

ALIKHAN BOKEIKHAN UNIVERSITY

**MODULAR EDUCATIONAL PROGRAM
«7M05109 – BIOTECHNOLOGY»**

(scientific and pedagogical direction)

Semey – 2022 y.

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I. EXPLANATORY NOTE

Modular educational program (MEP) is made in accordance with the following documents:

I. Normative Documents of the Republic of Kazakhstan

1. Law of the Republic of Kazakhstan of 27 July 2007 «About the Education» (with additions and changes of 21.02.19);
2. The State standard of higher and postgraduate education approved by the order No.2 of the Minister of Science and Higher Education of the Republic of Kazakhstan dated 20.07.2022;
3. Rules for organizing the educational process on credit technology of education, approved by order No.152 of the Minister of Education and Science of the Republic of Kazakhstan dated 20.04.2011 (as amended by order No.563 of the Ministry of Education and Science of the Republic of Kazakhstan dated 12.10.2018);
4. The standard rules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by order No.595 of the Minister of Education and Science of the Republic of Kazakhstan dated 30.10.2018.
5. Professional standard «Teacher», approved by the order No.133 of the Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated June 8, 2017.

II. Normative Documents of the «Alikhan Bokeikhan University» E.I.

1. MR. Edition No. № 4 from 05.10.2022 «Structure of the modular educational program»;
2. R. Edition No. № 4 from 23.08.2022 «Regulations on the research work of undergraduates».

The MEP is designed as a set of consecutive training modules for the entire period of training and is aimed at mastering the competencies necessary for the assignment of the academic degree of **Master of Science in Educational Program 7M05109 «Biotechnology»**.

The **block of basic disciplines (DB)** consists of **35 credits** and includes disciplines of the **University Component (UC) - 20 credits**, including pedagogical practice – 3 credits; **components of choice (CC) - 15 credits**. Modules of these disciplines form a complex of competencies: preparation of a highly qualified master-biotechnologist, ready for teaching, scientific and methodological, social and pedagogical activities, having the necessary knowledge in the field of methodological foundations of scientific research in biotechnology, teaching specialty disciplines, able to analyze the source materials and draw conclusions.

The **block of profile disciplines (PD)** consists of **49 credits** and includes disciplines of the **University Component (UC) - 14 credits** (including research practice – 9 credits); **components of the choice (CC) - 35 credits**. Modules of these disciplines allow forming a complex of key and special competencies acquired by the graduate: preparation of a specialist for creative, active, professional and social activities, qualitative performance

of practical tasks in production; in generalization and adaptation of positive foreign experience to domestic conditions; obtaining theoretical knowledge to solve practical problems and problems in production.

The **scientific-research work of undergraduates** (SRWU), including an internship and implementation of the master's dissertation, consists of **24 credits. Final attestation** (FA) consists of **12 credits**, including design of the master's dissertation (10 credits) and master's dissertation defense (2 credits).

The criterion for the completion of the educational process is the development of **120 credits** by undergraduates, of which **84 credits are theoretical training**. MEP consists of 9 modules, including all types of training (practices and SRWU) and the final attestation.

When developing a modular educational program, the wishes and recommendations of potential employers were taken into account, aimed at the formation of additional professional competencies that meet the requirements of the labor market round table with employers "University and social partners: prospects and problems of effective cooperation" from 04.02.21).

Graduates of 7M05109 «Biotechnology» educational program can perform the following professional activities:

- **scientific:** conduct research and development, carry out design and survey work, scientific and organizational activities in various fields of biotechnology and in various environmental institutions;
- **pedagogical:** to teach biotechnological and environmental disciplines in universities and other educational institutions of the state and non-state profile;
- **production:** to carry out organizational and technological activities in industrial establishments of food biotechnology (meat processing plants, factories producing dairy, wine and vodka, bakery and other products), to carry out managerial activities; perform organizational and technological activities to reduce environmental pollution by emissions from biotechnology production facilities and perform management tasks.

The goal of modular educational program - Preparation of competitive highly qualified masters of natural sciences, capable of personal development, application and improvement of their professional skills in scientific, pedagogical and industrial activities; make decisions that combine the interests of the individual, society and the state.

Expected results are determined on the basis of the Dublin Descriptors Level 2 (Masters). Learning outcomes are formulated both at the level of the entire program, and at the level of a module and a separate discipline.

