CATALOG OF ELECTIVE DISCIPLINES

6B05 - Natural Sciences, Mathematics and Statistics
(Code and classification of the field of education)

6B051 - Biological and related sciences
(Code and classification of the direction of training)

0510
(Code in the International Standard Classification of Education)

B050 - Biological and related sciences
(Code and classification of the educational program group)

6B05102 - Biotechnology
(Code and name of the educational program)

bachelor
(Level of preparation)

set of 2023

Семей 2023

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Chairman of the Academic Council Oralkanova I.A.

Biotechnology equipment

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies equipment for the preparation of semi-finished products and raw materials; general information about devices and machines for food production; engineering problems of food production and machine-hardware options for their solution; equipment for carrying out mass transfer and thermal processes in the processing of semi- finished products and raw materials; equipment for microbiological processes; equipment for electrophysical processing of raw materials and semi- finished products; equipment for mechanization of finishing operations.

Purpose of studying of the discipline
Getting the students basic knowledge in the field of design and operation of biotechnological machines and devices that specialist (bachelor) will be able to apply in their future practice when working in their specialty.

Learning Outcomes
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline
1. Perform operation of biotechnological machines and devices;
2. Explain the essence of the main methods used in the operation and calculation of biotechnological machines;
3. Use the knowledge of operation and calculation of biotechnological machines in the study of other academic disciplines.

Prerequisites
Fundamentals of biotechnology

Postrequisites
CAD Designing of the enterprises biotechnological production

Processes and devices of food manufactures

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the foundations of the theory of similarity; general principles for calculating technological processes and food production equipment; mechanical processes; hydromechanical processes; basics of modeling of technological processes and apparatuses of food production; characterization of heterogeneous systems; separation of gas heterogeneous systems; fundamentals of kinetics and dynamics of technological processes; calculations of hydromechanical and mechanical processes, machines, devices; modern problems of mechanical and hydromechanical processes and devices.

Purpose of studying of the discipline
Getting basic knowledge in the field of technological processes and engineering calculations of devices and machines.

Learning Outcomes
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline
1. Use technological processes for the production of food products from plant and animal raw materials;
2. To carry out the selection of technological equipment;
3. Perform calculations of mechanical and hydromechanical processes, devices, machines, use the acquired knowledge in the study of other academic disciplines.

Prerequisites
Bioengineering

Postrequisites
Design of fermentation enterprises Designing of the enterprises of meat and milk industry

Technological equipment of enterprises of meat and dairy industry

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the concept of technological equipment, classification, basic parameters; the speed of kinetics and movement of the product in the equipment; milk sterilization equipment; butter production equipment; equipment for the production of ice cream; cheese production equipment; technology features and equipment classification; equipment for the production of cottage cheese; technological calculations of equipment for the production of protein dairy products; equipment for bottling milk.

Purpose of studying of the discipline
Getting the students basic knowledge in the field of design and operation of biotechnological machines and devices that specialist

(bachelor) will be able to apply in their future practice when working in their specialty.

Learning Outcomes

ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Define the basic principles of the theory and calculation of technological processes of meat and dairy production;

2. Analyze production technologies and technical equipment of the processing industry;

3. Carry out modeling of technological processes; perform basic engineering calculations of machine components and parts.

Prerequisites

Bioengineering

Postrequisites

Design of fermentation enterprises Designing of the enterprises of meat and milk industry

Fundamentals of scientific research

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studying research activities and its features; stages of research activities; information resources of research activities; bibliographic information and forms of its existence; information retrieval strategies; results of research activities; research presentation forms; master`s thesis: purpose, tasks, structure; methodological basis of scientific knowledge; methods of theoretical and empirical research; methods of the metatheoretical level; elements of the theory and methodology of scientific and technical creativity.

Purpose of studying of the discipline

Getting knowledge of the subject area of work engineer - an expert.

Learning Outcomes

ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task

ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline

1. Formulate the goal and objectives, object and subject, research hypothesis;

2. Process the obtained results, analyze and comprehend them taking into account the available data; draw up a plan-prospect of written scientific work;

3. Apply computer technology for planning and conducting work on the basics of scientific research.

Prerequisites

Fundamentals of biotechnology

Postrequisites

Use o f enzyme preparations in food production Ecological biotechnology

Microbiology and biotechnology in the meat and milk industries

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the influence of microorganisms on the technological processes of processing and storage of meat and dairy products. Methods of microbiological research of meat and dairy products. Indication and identification of pathogenic microorganisms transmitted to humans through meat and dairy products. Methods of microbiological control of the production of agricultural products. Evaluation of the quality of meat and dairy products by microbiological indicators.

Purpose of studying of the discipline

Received by a student knowledge of the subject area of activity specialist food industry.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Perform technological control of compliance of the quality of products and services with established standards;

2. Determine the methodology for the selection and operation of technological equipment of modern brands;

3. Highlight the requirements for the quality of products.

Prerequisites

School course

Postrequisites
Expertise of food products Safety of food products Microbiological bases of biotechnological production

Food Microbiology

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the methods and means of sterilization, methods for preparing preparations of microorganisms, cultivating microorganisms, the technique of inoculating microorganisms on nutrient media, the morphology of filamentous fungi, yeasts, bacteria, cultural and physiological and biochemical characteristics of bacteria, the isolation of a pure culture of lactic acid bacteria, methods of quantitative accounting of microorganisms, study of indoor air microflora, sanitary and bacteriological analysis of water, sanitary and microbiological analysis of soil, characterization of bacteria that cause food spoilage, microbiological analysis of food products.

Purpose of studying of the discipline
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Ауыл шаруашылығы өнімдерін өндіру және қайта өңдеу саласында ғылыми зерттеулер жүргізу, алынған мәліметтерді талдау және жалпы қабылданған әдістер бойынша жалпылау;
2. Ауыл шаруашылығы шикізатының және оларды қайта өңдеу өнімдерінің сапасы мен қауіпсіздігі көрсеткіштерін талдау әдістерін басқару;
3. Тамақ өнімдерінің сапасына әсер ететін микроорганизмдердің негізгі топтарының морфологиясын анықтау.

Prerequisites
School course

Postrequisites
Cell biotechnology Fundamentals of Biotechnology of microorganisms Methods of food analysis Microbiological control of biotechnological productions

Food Microbiology and sanitary hygiene

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline «Food Microbiology and Sanitary Hygiene» studies sanitary indicative microorganisms, sanitary and microbiological control of food production, the principles of microbiological control, methods of disinfecting objects from microorganisms, industrial sanitation, biological properties and vital processes of microorganisms used in the production of alcohol, wine, beer, production of yeast, bakery, lactic acid products, food spoilage agents, sanitary and microbiological examination of food products, sanitary and bacteriological control of household items and personnel hands.

Purpose of studying of the discipline
Gaining knowledge to the subject area specialist food industry activity, the ability to practically apply the knowledge in their future activities

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. To carry out microbiological control of food production;
2. Use laboratory equipment;
3. Determine the main groups of microorganisms.

Prerequisites
School course

Postrequisites

Modern methods of creation of industrial strains of microorganisms Expertise of food products Safety of food products Microbiological bases of biotechnological production

General and molecular genetics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies genetic engineering; medical genetics; human genetics; population genetics; developmental genetics; principles and mechanisms of gene action regulation; the structure and function of the gene; mutation types of mutations; mutation process; non-nuclear inheritance; linked inheritance and crossing over; gender- linked inheritance; types of interaction of non- allelic genes: complementary action of genes, epistasis, polymerism; chromosomal gender determination and inheritance of gender-linked traits.

