Preparation for thesis work	**Purpose:** formation of knowledge and skills in plant protection of crops from pests and diseases specialists agronomic conditions of service for agricultural enterprises of different ownership forms. Contents: Classification of crops and especially their use in crop production systems in different soil and climatic conditions. Agroclimatic and agricultural zoning. Optimization of the selection of pesticides for crop protection. The organization works on plant protection in the agricultural enterprise. **Expected results of the study:** to own methodology of experimental work in plant protection; working with educational, scientific, industrial and scientific literature on plant protection.
6	Biotechnology of biological active substances	4	6	Fundamentals of Environmental Biotechnology	Preparation for thesis work	**Objective:** Getting knowledge of the subject area of activity specialist food industry, the ability to practically apply the knowledge in their future activities. Contents: Biotechnology of milk and dairy products. Physico-chemical and biochemical basis of milk technology. Biotechnology milking different kinds of animals. Biotechnological processing and canning of animal feed. **Expected results of the study:** Preparation of students for disposal, recovery and recycling of production waste, knows the scientific and practical aspects of recycling, recovery.

6	Basics of isolation and purif ication of bio-products	4	6	Processes and devices in biotechnology	Preparations for thesis work	**Objective:** In-depth study of modern food production methods for the use of knowledge in the development of new facilities and equipment of the world trends in the field of process equipment used in the food industry Contents: types of enterprises. Principles for food biotech industries in a market economy. Stages and steps of designing, engineering design and business plan. Project work. Typical design, reconstruction and technical re-equipment. Automated roektirovanie biotech industries. Design master plan. Calculation of raw materials, finished products; Calculation and selection of equipment; calculation of areas; venture arrangement. **Expected results of the study**: to learn modern methods for the preparation and identification of pure cultures of microorganisms to determine the shelf life of food products for microbiological indicators; interpret the results of ongoing studies and evaluate the quality of the products.
7	Technology equipment food industry	3	5	Processes and apparatuses in biotechnology	The preparation for graduate work	**Goal**: in-Depth study of modern methods of food production to use the knowledge in the development of new plant and equipment, of global trends in the field of technological equipment used in the food industry **Contents:** Types of enterprises. The principles of placing the food biotechnology industries in a market economy. Stages and phases of design, pre-design work and a business plan. Design work. Model design, reconstruction and technical re-equipment. Automated Proektirovanie biotechnology industries. The design of the master plan. Calculation of raw materials, finished products; calculation and selection of equipment; calculation of areas; the layout of the enterprise. **The expected results of the study:** to learn modern methods of production and identification of pure cultures of microorganisms;to determine the shelf life of food products for microbiological indicators; to interpret the results of ongoing research and to evaluate the quality of the products**.**
7	Technical equipment of environmental biotechnology	3	5	Processes and devices in biotechnology	Preparations for thesis work	**Objective:** In-depth study of modern methods for the development of new plant and equipment, on global trends in the field of process equipment used in environmental biotechnology Contents: types of enterprises. Principles for food biotech industries in a market economy. Stages and steps of designing, engineering design and business plan. Project work. Typical design, reconstruction and technical re-equipment. Automated roektirovanie biotech industries. Design master plan. **Expected results of the study:** Calculation of raw materials, finished products; Calculation and selection of equipment; calculation of areas; venture arrangement.

8	Fundamentals of biotechnological production	3	5	Production processes and devices in biotechnology	Preparations for thesis work	**Objective:** To provide future professionals theoretical knowledge and practical skills in general questions the understanding of basic standards for technological design, modern approaches to the design of biotechnological and chemical and pharmaceutical industries **Expected results of the study** provide future professionals theoretical knowledge and practical skills in general questions the understanding of basic standards for technological design
8	Industrial ecology	3	5	Fundamentals of Environmental Biotechnology	Preparation for thesis work	**Objective:** familiarize students with the major environmental problems of the environment, pollution-related industrial and domestic sewage, the main factors harmful effects of industrial production on the environment; ways to reduce harmful industrial emissions