After successful completion of the «7M05109 - Biotechnology» program the master will be able:

ON 1 - to analyze the main stages and regularities of historical and scientific development of Kazakhstan and world society for the formation of its civil position; to use the methodological tools of philosophy for the design of complex, interdisciplinary scientific research, including research in various fields of biotechnology;

ON 2 - critically evaluate modern domestic and foreign scientific achievements on the basis of knowledge of a foreign language, history and philosophy of science; generate new ideas when solving scientific problems and plan a scientific experiment in various fields of biotechnology using the methodology of scientific research; state their position in a reasoned manner and freely conduct scientific discussions with foreign researchers;

ON 3 - to design and carry out comprehensive research in biotechnology, including in the field of application of phytoresources of medicinal plants for the production of BAS and BAA, based on a holistic systematic scientific worldview formed on the basis of knowledge of the history and philosophy of science;

ON 4 - to freely use Russian and foreign languages for scientific communication, comparative analysis and planning of scientific and technical research in various areas of biotechnology, including environmental biotechnology; perceive and analyze scientific articles in foreign journals and reports at international conferences;

ON 5 - to conduct psychological and pedagogical research to evaluate and develop new knowledge and integrate knowledge from various fields; ethically competently organize pedagogical communication with students; apply knowledge of higher education pedagogy, modern pedagogical technologies and theory and methods of teaching specialty disciplines in the practical activities of a teacher and a mentor;

ON 6 - to carry out pedagogical and teaching activities in the field of higher education, freely navigating the diversity of modern pedagogical technologies and applying their elements in their professional activities; to plan and solve problems of their own professional and personal development; to design and manage the educational process in universities; to work in a team based on ethical principles, tolerantly perceiving social, ethnic, confessional and cultural differences;

ON 7 - to apply and manage risk management in the organization of work to reduce the degree of risk in education and in the workplace on the basis of the management psychology and pedagogical ethics knowledge; to apply special technologies for revealing individual ideas, cognitive limitations of employees, subordinates, in order to reveal their abilities to improve teamwork and increase labor productivity;

ON 8 - to systematize and summarize information on the use of enterprise resources; take responsibility as a supervisor (manager) for the development of the situation in the face of uncertainty; create a system of motivation and promotion of achievements of employees and subordinates; organize the work of performers, find and make management decisions in the field of organization and regulation of labor;

ON 9 - to participate in the work of Kazakhstan and international research teams to create, solve and implement scientific and research tasks in various fields of biotechnology; to conduct a comparative analysis of the results of the experiment with theoretical models; to formulate the conclusions of scientific research; to make an abstract, report or scientific article on the results of scientific research;

ON 10 - to carry out standard and certification tests of raw materials (including phytoresources of medicinal plants), finished products (food products: dairy, probiotic, etc., medicines) and technological processes using modern methods of biotechnology (including molecular genetic biotechnology: genetic engineering, genomics and proteomics) in order to identify the quality of products; to apply in professional activity modern ideas about the basics of genetic engineering, nanobiotechnology, molecular modeling, about the biochemical foundations of biotechnological processes, taking into account the environmental aspects of modern biotechnology;

ON 11 - to evaluate technical, biochemical, toxicometric means and modern methods of biotechnology in order to prevent the environmental consequences of their use on ecosystems; to carry out technological process according to regulations and to apply technical means for measurement of the main parameters of biotechnological processes, properties and quality of raw materials and production;

ON 12 - to analyze scientific and technical information, domestic and foreign experience in the use of microorganisms with recombinant DNA to create new safe biotechnological products (including medicines based on BAS /BAA dietary supplements or genetically modified products), taking into account GMP rules or for biological environmental purification (biological purification and deodorization of gas-air emissions, bioremediation of

water and soil systems); determine the main characteristics of the composition, properties and quality of products of therapeutic and preventive nutrition and functional purpose;

ON 13 - to assess compliance of biotechnological production of medicines (including on the basis of BAS) with GMP rules; to analyze compliance with the requirements of environmental safety of biological objects – producers (microorganisms) and target products (genetically modified, biologically active substances) for ecosystems;

ON 14 - to use the main methods of cultivation of microorganisms for obtaining strains of microorganisms used in biotechnology of dairy and probiotic products, drugs; in bioindication of soil pollution, hydrosphere, in wastewater treatment and industrial emissions; develop technologies for obtaining microbial preparations for the production of new functional (therapeutic and prophylactic) products;

ON 15 - to use the standards applied in management, including environmental management, for making managerial decisions; to assess the conditions and consequences of organizational and managerial decisions on the environment (water, soil and atmospheric ecosystems) and the effectiveness of environmental protection measures.