Purpose of studying of the discipline

Patterns of inheritance of signs of, cytological basis of heredity.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. To study a living organism at different levels of its organization: from molecular to biospheric. Explain the laws of genetics;
2. Characterize the fundamental genetic mechanisms that provide the properties of heredity and variability.
3. Explain the mechanisms of regulation of gene expression.

Prerequisites

School course

Postrequisites

Cell biotechnology

Physiology of nutrition

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the role of nutrition in the functioning of the main systems of the human body and the assessment of the nutritional status of the body; daily energy consumption; basic metabolic processes in the body; the concept of diet; physiological significance, composition, nutritional and energy value of various food products; daily norm of human need for nutrients; principles and norms of rational balanced nutrition for various population groups.

Purpose of studying of the discipline

Learning Outcomes

ON3 Apply the fundamental laws of physics, elements of linear algebra, differential and integral calculus in mathematical prob-lems of physics and mathematical methods for describing the physical processes occurring in nature, including in the body of living beings

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

Learning outcomes by discipline

1. Conduct an organoleptic assessment of the quality of food raw materials and products;
2. Calculate the energy value of dishes;
3. Make up diets for various categories of consumers.

Prerequisites

School course

Postrequisites

Fundamentals of biotechnological production Biotechnology for the production of national dairy products Biotechnology fermentation production

Plant physiology

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the general patterns of vital activity of plant organisms, the processes of absorption of mineral substances and

water by plant organisms, the processes of growth and development, flowering and fruiting, nutrition, respiration, biosynthesis and accumulation of various substances. Techniques and methods for increasing the overall productivity of plant organisms, nutritional value, technological quality of their tissues and organs; the latest developments and achievements in the field of plant physiology.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Apply the principles of structural and functional organization, use physiological, cytological, biochemical, biophysical methods of analysis to assess and correct the state of living objects and monitor their habitat;

2. To carry out the choice of methods adequate for solving research problems and identify the relationship between the physiological state of the object and environmental factors;

3. Apply methods to assess the state of living objects.

Prerequisites

School course

Postrequisites

Bioengineering Plant cell culture

Engineering Graphics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

In this discipline, the rules of execution and design of graphic works are studied; the problems of geometric and projection drawing are solved; the rules for the use of conditional graphic designations when performing drawings and diagrams are studied. Students, studying this discipline, acquire the skills of making images of parts using views, sections and sections, making sketches and working drawings, assembly drawings; drawing sizes and position numbers, drawing up specifications.

Purpose of studying of the discipline

the basic rules of execution and registration of design documentation are studied. Full mastery of the drawing as a means of expressing technical thought and

production documents, as well as the acquisition of stable drawing skills are achieved as a result of mastering the entire complex of technical disciplines of the relevant profile, supported by the practice of course and diploma design

Learning Outcomes

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Explain the main provisions of the USDD (Unified System for Design Documentation), which establish interrelated rules and regulations for the development, execution and circulation of design documentation;

2. Perform calculations of processes, devices, machines;

3. Determine the geometric shapes of parts from images and be able to make these images from life and according to the drawing of products or its elements.

Prerequisites

School course

Postrequisites

CAD Designing of the enterprises biotechnological production

Computer graphics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies a brief history of computer graphics; areas of application of computer graphics; basic concepts of computer graphics; software and hardware used; principles of representation of graphic information in a computer; graphic file formats; devices for input and output of graphic information; graphics adapters and monitors; scanners and digitizers; plotters and printers; review of computer editors and graphic programs; vector graphic editors; raster graphic editors.

Purpose of studying of the discipline

Learning Outcomes

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline

1. Use modern software in the field of computer graphics development;

2. Implement the basic algorithms for raster and vector graphics;
3. Use graphic standards and libraries.

Prerequisites

School course

Postrequisites

Design of fermentation enterprises Designing of the enterprises of meat and milk industry

Descriptive geometry and drawing

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

In this discipline, the theory of drawing construction is studied; positional tasks; rules for drawing up and reading drawings; ways to convert a complex drawing, curved surfaces, views, sections, cuts, welding, soldering, threads and threaded connections, adhesive, slotted and keyed connections, sketches; gear wheels; working and assembly drawings; the main provisions of the USDD, which establish interrelated provisions and rules for the development, circulation and execution of design documentation.

Purpose of studying of the discipline

Teaching descriptive geometry is the acquisition of knowledge by students, ensuring the development of their spatial representation and imagination, constructive-geometrical thinking, the ability to analyze and synthesize the spatial forms and their relations on the basis of graphic models of space, practically implemented in the form of certain specific drawings of spatial objects.

Learning Outcomes

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Apply knowledge of engineering graphics in solving practical engineering problems;
2. Work with drawing tools and sketch details;
3. Use reference literature and ESKD standards.

Prerequisites

School course

Postrequisites

Design of fermentation enterprises Designing of the enterprises of meat and milk industry

English for Academic purposes

Discipline cycle	Basic disciplines
Course	2
Credits count	3
Knowledge control form	Examination

Short description of discipline

In the course of studying the discipline, the specifics of written and oral communication, academic communication, linguistic features of analytical speech works, scientific style, academic reading, oral forms of analytical communication, stages of preparation of analytical speech works, technical design of scientific text, academic writing, technique of scientific research are studied. Information is analyzed, texts are refereed and annotated; reference materials, including Internet resources, are used.

Purpose of studying of the discipline

To form skills of students of foreign language communicative competence to communicate effectively in an academic environment

Learning Outcomes

ON2 Analyze and critically comprehend socially and professionally significant experience, communicate effectively in an intercultural environment in oral and written form, including in a foreign language

Learning outcomes by discipline

1. Demonstrate the academic vocabulary necessary for communication in an academic environment;
2. Form a logical, structured message on a wide range of topics in an academic environment;
3. Analyze information, abstract and annotate texts.

Prerequisites

Foreign language Kazakh language Russian language

Postrequisites

Fundamentals of biotechnological production Industrial biotechnology

Professionally-oriented foreign

Discipline cycle	Basic disciplines
Course	2
Credits count	3
Knowledge control form	Examination

Short description of discipline

In the course of studying the discipline, professional terminology, special professionally-oriented material and its use in professional situations are studied. Orientation in texts in Kazakh, Russian and English, monologue statements of professional content. The connection of professional Kazakh, Russian and English languages with the disciplines of the specialty. The purpose of teaching a professionally oriented language is to integrate it with special disciplines in order to form professionally significant personality qualities and gain professional knowledge.

Purpose of studying of the discipline

Preparing students for communication in oral and written forms, both in professional and social spheres of communication, mastering communicative competence, to teach them to use professional Kazakh/ Russian/ English in various fields of professional activity, scientific and practical work.

Learning Outcomes

ON2 Analyze and critically comprehend socially and professionally significant experience, communicate effectively in an intercultural environment in oral and written form, including in a foreign language

Learning outcomes by discipline

1. Translate original literature in the chosen specialty and formulate sentences according to the meaning in Kazakh, Russian and foreign languages;
2. Demonstrate information in three languages in accordance with the goals and objectives of training (abstract, annotation, resume);
3. Interpret oral messages on professional topics, including using multimedia technologies.

Prerequisites

Foreign language Kazakh language Russian language

Postrequisites

Fundamentals of biotechnology Industrial biotechnology

Work with professional – oriented text

Discipline cycle	Basic disciplines
Course	2
Credits count	3
Knowledge control form	Examination

Short description of discipline

The discipline studies the specifics of oral and written speech in the areas of professional, scientific, social and political communication; main provisions of lectures, conversations, reports; make a clear, logically structured report on professional topics; understand and perceive the stylistic features of the vocabulary of the English language in the field of professional communication; texts of different genres and be able to analyze them and can use information in communication.