Note: * - means that the discipline of study for all educational trajectories

LIST OF ELECTIVE COURSES

Name of Discipline	**Credit CODE**	**Credits**		**Semester**
		RK	**RK**	
General educational disciplines				
Elective course 1		2	3	2
Ecology with the basics of life safety	1+1+0	1+1+0		
Psychology	PS1106			
Elective course 2		2	3	3
Political Science	1+1+0	1+1+0		
Sociology	Soc 2107			
Culturology	Cul 2107			
Fundamentals of Anti-Corruption Culture	FACC 2017			
Elective course 3 (Established by the university)		3	5	5
Religious	Rel 3104	2+1+0		
BASIC DISCIPLINES				
Elective course 1		3	5	2
Cytology and histology	CH1208	1+1+1		
Cell biotechnology	CB1208			
Elective course 2		3	5	3
Phytoresource in biotechnology	PhB 2209	2+1+0		
Fundamentals of plant growing	FPG2209			
Elective course 3		3	5	3
Zooresources in biotechnology	ZB 2210	2+1+0		
Perspective directions of ecological biotechnology	PAEB2210			
Elective course 4		4	6	3
Microbiology and Virology	MV 2211	2+1+1		

Medical microbiology virology and immunology	MMVI2211			
Elective course 5		3	5	4
Plant Physiology	PP 2212	2+0+1		
Anatomy and morphology of plants	AMP2212			
Elective course 6		3	5	4
Human and animals physiology	HAPh 2213	2+0+1		
Physiology of higher nervous activity and sensory systems	PHNASS2213			
Elective course 7		4	6	4
Biotechnology of microorganisms	BM 2214	2+1+1		
Fundamentals of genetics of microorganisms	FGM2214			
Elective course 8		3	5	4
Fundamentals of physical and chemical analysis	FM2215	2+0+1		
Food Chemistry	FHim2215			
Elective course 9		3	5	5
Plant biotechnology	PB 3216	2+0+1		
Culture of cells of higher plants	CCHP 3216			
Elective course 10		3	5	5
Animal biotechnology	AB 3217	2+0+1		
Fundamentals of animal breeding	FAB3217			
Elective course 11		3	5	5
General and molecular genetics/ Immunogenetics	GMG 3218/	2+0+1		
Immunogenetics	Imm3218			
Elective course 12		4	6	5
Fundamentals of Food	FB 3219	2+0+2		
/Biotechnological fundamentals of food technology	BFFT3219			
Elective course 13		4	6	6
Engineering enzymology	EE 3220	2+2+0		
Fundamental and applied enzymology	FAE3220			
Elective course 14		3	5	6
Basics of genetic engineering	BGE 3221	2+1+0		
Genetic basis of animal breeding/	GBAB3221			
Elective course 15		3	5	6
Fundamentals of Environmental	FE3222	2+1+0		
Science with the Basics of Biotechnology	SBB3222			
Main disciplines				
Elective course 1		4	6	6,7
Biotechnology products of plant origin	BPPO 3303	2+1+1		
Biotechnology soil purification	BSC 3303			

Elective course 2		4	6	6
Biotechnology of products of animal origin	BPAO 3304	2+1+1		
Biotechnology of reservoirs water	BRW 3304			
Elective course 3		3	5	6
Toxicological analysis of food	TAF 3305	2+0+1		
Biotechnology in animal protection	BAP 3305			
Elective course 4		3	5	7
Food microbiology, sanitation and hygiene	FMSH 4307	2+0+1		
Biotechnology in plant protection	BPP 4307			
Elective course 5		3	5	7
Food microbiology, sanitation and hygiene	FMSH 4307	2+0+1		
Biotechnology in plant protection	BPP 4307			
Elective course 6		4	6	7
Biotechnology of biological active substances/	BBAS 4308/	2+1+1		
Biotechnology recycling industry	BRI 4308			
Elective course 7		3	5	7
Technology equipment food industry	TEFI 4309	2+1+0		
Technical equipment of environmental biotechnology	TEEB 4309			
Elective course 8		3	5	7
Fundamentals of biotechnological production	FBP 4310	2+1+0		
Industrial ecology	IE 4310			