II. COMPETENCE MODEL OF THE GRADUATE

Master's competencies, i.e. his ability to apply knowledge, skills and personal qualities in accordance with the tasks of professional activity, are determined by the learning outcomes formed in the learning process until the successful completion of the educational program «7M05109 – Biotechnology». In general, the master's competencies are divided into general cultural (**GCC**), general professional (**GPC**) and professional competencies (**PC**).

A graduate who has mastered the master's program should have the following competencies:

GENERAL CULTURAL COMPETENCES (GCC):

GCC - the ability to analyze, synthesize and abstract thinking; to professional growth, improvement and development of their intellectual and general cultural level; ability to act in unusual situations.

GENERAL PROFESSIONAL COMPETENCES (GPC):

GPC 1 - the ability to professionally operate modern biotechnological equipment, scientific instruments, use modern information technologies to collect and process the necessary information in the field of biotechnology and related industries;

GPC 2 - the ability to communicate in oral and written forms in a foreign and state language of the Republic of Kazakhstan to solve the problems of professional activity; leadership of the team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences.

PROFESSIONAL COMPETENCES (PC):

scientific-research:

PC 1 - the ability to plan, organize and conduct research work in the field of biotechnology; carrying out correct processing of the results of experiments with their further presentation in the form of scientific reports, reports, publications and presentations; substantiation of the conclusion and conclusions.

industrial-technological:

PC 2 - the ability to organize the work of a team of performers, make executive decisions on monitoring and protecting the environment in order to ensure safety, sanitary, hygienic and environmental conditions of the enterprise;

PC 3 - the ability to analyze the composition, properties and quality of biotechnological products; development of a quality management system for biotechnological products in production in accordance with the requirements of Kazakhstan and international quality standards in order to ensure the stability of production indicators and the quality of products.

pedagogical:

PC 4 (teaching) – the ability to independently conduct lectures, seminars, practical classes and laboratory workshops using modern educational technologies; plan and organize independent work of students;

PC 5 (upbringical) – the ability to observe pedagogical tact, the rules of pedagogical ethics; to show respect for the personality of students; to adhere to a democratic style in relationships with students; to show commitment to the highest social values, to the ideas of humanistic pedagogy; to be attached to the system of universal and national values in their unity; to build the educational process taking into account national priorities Kazakhstan; to resist any kind of discrimination, extremism; the ability to solve moral and ethical problems that may arise in pedagogical activity;

PC 6 (methodical) – the ability to develop the teaching materials of the disciplines being read; author's courses in accordance with the mission and goals of the organization of education.

Table 1. The sequence of mastering disciplines in the process of forming special competencies

| № | Competencies | The list of compulsory, elective disciplines and the sequence of their study | | Expected results |
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| | | list of disciplines | semester | |
| 1. | - general professional competences - GPC 1; - professional (scientific-research) competences - PC 1. | Methodological bases of scientific research in biotechnology and experimental planning | 1 | Knowledge about the history of the formation and development of science as an activity in Kazakhstan; methodological foundations of scientific knowledge; normative documents regulating scientific activity, on the system of scientific organizations in Kazakhstan; scientific degrees and academic titles in Kazakhstan and the world scientific space; about the Kazakh system of science management; about Kazakhstani normative documents regulating scientific activity; about the system of scientific organizations in Kazakhstan; about the ethical side of scientific research. Abilities: to put the purpose and objectives of the |