Purpose of studying of the discipline

To training professional – oriented foreign-language communication developing personal qualities of the student, knowledge of culture of the country of the learned language and acquisition of special skills.

Learning Outcomes

ON2 Analyze and critically comprehend socially and professionally significant experience, communicate effectively in an intercultural environment in oral and written form, including in a foreign language

Learning outcomes by discipline

1. Apply oral and written speech in the areas of professional, scientific, socio-political communication;
2. Participate in professional discussions, scientific debates, discussions, conversations in Kazakh, Russian and foreign languages;
3. Demonstrate the skills of constructing and organizing text in English in the framework of professionally determined situations.

Prerequisites

Foreign language Kazakh language Russian language

Postrequisites

Fundamentals of biotechnological production Industrial biotechnology

Bioengineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the application of methods and concepts of biology (and, secondly, computer science and mathematics, chemistry, physics) to solve actual problems associated with the sciences of living organisms, using synthetic and analytical methodologies of engineering; the latest research methods used to solve bioengineering problems; Bioengineering for the development and study of the application of living organisms mainly uses the rapidly developing field of molecular biology.

Purpose of studying of the discipline

Learning Outcomes

ON3 Apply the fundamental laws of physics, elements of linear algebra, differential and integral calculus in mathematical prob-lems of physics and mathematical methods for describing the physical processes occurring in nature, including in the body of living beings
ON4 Apply the basic stoichiometric laws of chemistry in solving computational problems, patterns of different types of reactions, calculate the energy characteristics of chemical processes and the number of components of solutions of a given concentration
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Apply in professional activities modern ideas about the basics of biotechnological and biomedical industries, genetic engineering, nanobiotechnology, molecular modeling;
2. Evaluate and predict the prospects of the objects of their professional activity for biotechnological industries;
3. Define the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology and molecular

modeling.

Prerequisites

Food Microbiology and sanitary hygiene

Postrequisites

Fundamentals of biotechnological production Industrial biotechnology Microbiological bases of biotechnological production

Cell biotechnology

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the theoretical foundations of cellular biotechnology; genomics, proteomics and bioinformatics; structural, functional and comparative genomics as the basis for the creation of genetically engineered structures at the cellular level; proteome of various types of organisms, its functional organization and regulation; bioinformatics in planning, organization and implementation of biotechnological tasks; characterization of cells cultured in vitro; nutrient media and cultivation conditions; cell culture in the production of biologically active compounds.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Use the principles of the structure and functioning of living cells to obtain a biotechnological product;

2. Use modern information technologies, including databases and application packages, to solve the problems of cell biotechnology;

3. Use theoretical knowledge and practical skills in the field of genetic engineering.

Prerequisites

Objects of biotechnology

Postrequisites

Food Biotechnology Methods of food analysis Microbiological control of biotechnological productions

Plant cell culture

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the growth of cells in culture; dedifferentiation and callus formation; cell culture biology; culturing cells in a liquid medium; nutrient media; principles and methods of cultivation of plant cells; clonal micropropagation of plants; obtaining secondary metabolites using plant cell and tissue culture; preservation of the gene pool of higher plants in collections and cryobanks; the use of cell culture to solve theoretical problems of plant biology.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Apply knowledge of the principles of cellular organization of biological objects, biophysical and biochemical foundations, membrane processes and molecular mechanisms of life;

2. Predict the consequences of the introduction of plants created by biotechnological methods;

3. Use biotechnological techniques to improve the yield and sustainability of critical crops.

Prerequisites

Plant physiology

Postrequisites

Phytohormones in biotechnology Biotechnology of phototrophic microorganisms

Fundamentals of Biotechnology of microorganisms

Discipline cycle	Basic disciplines
Course	2
Credits count	5

Knowledge control form	Examination

Short description of discipline
The discipline studies the history of development, goals and objectives of biotechnology; fundamentals of microbiological biotechnology; development prospects; main directions of biotechnology; the concept of "autoselection" and "population stability"; methods of creation and the problem of preserving the valuable properties of industrial strains of microorganisms; modern methods of storage of strains of microorganisms; biotechnological processes: systematization, stage and principles of implementation; cultivation of microorganisms, formulation of a nutrient medium for the cultivation of microorganisms.

Purpose of studying of the discipline
Getting the students knowledge of the aims and objectives of biotechnology, principles and features of microbiological processes, methods of obtaining highly industrial strains of microorganisms, methods of cultivation and storage. To introduce industrial production of antibiotics, enzymes, amino acids, polysaccharides, organic acids and neutral products, bacterial plant protection products and fertilizers, protein, single-celled organisms, etc.

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline
1. Determine the purity and activity of cultures and preparations, control the growth of producers;
2. Use knowledge about the biotechnology of microorganisms in practice;
3. Analyze practically useful properties of biotechnology objects.

Prerequisites
Objects of biotechnology Food Microbiology

Postrequisites
Fundamentals of scientific research Ecological biotechnology Microbiological control of biotechnological productions

Commodity Basics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the systematization of goods using classification and coding methods; assortment management of the organization; the fundamental characteristics of the goods that make up its use value, as well as their possible changes at all stages of the distribution of goods; merchandising characteristics of specific goods; needs and requirements for the quality of goods; commodity analysis and examination of goods; consumer properties of goods; indicators of the quality of goods; appraisal activity in merchandising.

Purpose of studying of the discipline
Study theoretical assumptions common to all goods irrespective of their classes, subclasses and groups, the acquisition of the primary skills to use certain techniques and merchandising, to determine the basic characteristics of the goods, learn to assess and maintain the quality in the production stages, product distribution and use.

Learning Outcomes
ON3 Apply the fundamental laws of physics, elements of linear algebra, differential and integral calculus in mathematical prob-lems of physics and mathematical methods for describing the physical processes occurring in nature, including in the body of living beings
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Recognize classification groups of goods;
2. Analyze the stages and stages of merchandising;
3. Analyze the stages and stages of the technological cycle of goods.

Prerequisites
Food Microbiology and sanitary hygiene

Postrequisites
Expertise of food products Safety of food products The methodology of research work

Modern methods of creation of industrial strains of microorganisms

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the regulation of metabolism in a microbial cell, the induction and repression of enzyme synthesis, the regulation and proteolysis of metabolism, methods for isolating mutants and mutagenesis, hybridization of eukaryotic microorganisms, genetic engineering of industrially important microorganisms, and the construction of strains of human interferon producers. expression of foreign genes in microorganisms, conjugation and plasmids in bacteria, vector molecules, protoplast fusion, construction of strains producing primary metabolites.

Purpose of studying of the discipline

Gaining knowledge in the field of modern methods for the creation of industrial strains of microorganisms, the application of acquired knowledge in practice.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Conduct microscopy using a light microscope; cultivate microorganisms using various nutrient media, incl. under anaerobic conditions;

2. Isolate a pure culture of microorganisms by various methods; identify microorganisms using microscopic, cultural and biochemical methods;

3. Prepare stained bacteriological preparations of microorganisms.

Prerequisites

Food Microbiology and sanitary hygiene Microbiology and biotechnology in the meat and milk industries

Postrequisites

Selection of industrial strains of microorganisms Microorganisms of fermentative productions

Animal biotechnology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies cloning techniques; structure of animal genes; genetic transformation of embryonic and somatic cells of animals; methods of artificial insemination; obtaining transgenic animals; production of allopheneic animals (genetic chimeras) and issues of cryopreservation of sex and germ cells; general biological foundations of animal biotechnology; approaches to cellular and embryological engineering; principles of cloning and genetic transformation of somatic cells; understanding of the application of biotechnological methods in the science and practice of animal husbandry.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

Prerequisites

Bioengineering

Postrequisites

Medical and veterinary biotechnology Biotechnology for the production of national dairy products

Plant biotechnology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the diversity of biotechnological processes; main directions of biotechnology; plant biotechnology, its specifics; prospects for the development of biotechnology, cultivated plant cells as an object of biotechnology; theoretical and methodological principles of cultivation of plant cells; nutrition of cultured cells; general characteristics of nutrient media; application of fundamental biological knowledge in practical activities aimed at the production of drugs, enzymes, proteins, dyes, aromatic substances, vitamins and a number of biologically active compounds.

Purpose of studying of the discipline

The lighting of the current state of knowledge about the biology of cultured plant cells as an object of biotechnology and all the main areas of biotechnology.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Analyze cell subculturing and evaluate their growth;
2. Carry out work in the laboratory, prepare nutrient media for cultivation;
3. Prepare nutrient media for cultivation and obtaining a whole plant from cell culture.

Prerequisites

Fundamentals of biotechnology Objects of biotechnology Cell biotechnology

Postrequisites

Fundamentals of scientific research Ecological biotechnology

Phytohormones in biotechnology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the main types of plant phytohormones, as well as biotechnological methods for their production; plant hormonal system; synthetic regulators of plant development and growth; synthetic regulators (growth substances) and phytohormones in plant biotechnology; biotechnological methods for obtaining phytoregulators and phytohormones; genetic and environmental safety of the use of growth regulators; general features of the action of phytohormones; classification of phytohormones; auxins; content and distribution in plants; chemical structure of auxins; auxin metabolism.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

Learning outcomes by discipline

1. Understand the principles of obtaining and methods of using phytohormones;
2. Analyze the safety of using plant growth regulators; work in the laboratory;
3. Use the main types of plant phytohormones, as well as biotechnological methods for their production and have the skills of laboratory work, analysis of the results obtained, and apply the acquired knowledge in practice.
Demonstrates basic knowledge and professional qualities of a specialist in the field of phytobiotechnology.

Prerequisites

Plant cell culture Plant physiology

Postrequisites

The methodology of research work Biotechnology of phototrophic microorganisms

Industrial biotechnology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the typical scheme and main stages of biotechnological productions; fermentation process: main characteristics; mathematical models of the kinetics of fermentation processes; continuous cultivation of microorganisms; control of technological regimes of periodic and semi-periodic fermentation processes; biocatalysis and biotransformation; sorption methods for the isolation of biosynthesis products; membrane methods in biotechnology; main sources of biogenic elements; generalized technological scheme of the process of microbial synthesis; equipment for cultivating microorganisms.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline
1. To form an idea of microbiological processes in biotechnology;
2. Check the main branches of biotechnology development, methods and methodologies, raw material base and the global market for biotechnological products;
3. Classify the stages of biotechnological production.
Prerequisites
Bioengineering
Postrequisites
Modern technologies of use of biologically active substances in bioindustry

Fundamentals of biotechnological production

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the rate and peculiarity of metabolism in microbial cells, examples (the ability to synthesize secondary metabolites, doubling time, the ability to regulate the rate of metabolic reactions); the use of different strains of microorganisms depending on the type of bioproduction; metabolism of biological objects, requirements for the use of raw materials (substrates) for biotechnological production; the importance of microorganisms as objects of biotechnological production; typical scheme and main stages of biotechnological productions.
Purpose of studying of the discipline
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
Learning outcomes by discipline
1. Explain the peculiarity of the metabolism of biological objects, the requirements for the use of raw materials (substrates) for biotechnological production;
2. Use the acquired knowledge in the development of the use of biotechnology;
3. Demonstrate the skills of maintaining sterile conditions, methods for obtaining biomass and metabolites, knowledge of industrial biotechnology.
Prerequisites
Bioengineering Microbiology and biotechnology in the meat and milk industries
Postrequisites
Biotechnology fermentation production Probiotic biotechnology Microorganisms of fermentative productions

Industrial biotechnology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the areas of application of products of biotechnological industries; biological objects - a component of biotechnological production; mass transfer characteristics of fermentation equipment; methods of long- term storage of microbial cultures; models of biotechnological process control; biopesticides and soil fertilizers; models of biotechnological process control; fundamentals of modern immunobiotechnology; hardware design of the processes of isolation and purification of products of microbial synthesis; technological bioenergy; obtaining ethanol as a fuel.
Purpose of studying of the discipline
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
Learning outcomes by discipline
1. Create a technology for obtaining new types of products, including products obtained using microbiological synthesis, biocatalysis, genetic engineering and biotechnologies;

2. Use the skills of working in the field of laboratory, pilot and industrial production to create a biotechnological product of biotechnological methods;
3. Organize work on the isolation and purification of biologically active substances.

Prerequisites

Fundamentals of biotechnology

Postrequisites

Biotechnology of industrial waste processing Ecological biotechnology Biotechnology of dairy production and processing of secondary raw materials Microbiological control of biotechnological productions

Microbiological bases of biotechnological production

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studies the structure of the cell, the chemical composition of cells, the role of water in life processes, metabolism and enzymatic processes, enzymes and coenzymes, the kinetics of enzymatic reactions, the most important energy processes, the biosynthesis of proteins and nucleic acids, the principles of regulation of metabolism, the cultivation of microorganisms, optimal cultivation conditions, growth and reproduction, cultivation methods, basics of microbiological production, raw materials, technological equipment, stages of the technological process.

Purpose of studying of the discipline

Have an idea about the features of metabolic and biosynthetic capabilities of microorganisms, the principles of regulation of metabolism of microorganisms at the genetic and biochemical level, the laws of growth of the microorganism, the influence of external conditions on the growth and biosynthesis of primary and secondary metabolites.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Select conditions and carry out identification, isolation and cultivation of microorganisms producing biomass, organic acids, ethanol, amino acids, antibiotics;
2. Determine possible ways of biosynthesis of key intermediates and target products to select the optimal biotechnological process;
3. Apply fundamental theoretical knowledge to solve practical problems in the field of microbial biotechnology, when performing practical laboratory tasks, term papers and theses, in research work.

Prerequisites

Food Microbiology and sanitary hygiene

Postrequisites

Yeast and micromycetes in industrial biotechnology Probiotic biotechnology Microorganisms of fermentative productions

Scientific basis of food production

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studying ways to control technological processes in order to obtain finished food products of high quality; biochemical, physical and chemical processes occurring in products during their processing; methods of research of technological processes of production, raw materials and finished products; methods and principles of conservation; technological properties of food products; emulsion and foam structures; adhesive properties of food products; hydrolysis of disaccharides and polysaccharides.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Establish and prioritize food production;
2. Justify the adoption of a specific technical solution in the development of new technological processes for the production of food products;
3. Choose technical means and technologies taking into account the environmental consequences of their use.
Prerequisites
Fundamentals of biotechnology Food Microbiology
Postrequisites
Fundamentals of scientific research Biotechnology of dairy production and processing of secondary raw materials