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| | | | | <p>forthcoming research; find, use, summarize and analyze relevant literature data on the studied research problem; find ways of achieving the objectives of the study in terms of the formation and development of information technologies; to choose the right object of research; to plan a scientific experiment; to critically analyze experimental data; summarize and arrange the data obtained; to draw conclusions; to write scientific articles; presentations at scientific conferences.</p> <p>Skills with laboratory equipment; establishment of conditions to perform the experiment; design of the experimental data in graphs, tables, figures; presentation of experimental data.</p> |
| 2. | <p>- general professional competences - GPC 1;</p> <p>- professional (scientific-research) competences - PC 1;</p> <p>- professional (industrial-technological) competences - PC 2.</p> | Methodology of scientific research in environmental biotechnology | 1 | <p>Knowledge of scientific research: purposes, tasks, subject and object research; objects of scientific research in the field of environmental biotechnology; classification of scientific research; major types of research: fundamental, applied and development; main areas of research; requirements for the subject research.</p> <p>Abilities: to put the purpose and objectives of the forthcoming research; find, use, summarize and analyze relevant literature data on the studied research problem; find ways of achieving the objectives of the study in terms of the formation and development of information technologies; to choose the right object of research; to plan a scientific experiment; to critically analyze experimental data; summarize and arrange the data obtained; to draw conclusions on the accomplished work; writing scientific articles; presentations at scientific conferences.</p> <p>Skills with laboratory equipment; establishment of conditions to perform the experiment; design of the experimental data in graphs, tables, figures; presenta-</p> |

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| | | | | tion of experimental data; presentations to a wider audience. |
| 3. | <p>- professional (pedagogical, upbringing) competences - PC 5;</p> <p>- general professional competences - GPC 2</p> | Pedagogical ethics of a modern teacher | 1 | <p>Knowledge: historical aspects of the formation of ethics as a science; theoretical foundations of ethics, its conceptual and categorical apparatus.</p> <p>Abilities: apply ethical norms and standards in professional practice; independently navigate ethical problems and ways to resolve them; apply general moral norms and requirements of professional ethics in practice.</p> <p>Skills: to possess the conceptual apparatus of professional ethics of a specialist; methodological approaches to the choice of theoretical tools appropriate to the task being solved; culture of communication in professional and everyday life, skills of public speech, argumentation, discussion.</p> |
| 4. | <p>- professional (pedagogical, teaching) competences - PC 4.</p> | Modern pedagogical technologies | 1 | <p>Knowledge: the concept of pedagogical technology, its structure, the methodology of pedagogical technology and the peculiarities of the use of pedagogical technology in the educational process.</p> <p>Abilities: design, predict and design pedagogical technologies in professional pedagogical activity; apply pedagogical technologies in the pedagogical process of a modern school.</p> <p>Skills: creative use of new technologies in professional activity.</p> |
| 5. | <p>- general professional competences - GPC 1;</p> <p>- professional (scientific-research) competences - PC 1</p> | Modern methods in biotechnology | 1 | <p>Knowledge: about the theory, essence and principles of physical, biophysical, biochemical, molecular genetic immunological methods and information technologies used in biotechnology; about new achievements in the development of biotechnology methods and prospects for their development.</p> <p>Abilities: to plan and conduct experiments in various</p> |

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| | | | | <p>branches of biotechnology; to apply the acquired knowledge to further improve the level of practical and theoretical training.</p> <p>Skills of working on devices used in various branches of biotechnology; selection of appropriate methods and analysis of experimental results.</p> |
| 6. | <p>- general professional competences - GPC 1;</p> <p>- professional (pedagogical, teaching) competences - PC 4;</p> | Teaching methodology of specialty disciplines | 2 | <p>Knowledge about the patterns underlying the learning process binding disciplines undergraduate of educational program 6B05121 «Biotechnology» of master students; the variety of forms and teaching methods of biotechnology; issues and trends in the development of biotech education and the ways of their solution.</p> <p>Abilities: reasoned approach to the problem of choice of methods and forms of learning biotechnology; to make curriculums, syllabuses, glossaries, and other educational-methodical materials; to predict the results of their activities; to use various forms of organization of educational activity in the classroom, to be able to analyze the effectiveness of various types of studies, as well as techniques and methods of teaching; to apply the acquired knowledge and skills at the university in the period of pedagogical practice and the subsequent teaching activities.</p> |
| 7. | - professional (pedagogical, methodical) competences - PC 6. | Theory and technology of teaching in the university | 2 | <p>Skills of maintaining aseptic conditions in the biotechnology laboratory; preparation of temporary and permanent micropreparations; possession of methods of cultivation of microorganisms and culture plant and animal cells; design presentations, selection needed for training video materials; use of laboratory equipment.</p> |
| 8. | - general professional competences - GPC 1; | Biotechnology of medicines and genetically modified foods | 2 | <p>Knowledge of modern achievements in fundamental biological sciences and biomedical technologies; the concept of with specific drugs; innovative ways of creating drugs; key regulatory documents relating to</p> |