Modern directions the development of food biotechnology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
He studies the directions and stages of modern biotechnology. Development trend of food and industrial biotechnology. Processes for obtaining substances and compounds useful for humans with the help of microbial, animal, plant cells; biotechnological processes used in various areas of the food industry, and their role in the formation of consumer properties of food products; today`s achievements in food biotechnology and the main trends in its development.
Purpose of studying of the discipline
The acquisition of theoretical knowledge and development of skills and abilities in the field of modern food biotechnology.
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task
Learning outcomes by discipline
1. Explain the biotechnological functions of biotechnology agents;
2. Characterize the main biotechnological productions;
3. Use tools and laboratory biotechnological equipment.
Prerequisites
Food Microbiology and sanitary hygiene Microbiology and biotechnology in the meat and milk industries
Postrequisites
Functional starter cultures in food industry Modern technologies of use of biologically active substances in bioindustry Modern problems of biosafety in food and industrial production

Safety of food products

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the basics of security and its types; product quality indicators; improving product quality; methods for analyzing data on product quality; hygienic requirements for the quality and safety of food raw materials and food products; quality and safety of raw materials and food products; basic scientific and practical provisions of food security; requirements for ensuring the quality and safety of food products, materials and products; international aspects of food security.
Purpose of studying of the discipline
Formation of knowledge on the main provisions of methods of planning, organization and carrying out of tests and controls on the processing of test results for later use knowledge in solving organizational, methodological and technical issues of research, attributive and product control tests in various industries under trial operation, in landfills, PA production facilities and design research organizations.
Learning Outcomes
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
Learning outcomes by discipline
1. Determine the qualitative characteristics of raw materials of animal and vegetable origin based on organoleptic and physico-chemical

indicators;
2. Assess the safety of products and semi-finished products;
3. Apply in practice the regulations governing the safety and quality of food products.

Prerequisites

Food Microbiology and sanitary hygiene Microbiology and biotechnology in the meat and milk industries

Postrequisites

The methodology of research work Research work on the specialty

Food Biotechnology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies the basics of food biotechnology; microbiological production of biologically active substances and preparations; chemical composition of food products; requirements for raw materials and auxiliary materials; the use of yeast, mold fungi and bacteria in food production; alcohol production; brewing; wine production; bakery production; starch technology; fruit processing technology; genetically modified products; technology of sausage products; confectionery technology.

Purpose of studying of the discipline

To familiarize students with the peculiarities of biological processes in cells of various groups of microorganisms that underlie food production.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Use methods of synthesis, physical and chemical research and analysis of biologically active substances;
2. Use the acquired knowledge to analyze experimental data related to the selection, characterization and improvement of biotechnology objects, as well as their use in various technological processes of food production;
3. Evaluate the technological efficiency of production and make suggestions for their improvement.

Prerequisites

Fundamentals of biotechnology Objects of biotechnology

Postrequisites

Methods of food analysis Fundamentals of scientific research

Expertise of food products

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline studies commodity expertise of food products; theoretical foundations for the examination of food products; examination of low-quality and dangerous food products; veterinary and sanitary examination of food products; fundamental documents regulating the conduct of examinations, the structure of the expert opinion; sanitary and epidemiological examination of food products; biological value of food; principles, methods and equipment of food biotechnology; contamination of food raw materials and food products with xenobiotics and pollutants of chemical origin.

Purpose of studying of the discipline

Learning Outcomes

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Apply rational methods of monitoring and assessing the quality of food raw materials, semi-finished products and finished products;
2. Identify products and services, identify their falsification; -
3. Carry out quality control of products and services in public catering at different stages of the technological process.

Prerequisites

Food Microbiology and sanitary hygiene Microbiology and biotechnology in the meat and milk industries

Postrequisites

The methodology of research work Research work on the specialty Microorganisms of fermentative productions

The methodology of research work

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the main stages of research work; methods of theoretical research; methodological foundations of scientific knowledge; search and processing of scientific information and registration of the results of experimental studies; issues of modeling in scientific research; methods of selection and objectives of the direction of scientific research; search, accumulation and processing of scientific information; theoretical and experimental research; processing the results of experimental studies; structure and concept of master`s thesis.

Purpose of studying of the discipline
To learn the system and methods of producing the specific methods of scientific knowledge and its presentation in forms appropriate requests of the scientific community.

Learning Outcomes
ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Select and implement research methods, analyze and summarize research results, bring them to practical implementation;
2 Formulate the purpose and statement of the research problem;
3. Work with scientific and technical information, carry out patent search.

Prerequisites
Bioengineering Fundamentals of biotechnological production Safety of food products

Postrequisites
Yeast and micromycetes in industrial biotechnology Probiotic biotechnology

Research work on the specialty

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the planning of scientific research; formulation of the problem; scientific research methods; conducting empirical or theoretical research; evaluation of the result, conclusions, prospects; development of regulatory and technical documentation for processes and products, practical work on the creation of new food products; selection and justification of the research topic; analysis of the main results and provisions; evaluation of their effectiveness in the framework of the study; planning and conducting experimental research on the problem.

Purpose of studying of the discipline
Mastering the rules of scientific research and the processing of their results.

Learning Outcomes
ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Draw up a general plan of work on a given topic;
2. Propose research methods and methods for processing results, conduct research according to a plan agreed with the head, present the results;
3. Work with scientific and technical information, carry out patent search.

Prerequisites
Bioengineering Fundamentals of biotechnological production Safety of food products

Postrequisites
Yeast and micromycetes in industrial biotechnology Probiotic biotechnology

Biotechnology fermentation production

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The discipline studies the general characteristics of fermentation and its types; the main characteristics of industries based on the use of microorganisms; the main patterns of reproduction and growth of yeast and other cultures of microorganisms; characteristics of enzymes used in fermentation industries; outlined the basics of alcoholic fermentation; yeast in fermentation industries; malt production technology; calculation of the yield of finished malt from barley in terms of dry and air-dry matter.

Purpose of studying of the discipline

Learning Outcomes
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of

biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. To carry out technological support for the production of food from plant materials;
2. Analyze the quality of food products from vegetable raw materials in accordance with the requirements of regulatory documentation and market needs;
3. Apply scientific and technical information and advanced production experience in the field of processing of vegetable raw materials and food production.

Prerequisites

Fundamentals of biotechnological production Industrial biotechnology

Postrequisites

Design of fermentation enterprises Probiotic biotechnology

Biotechnology of dairy production and processing of secondary raw materials

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

The discipline studies the composition and properties of milk - as an object for biotechnological processes; bacterial preparations for fermented dairy products; classification of microorganisms used in the production of dairy products; selection of bacterial preparations; formation of bacterial starter cultures; preparation and use of bacterial preparations in production conditions; technologies of dairy products; dairy products; products made from skimmed milk, buttermilk and whey; recycled drinks; protein products from secondary raw materials.

Purpose of studying of the discipline

Mastering theoretical knowledge and practical skills in biotechnology of dairy products production and processing of secondary raw materials by students

Learning Outcomes

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Substantiate and control the parameters of technological processes in accordance with the regulations in the production of dairy products;
2. Use technical means to measure the main parameters of biotechnological processes, the properties of raw materials and products in the production of dairy products;
3. Improve the basic methods and techniques for the implementation of technological processes in accordance with the regulations in the production of dairy products.

Prerequisites

Industrial biotechnology Food Biotechnology

Postrequisites

Final examination

Biotechnology for the production of national dairy products

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

Studying the state and prospects for the development of the dairy industry; history, sanitary and hygienic requirements for obtaining high-quality milk; the procedure for its primary processing and storage; the composition and properties of milk of farm animals, as well as the factors that determine them; technological processes for the production of national dairy products; fermented milk products, oils, cheeses, canned milk, ice cream, baby food and secondary dairy raw materials.

Purpose of studying of the discipline

Learning Outcomes

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Classify the assortments of dairy products;
2. Analyze the technological methods for the production of various dairy products in practice and the schedule for the operation;
3. Apply the study of the technological features of high-quality dairy products in the production of new types.

Prerequisites

Fundamentals of biotechnological production Technological equipment of enterprises of meat and dairy industry

Postrequisites

Designing of the enterprises of meat and milk industry

Intellectual property in quality management

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studies the protection of intellectual property and copyright; the volume and composition of intangible assets of enterprises, their condition and development; innovative activity of enterprises; improving the qualification level of personnel; accounting for rationalization proposals and inventions in the course of production; intellectual property in quality management; intellectual goods, intellectual property; objects of industrial property and its types; objects of industrial property; documents certifying authorship.

Purpose of studying of the discipline

The acquisition of knowledgein the field ofintellectual propertyandthe rules of registrationof patent documents.

Learning Outcomes

ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline

1. Identify and register objects of intellectual property of the organization;
2. Assess the value and commercial prospects of intellectual property;
3. Assess the impact of investment and financing decisions on the growth of business value in connection with the strategy of innovative development.

Prerequisites

Fundamentals of biotechnological production Safety of food products

Postrequisites

Standardization, certification and technical measurements

Medical and veterinary biotechnology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studies the stages of development of medical and veterinary biotechnology; basic approaches to the creation of biotechnological pharmaceutical and veterinary preparations; objects of medical and veterinary biotechnology; preclinical and clinical trials of medicines; biotechnology of immunogens and vaccines; genetic engineering microbiological production; immunobiotechnology; immunological diagnostic systems; modern biotechnologies in animal husbandry; transgenic animals; methods of obtaining and prospects for use; study of the basics of feeding laboratory animals.

Purpose of studying of the discipline

Getting the students knowledge of the aims and objectives of the medical and veterinary biotechnology, research on natural compounds that control the level of the body`s defenses against infection, malignancy and other diseases.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline

1. Carry out the main operations of genetic engineering;
2. Perform a set of operations related to hybrid technology;
3. Carry out the necessary work on preclinical testing of the biological activity of drugs prepared by medical and veterinary biotechnological methods.

Prerequisites

Bioengineering General and molecular genetics Animal biotechnology

Postrequisites

Selection of industrial strains of microorganisms

Patent engineering

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the fundamentals of the legislation of foreign countries and the Republic of Kazakhstan in the field of protection of objects of intellectual (industrial) property; the essence of the system of patenting industrial property objects; legal documentation of the Republic of Kazakhstan on the protection of intellectual property; features and structure of patent documentation; the structure of the description of the invention; the essence of the system of patenting industrial property objects; INID codes for identifying bibliographic data in the specification; features of text construction; composition of an application for an object of industrial property.

Purpose of studying of the discipline
The acquisition of knowledgein the field ofintellectual propertyandthe rules of registrationof patent documents.

Learning Outcomes
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Determine the essence of activities for the protection of intellectual property rights;
2. To form an understanding of the main provisions of the theory and practice of patent science;
4. To form skills in the application of International documents on patent science.

Prerequisites
Food Biotechnology

Postrequisites
Final examination

Microbiological control of biotechnological productions

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the characteristics of the main microorganisms- contaminants of sanitary- indicative microorganisms and biotechnological industries; on the safety of biotechnological production of food products and food raw materials; methods of sterilization, disinfection and preservation used in the food industry; ways to ensure the sterility of microbiological production; the role of the microflora of air, water, soil in the contamination of food products with foreign microorganisms and the spread of infectious diseases; sanitary and hygienic requirements for production processes and industrial equipment; risk analysis systems.

Purpose of studying of the discipline
To form the student`s knowledge about the safety of biotechnological production of food raw materials and food products.

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Accept raw materials, bring them to a standard state, analyze and process;
2. Use instruments and equipment used in biotechnological production and instrumentation.
3. Apply sterilization methods in practice, the skills of self-assessment of the quality of food raw materials, semi-finished products and finished products.

Prerequisites
Food Biotechnology Food Microbiology

Postrequisites
Final examination

Microorganisms of fermentative productions

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
In the module are the General characteristics of fermentation and its types, the main characteristics of the industries based on the use of microorganisms, the basic principles governing the growth and reproduction of yeast and other cultures of micro-organisms: stages of development and methods of cultivation; relationships of microorganisms; The characteristics of the enzymes used in the fermentation industries, their properties and classification. The fundamentals of alcoholic fermentation: the structure, chemical composition of the yeast cell; characteristics and race of yeast used in fermentation industries, as well as chemical reactions underlying alcoholic fermentation.

Purpose of studying of the discipline
The purpose of the module is to familiarize students with the technology of fermentation, methods and processes of processing various types of raw materials into fermentation products.
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
Learning outcomes by discipline
1. Determine the qualitative composition of the microflora of fermentation products and other objects;
2. Determine the properties of microorganisms isolated in pure culture;
3. Determine the number of microorganisms by various methods (by counting colonies, direct counting under a microscope, limiting dilutions).
Prerequisites
Modern methods of creation of industrial strains of microorganisms
Postrequisites
Design of fermentation enterprises

Functional starter cultures in food industry

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the selection of starter crops; identification of microorganisms using genotypic methods; the history of the development of taxonomy, the problem of the spread of resistance to antibiotics in industrial strains; application of cultures of yeast and filamentous fungi in the food industry, biotechnology of starter cultures; the use of denitrifying microorganisms and nitrites in the food industry, the formation of aromatic compounds by starter cultures, the role of oxygen in the vital activity of starter cultures; starter cultures are bacteriocin producers.
Purpose of studying of the discipline
Getting knowledge of the subject area of activity specialist food industry, the ability to practically apply the knowledge in their future activities.
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases
Learning outcomes by discipline
1. Control strains of lactic acid and probiotic microorganisms, cultivation of starter cultures;
2. Organize the monitoring of starter cultures and bacteriophages in the technological cycle of food and feed;
3. Apply the acquired knowledge in practice.
Prerequisites
Food Microbiology and sanitary hygiene Microbiology and biotechnology in the meat and milk industries
Postrequisites
Final examination

Design of fermentation enterprises

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination and term work/Project

Short description of discipline
The discipline studies the structure of fermentation enterprises; factors regulating the location of fermentation enterprises, requirements for production buildings of fermentation production; feasibility study of construction; fundamentals of designing food industry enterprises; industrial transport; design of air conditioning systems in industrial premises; calculation of raw materials and substantiation of the range; the current state of the enterprises of the fermentation industry for the production of alcohol, alcoholic beverages, baker`s yeast, malt and the prospects for its development.