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| | - professional (industrial-technological) competences - PC 2, PC 3. | | | <p>the production, quality control, environmental safety, storage, international and domestic standards in relation to biotechnological methods derived medicines and biological objects to their producers.</p> <p>Abilities: to maintain optimal conditions for the biosynthesis of the target product; to provide the aseptic conditions of the production process; to implement stepwise control and standardization of drugs derived (determination of antimicrobial activity the antibiotic activity of enzyme preparations, the viability of microorganisms); to obtain finished drug products and diagnostic preparations of medicinal substances of microbiological origin; choose optimal storage conditions therapeutic and diagnostic agents and to assess their quality during prolonged storage; to ensure compliance with regulations, industrial hygiene, environmental, occupational health and safety.</p> <p>Skills: experience of scientific-technical documentation: laboratory and experimental-industrial regulations, etc.; determining the biological activity of antibiotics, vitamins, hormones, recombinant proteins and immunopreparation.</p> |
| 9. | - general professional competences - GPC 1; - professional (industrial-technological) competences - PC 2, PC 3. | Biotechnology of biologically active substances taking into account the rules of GMP | 2 | <p>Knowledge about biotechnological processes: their classification by types of producers (biological, biochemical and biosimilar). Preparation of equipment and culture media, sterilization, sowing of biological object, isolation and purification of target product, its drying and packaging. Main directions of quality assurance of biotechnological preparations (GLP, GCP, GMP). Concept of biologically active substances (BAS). Classification of BAS, of biologically active substances of plant, microbial and animal origin.</p> <p>Abilities: to determine the purity of microorganisms-</p> |

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| | | | | <p>producers by a method of microscopy; to determine the concentration of viable cells and their enzymatic activity.</p> <p>Skills: working in aseptic conditions, including use of flambeau; work with microorganisms; design of nutrient medium, to select and calculate the mode of sterilization; choose fermentation and auxiliary equipment, to determine the mode of sterilization; to provide the aseptic conditions of realization of technological process, observance of rules of industrial hygiene.</p> |
| 10. | <p>- general professional competences - GPC 1;</p> <p>- professional (industrial-technological) competences - PC 2, PC 3.</p> | Biotechnology of biologically active substances and additives | 2 | <p>Knowledge about modern achievements in field of biotechnology of biologically active substances (BAS) and additives (BAA); scientific aspects of application of BAS and BAA in biotechnology. Classification of BAS and BAA. Alkaloids, glycosides, phenolic compounds, carotenoids, coumarins: their physiological role. Scientific and practical bases of use of BAS, BAA in production of specialized foodstuff.</p> <p>Abilities: to determine the purity of microorganisms-producers by a method of microscopy; to determine the concentration of viable cells and their enzymatic activity.</p> <p>Skills: working in aseptic conditions, including use of flam-beau; work with microorganisms; design of nutrient medium, to select and calculate the mode of sterilization; select enzymatic and accessories, to determine the mode of sterilization; to provide the aseptic conditions of realization of technological process, observance of rules of industrial hygiene.</p> |
| 11. | - professional (industrial-technological) competences | Phytoresources of medicinal plants | 2 | <p>Knowledge about the main stages of development of modern directions of scientific researches in the field of medicinal plants; the characterization of raw mate-</p> |

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| | <p>ces - PC 2;</p> <p>- general cultural competences - GCC.</p> | | | <p>rials of medicinal plants; the system of state measures on the rational use and conservation of medicinal plants; basic information on distribution and habitat of medicinal plants; influence of environmental factors on the development of the commodity mass of medicinal plants and the accumulation of biologically active substances; safety instructions when working with medicinal plants and medicinal plant raw materials.</p> <p>Abilities: to identify the morphological characteristics of medicinal plants in your living and herbarium; to identify medicinal plant material in solid form using the respective identifiers.</p> <p>Skills: collecting medicinal raw materials; proper storage of medicinal raw materials and preparation of herbaria of medicinal plants.</p> |
| 12. | <p>- professional (industrial-technological) competences - PC 2, PC 3.</p> | <p>Quality management of biotechnological products</p> | 2 | <p>Knowledge about the basic concepts of quality management; various types of systems ensuring quality; methods of monitoring and analysis of quality in production and service systems; methods of organization of work on improvement of quality; the main types of quality costs; the methodology and terminology of quality management and reliability of complex technological systems; the recommendations of Kazakh and international standards of series ISO 9000 to ensure the quality of products; modern methods of forecasting and ensuring a specified level.</p> <p>Abilities: use the principles of the quality management system and organizational and legal bases of managerial and entrepreneurial activities; create production documentation (work schedules, instructions, material requisitions, equipment), as well as the established reporting on approved standards.</p> |