Purpose of studying of the discipline
Learning Outcomes
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases
Learning outcomes by discipline
1. Perform product calculations, selection and calculation of technological equipment, calculation of the areas of workshops and auxiliary premises;
2. Perform architectural and construction solutions and production layout
3. To carry out technological control.
Prerequisites
Biotechnology fermentation production Microorganisms of fermentative productions
Postrequisites
Final examination

Designing of the enterprises of meat and milk industry

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination and term work/Project

Short description of discipline
Studying the structure of meat and dairy industry enterprises; requirements for industrial buildings; feasibility study of construction; basics of designing enterprises of the meat and dairy industry; calculation of raw materials and substantiation of the assortment; schedule of organization of technological processes; calculation of the areas of production shops; layout of technological equipment; the current state of the enterprises of the meat and dairy industry and the prospects for its development; the state and prospects for the development of the production of sausages, meat semi-finished products of fermented milk products.
Purpose of studying of the discipline
Learning Outcomes
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases
Learning outcomes by discipline
1. Perform product calculations, selection and calculation of technological equipment, calculation of the areas of workshops and auxiliary premises;
2. Perform architectural and construction solutions and production layout
3. To carry out technological control.
Prerequisites
Microbiology and biotechnology in the meat and milk industries Technological equipment of enterprises of meat and dairy industry
Postrequisites
Final examination

CAD Designing of the enterprises biotechnological production

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination and term work/Project

Short description of discipline
Learns the basics of designing biotechnological enterprises for the production of food products; design principles for individual industries and the relationship between them, the technological structure of the enterprise, the composition and types of projects, the feasibility study of design, the principles of reconstruction of industries. Enterprise design using CAD; schedule of organization of technological processes; grocery calculation of a dairy plant; grocery calculation of the cheese-making plant; assortment selection; calculation and selection of technological equipment.
Purpose of studying of the discipline
Obtaining knowledge with the subject area of a food industry specialist, the ability to practically apply the knowledge gained in work on term and diploma projects.
Learning Outcomes
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases
Learning outcomes by discipline
1. Perform product calculations, selection and calculation of technological equipment, calculation of the areas of workshops and auxiliary premises;
2. Perform architectural and construction solutions and production layout
3. To carry out technological control.

Prerequisites
Industrial biotechnology Food Biotechnology Biotechnology equipment
Postrequisites
Final examination

Biotechnology of industrial waste processing

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline studies environmental pollution and scientific and technological progress; types of pollution and their characteristics; creation of non-waste and low-waste industries as a way to solve the problems of technogenic pollution; natural, biogeochemical and technogenic flows (cycles) of individual elements; bioremediation, biostimulation and bioaugmentation are the main directions in the use of biological objects for the decomposition of organic substances; pathways and sources of technogenic pollutants into soil, water and atmosphere.
Purpose of studying of the discipline
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production
Learning outcomes by discipline
1. Distinguish between the classification of waste, the characteristics of industrial and municipal waste, methods of disposal and recycling of waste;
2. Assess the consequences of environmental pollution by production and consumption waste;
3. Plan and conduct research work in the field of waste processing, analyze the results of experiments.
Prerequisites
Fundamentals of biotechnology Industrial biotechnology
Postrequisites
Final examination

Probiotic biotechnology

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline studies probiotics, prebiotics and synbiotics, metabolite, lactulose- containing and combined probiotic preparations; creation of new bacterial preparations based on probiotic bacteria; with the technology of obtaining probiotic preparations, with the development of new types of biologically active substances and products for food and medical and preventive purposes; functional products in the modern structure of nutrition; selection criteria for lactic acid bacteria; prebiotics; rationale for the choice of starter cultures.
Purpose of studying of the discipline
Development of new types of biologically active substances and food products and therapeutic and prophylactic purposes
Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
Learning outcomes by discipline
1. Identify microorganisms used for the preparation of probiotics;
2. Conduct research on traditional fermented milk products, cheeses, characterize the technologies for the production of food products containing pre- and probiotics;
3. Work with scientific and technical information about the manufacture and use of probiotics.
Prerequisites
Modern methods of creation of industrial strains of microorganisms
Postrequisites

Final examination

Selection of industrial strains of microorganisms

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline

The discipline studies the role of starter cultures in biotechnological processes; obtaining pure cultures of starter microorganisms, modern methods of their selection and principles of selecting strains for the preparation of bacterial starter cultures that provide active biotechnological processes for food production; the history of the emergence and development prospects of microbiological production; ways to improve the production- valuable properties of starter microflora; quality control of bacterial starter cultures; methods and features of the technology of industrial cultivation of microorganisms; eukaryotic cell structure.

Purpose of studying of the discipline

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Draw up schemes for constructing organisms based on the reunification of DNA fragments in vitro;
2. Determine the specific gene responsible for the synthesis of a particular protein in obtaining a mutation;
3. Explain the general position and approaches to the creation of industrial strains of microorganisms.

Prerequisites

Modern methods of creation of industrial strains of microorganisms Microorganisms of fermentative productions

Postrequisites

Final examination

Biotechnology of phototrophic microorganisms

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline

The discipline studies phototrophic microorganisms, their role in nature and human life; the possibility of using microalgae in mass cultivation to obtain biologically active substances, to study the mechanisms and productivity of photosynthesis of various groups of phototrophic organisms; the role of phototrophic microorganisms in the development of photobiotechnology, namely, obtaining dietary supplements based on microalgae; the role of phototrophic microorganisms in biotechnological production, methods for isolating promising strains and methods for their cultivation.

Purpose of studying of the discipline

Getting the students knowledge of phototrophic microorganisms and producing the desired products using microalgae and cyanobacteria.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Explain the role of phototrophic microorganisms in the development of photobiotechnology, namely, obtaining dietary supplements based on microalgae;
2. Discuss the role of phototrophic microorganisms in biotechnological production, methods for isolating promising strains and methods for their cultivation.
3. Use microalgae in mass cultivation to obtain biologically active substances and biologically active additives.

Prerequisites

Modern methods of creation of industrial strains of microorganisms Microorganisms of fermentative productions

Postrequisites

Final examination

Yeast and micromycetes in industrial biotechnology

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline studies the yeast cell, cytology; yeast cell components; cytological features of yeast in different growth conditions; morphology and asexual reproduction; yeast micromorphology; cell cycle; sexual reproduction and yeast life cycles; ascomycete yeast, basidiomycete yeast; features of metabolism; distribution of yeast fungi in nature; industrial use of yeast; yeast as pathogens of human diseases; yeast systematization.

Purpose of studying of the discipline

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Analyze structural features yeast cells, chemical composition and functions of the main cellular structures, features of the morphology of yeast fungi, types of their reproduction;
2. Explain the patterns of yeast settlement in nature habitats;
3. Plan and carry out basic experiments with yeasts and micromycetes.

Prerequisites
Fundamentals of biotechnological production Biotechnology fermentation production Microorganisms of fermentative productions

Postrequisites
Final examination

Use o f enzyme preparations in food production

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline studies general information about enzymes; groups of enzyme preparations used in the food industry; the use of enzyme preparations in the dairy industry; the use of enzyme activity values to assess the quality of milk; enzymes in the meat industry of the food industry; the use of enzymes in baking; the use of enzyme preparations in the brewing industry and in the starch industry; the use of enzyme preparations in the production of fruit and berry and grape juices, wines and soft drinks.

Purpose of studying of the discipline
Preparation of knowledge, skills andskills for the preparation and use of enzyme preparations in food production.

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Classify and apply enzymes in the production, storage and transportation of food products;
2. Use the skills of working in the laboratory, obtaining enzyme preparations, determining their activity, as well as using them in food production;
3. Demonstrate basic knowledge and professional qualities of a specialist in the field of the use of enzyme preparations in food production.

Prerequisites
Fundamentals of biotechnology Objects of biotechnology Industrial biotechnology Food Biotechnology

Postrequisites
Final examination

Biotechnological waste recycling food production

Discipline cycle	Profiling discipline
Course	4
Credits count	5

Knowledge control form	Examination

Short description of discipline
The discipline studies low-waste technologies; general principles for creating resource-saving technologies; limitations of technogenic development of the economy; characterization and classification of waste; general methods and principles of solid waste disposal; recycling of agricultural waste; general methods and principles of gaseous waste disposal; chemicals used in food production, disposal of residual substances in septic tanks, reuse of water resources opens up great opportunities for the food industry .; biotechnology in waste processing.

Purpose of studying of the discipline

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Analyze the sources of formation of secondary raw materials, effluents in the conditions of the enterprise;
2. Develop recommendations for the collection, rational use and processing of secondary raw materials and waste;
3. Evaluate the prospects for expanding the range based on attracting additional sources of raw materials.

Prerequisites
Fundamentals of biotechnology Objects of biotechnology

Postrequisites
Final examination

Modern problems of biosafety in food and industrial production

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the concept of biosafety in food production; hazardous biological organisms and their products; biotechnology and biosafety; stability of biosafety in bioengineering; creation of genetically modified organisms; biological, ecological, economic, food and other security; the main constituents of food products and their properties, structure, classification and changes in their production process; biosafety in tissue, cellular and organogenic biotechnologies.

Purpose of studying of the discipline
Study of topical issues in food and industrial production, identification of modern problems, in solving which methods and approaches of traditional and modern biotechnology can be used.

Learning Outcomes
ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process
ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline
1. Explain the main constituents of food products and their properties, structure, classification and changes in the production process.
2. Determine the actual tasks of modern biotechnology and develop applications for participation in the competition of scientific projects.
3. Use modern laboratory equipment.

Prerequisites
Expertise of food products Safety of food products

Postrequisites
Final examination

Modern technologies of use of biologically active substances in bioindustry

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies the classification of enzymes, hormones and vitamins; catalysis and activation energy; regulation of metabolism; the mechanism of action of enzymes and hormones; sources and uses of enzymes; production of vitamins; technology for isolation and

purification of enzymatic preparations; immobilized enzymes; cell immobilization; industrial processes using enzymes and cells; enzyme immobilization methods; application of biologically active substances in the microbiological, food and medical industries; ecological and genetic safety of biologically active substances.

Purpose of studying of the discipline

Getting the students knowledge of the subject area of activity specialist food industry.

Learning Outcomes

ON5 To analyze the main processes and phenomena occurring in animate and inanimate nature and determine the principles of the structural and functional organization of biological objects, possible ways of biosynthesis of key ingredients and target products to select optimal conditions for the biotechnological process

ON6 Explain morphophysiological, biochemical, molecular genetic features of the functioning of biological objects in the field, laboratory and industrial conditions and perform qualitative and quantitative analyses using physico-chemical and microbiological methods in the cultivation of individual cells of microorganisms

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

Learning outcomes by discipline

1. Name the modern classification of biologically active substances, modern aspects of the use of biologically active substances in various industries, technological schemes for the production of basic biologically active substances;

2. Classify biologically active substances, determine the main sources and use of biologically active substances;

3. Demonstrate basic knowledge and professional qualities of a specialist in the field use of biologically active substances in the bioindustry.

Prerequisites

Fundamentals of biotechnological production Industrial biotechnology

Postrequisites

Final examination

Organization and planning of production

Discipline cycle	Basic disciplines
Course	4
Credits count	3
Knowledge control form	Examination

Short description of discipline

The discipline «Organization and production planning» gives different ideas about the basics of organization, industrial production planning, methods of evaluating its effective activities. As well as the analysis and forecast of production risks and losses of the enterprise, including ways to eliminate them as soon as possible. Students will gain knowledge and skills in the field of implementation, organization and planning of industrial production of the enterprise.

Purpose of studying of the discipline

The purpose of studying the discipline "Organization and planning of production" is to study the theoretical and methodological foundations of the organization and planning of production and production infrastructure at enterprises.

Learning Outcomes

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1. Demonstrates the ability to work effectively both individually and as a team member;

2. Organizes the work of small labor collectives of performers of production tasks;

3. Draws up technical documentation on the planning and organization of production, as well as on the established reporting according to approved forms.

Prerequisites

Bases of economics, law and ecological knowledge

Postrequisites

Final examination

Cost management

Discipline cycle	Basic disciplines
Course	4
Credits count	3
Knowledge control form	Examination

Short description of discipline

The purpose of the course "Cost Management" is the formation of students` competencies in cost management, the ability to conduct analytical work in the field of cost management. This discipline is aimed at forming students with a set of necessary theoretical knowledge to understand the essence of costs and the basics of their management, as well as practical skills necessary for the purposes of strategic cost management.

Purpose of studying of the discipline

To reveal the problems in the field of organization, planning and management of production in a market economy in order to reduce costs.

Learning Outcomes

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline

1) Demonstrates the ability to work effectively both individually and as a team member;
2) Draws up technical documentation (work schedules, instructions, plans, estimates, applications for materials, equipment, etc.), as well as established reporting on approved forms;
3) Organizes the work of small groups of performers.

Prerequisites
Bases of economics, law and ecological knowledge

Postrequisites
Final examination

Economics of enterprise

Discipline cycle	Basic disciplines
Course	4
Credits count	3
Knowledge control form	Examination

Short description of discipline
At the present stage of economic reforms, significant changes are taking place in the economy, especially at the microeconomic level: the nature and methods of economic activity of enterprises are changing. This course studies in detail the resources of the enterprise, the efficiency of their use, profitability and the main technical and economic indicators of the functioning of the enterprise. In addition, methods of stimulating labor resources, in order to optimize the production capacity and capital of the enterprise.

Purpose of studying of the discipline
The purpose of studying the discipline "Enterprise Economics" is to develop students` economic thinking based on the study of the economic mechanism of the enterprise in market conditions, providing deep theoretical knowledge and practical experience in the field of economics and organization of the enterprise and the use of technological equipment.

Learning Outcomes
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

Learning outcomes by discipline
1. Demonstrates the ability to work effectively both individually and as a team member;
2. Assesses the feasibility study of design solutions;
3. Organizes activities related to the management of the actions of individual employees.

Prerequisites
Bases of economics, law and ecological knowledge

Postrequisites
Final examination

Prediploma practice

Discipline cycle	Profiling discipline
Course	4
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline
Selection and study of material for use and interpretation in their thesis (project). Acquaintance with the peculiarities of the production of the enterprise, its organization, research for the practical part of the thesis (project), systematization of the results obtained.

Purpose of studying of the discipline

Learning Outcomes
ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology
ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management
ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production
ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task
ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline
1. Carry out complex engineering projects for biotechnological production enterprises;
2. Carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management;
3. Have the skills to study biotechnological production and control of biotechnological processes.

Prerequisites
Production practice III

Postrequisites
Final examination

Production practice III

Discipline cycle	Profiling discipline
Course	4
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline

Acquaintance with the features of the production of the enterprise, its organization. Design of the main workshops, auxiliary, technological schemes of products and the general plan of the enterprise. Water, heat and power supply of the enterprise. Communication during the practice between students and the head in a foreign language. Writing a Biotechnology Part of a Practice Report in a Foreign Language.

Purpose of studying of the discipline

Learning Outcomes

ON7 Apply microorganisms, plants or animals as objects for scientific research and practical purposes applied in various fields of biotechnology

ON8 Is Able to carry out the technological process of biotechnological production and processing of industrial waste in accordance with the requirements of the international standard for environmental management

ON9 Design enterprises of biotechnological production in accordance with the requirements of SNR and others regulations using of elements of CAD, engineering graphics and ways to ensure economic efficiency of production

ON10 Determine the order of organization, planning and carrying out research work using modern research, educa-tional and information technologies, and is able to select me-thods of analysis depending on the object and the task

ON11 Use information resources to search and store infor-mation, work with spreadsheets, organize data, work with databases

Learning outcomes by discipline

1. Organize biotechnological production and manage production processes;

2. Carry out complex engineering projects for biotechnological production enterprises;

3. Use methods and obtaining food products using biological objects and food biotechnology.

Prerequisites

Production practice II

Postrequisites

Prediploma practice