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| | | | | <p>Skills: organizational and managerial work in small groups; analysis and evaluation of the effectiveness of the system of control of production activities.</p> |
| 13. | <p>- general professional competences - GPC 1;</p> <p>- professional (industrial-technological) competences - PC 2.</p> | Ecological management in biotechnology | 2 | <p>The knowledge of process management and work organization at the level of primary group structures and middle managers; the normative-organizational documentation in the field of environmental management; current legislation in the field of environmental protection; compliance with ethical standards and risk strategies in the development of biotechnologies.</p> <p>Abilities: collect and organize data for environmental impact assessment and environmental audit; conduct an assessment of the economic damage and risks for the natural environment, the economic efficiency of environmental measures, and payment for use of natural resources; to analyze the technological process as a control object.</p> <p>Skills: apply this knowledge to improve the quality of life of people and the environment.</p> |
| 14. | <p>- general professional competences - GPC 1;</p> <p>- professional (scientific-research) competences - PC 1.</p> | Molecular genetic bases of biotechnology | 3 | <p>Knowledge of the structure of DNA, its replication, features of the genome in prokaryotes and eukaryotes; the realization of genetic information (protein biosynthesis); the regulation of transcription in prokaryotes (bacteria) and eukaryotes; General principles of construction of recombinant organisms; modern notions of identification, transfer and expression of the target gene; the possibilities of using transgenic organisms – from bacteria to plants and animals; legal aspects and problems of Biosafety while using GMOs.</p> <p>Abilities: to navigate in questions of molecular genetic biotechnology and highly specialized issues of molecular biotechnology; be familiar with the basic methods of molecular biology: working with cell cultu-</p> |

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| | | | | res, etc. Skills in modern laboratory; the laboratory equipment: pH meter, analytical balance, automatic pipettes, microscopes; recognize major differences between DNA and RNA; to distinguish the structural organization of nucleic acids. |
| 15. | - general professional competences - GPC 1; - professional (industrial-technological) competences - PC 2. | Environmental aspects of modern biotechnology | 3 | Knowledge about the tasks of environmental biotechnology; basic terms in environmental biotechnology; methods of use of microorganisms in wastewater treatment and industrial plants; methods of bioindication of pollution of the environment; use of biotechnology in environmental protection, bioindicators of pollution of water bodies. Abilities: use of primary, secondary, and reference books on environmental biotechnology, environmental biotechnology terms; to navigate in the modern directions and methods of ecology; carry out examination of the state of air masses and bodies of water. Skills of conducting biomonitoring and bioindication methods for monitoring current changes in the biosphere. |
| 16. | - general professional competences - GPC 1; - general cultural competences - GCC; - professional (industrial-technological) competences - PC 2. | Bases of microorganism cultivation in biotechnological production | 3 | Knowledge about the main representatives of microorganisms used in the biotechnological production; the selection of strains and requirements to them; the peculiarities of the cultivation of various microorganisms; fermentation, biotransformation; production of microbial synthesis; the concept microbiotechnological production from culture to the final product. Abilities: to characterize the strain for use in production; to choose nutrient medium for cultivation of microorganisms; to make the concept of producing microbial preparation. Skills: calculation and preparation of nutrient media |

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| | ces - PC 2. | | | for cultivation of microorganisms; working in sterile conditions; sterilizing laboratory instruments, glassware, culture media; cultivation of microorganisms. |
| 17. | - general professional competences - GPC 1; - professional (industrial-technological) competences - PC 2. | Biotechnological methods of waste-water treatment and emissions of industrial enterprises | 3 | Knowledge about sources of oily waste water in the modern technosphere; composition and properties of the main fractions of oil-containing waste water; processes and equipment for mechanical purification: processes and apparatuses for the physic-chemical treatment. Abilities: to explain the causes of changes in the ratio of the fractions of oil pollution of various types; to understand the structure of plants protection of the environment; to know the scope of work included in the commissioning and maintenance of these facilities; used in control devices. Skills: control of compliance with norms and rules of environmental safety in keeping with the changing environment and the conditions of technogenic load on the territory of industrial enterprises. |
| 18. | - general professional competences - GPC 1; - professional (industrial-technological) competences - PC 2, PC 3. | Biotechnology of dairy and probiotic products | 3 | Knowledge about the role of dairy and probiotic products in providing nutrition; the composition, properties, biological and nutritional value of dairy and probiotic products; requirements the prepared milk as a raw material for the dairy industry and ways of its improvement; theoretical and practical essence of technological processes of production of various dairy products; the main range of products produced and the fundamental features of their production; the latest technological processes and technologies introduced in the dairy industry; principles of development of technology of new types of dairy products (eco-friendly, medical, etc.); methods of control of raw materials, technological processes and finished pro- |

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| | | | | <p>ducts, as well as the requirements of the standards.</p> <p>Abilities: to carry out theoretical studies, use of reference and monographic literature in the field of biotechnology for dairy and probiotic products; to choose their own technical means, a rational scheme of production of a given product; to assess the technological efficiency of production and to make proposals for their improvement.</p> <p>Skills: determination of the chemical composition and organoleptic properties of milk and milk products; to define the microflora of milk and dairy products; possession of methods of environmental security of production and environmental protection.</p> |
| 19. | <p>- general professional competences - GPC 1;</p> <p>- professional (industrial-technological) competences - PC 2.</p> | Bioindication of pollution of water and soil ecosystems | 3 | <p>Knowledge on the biological monitoring; the forms, levels and types of bioindication; the selection criteria indicative of the types and methods of assessing the ecological condition of communities and ecosystems; methods, bioindicative assessment of soil quality and aquatic ecosystems.</p> <p>Abilities: use of biological indicators for bioindication; apply the basic principles of bioassay contamination of soil and water ecosystems; to apply modern methods of analysis to assess the quality of the environment.</p> <p>Skills: selection criteria and indicators in bioindicative studies; conduct of research; laboratory of modeling and experiment for bioindication and biotesting of soil and water ecosystems.</p> |
| 20. | - general professional competences - GPC 1; | Food biochemistry and biotechnology | 3 | <p>Knowledge about the composition of proteins, carbohydrates, lipids, minerals, vitamins, food raw materials, their place in human nutrition; functional properties of proteins, carbohydrates, lipids, vitamins; bases of transformations of proteins, carbohydrates, li-</p> |

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| | - professional (industrial-technological) competences - PC 3. | | | <p>pids in the production of food; role of minerals and vitamins in the human body; the structure of food components, their transformations under the influence of technological factors; modern methods a comprehensive selection of the main components of food raw materials.</p> <p>Abilities: to assess the nutritional and biological value of food products; to use knowledge of the laws of physics, chemistry, and Microbiology, to explain the processes of transformation of the original food raw materials into a finished product; to evaluate the safety of food products; to explain the processes of change in dietary components in the process stream to produce a finished product.</p> <p>Skills: evaluation of food and biological value of food; possession of methods of analysis and the study of food systems.</p> |
| 21. | <p>- general professional competences - GPC 1;</p> <p>- professional (scientific-research) competences - PC 1.</p> | Bases of toxicology and ecotoxicology | 3 | <p>Knowledge about the basic concepts of toxicology; stages of acute poisoning and the factors determining their development; toxic-kinetic characteristics of different types of poisoning; the major toxicants and the superecotoxicants.</p> <p>Abilities: to apply the theory of receptors toxicity characteristics of the communication of the poison to the receptor; to characterize the factors that determine the development of poisoning and to take measures emergency first aid; to characterize the impact of toxicants on ecosystems and human health.</p> <p>Skills: draw conclusions about the current and projected quality of the human environment and the possible changes in the level of health of the population in specific regions in the implementation of large industrial or social projects; calculation of environmental and</p> |

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| | | | | economic damage from environmental pollution; application of the basic methods and techniques of research and practical experience in the field of ecotoxicology in the environment. |
| 22. | <p>- general professional competences - GPC 1;</p> <p>- professional (industrial-technological) competences - PC 3.</p> | Biotechnology of therapeutic, preventive foods, and foods with special purpose | 3 | <p>Knowledge about main principles of formation of functional properties of raw milk to obtain systems with desired physic-chemical and biological indicators; socio-economic aspects of food and health of the population; major and alternative theories of nutrition; medico-biological requirements for nutrition of different groups of consumers; the dietary characteristics of the therapeutic properties of dairy products, technology of clinical nutrition milk-based.</p> <p>Abilities: producing financial calculations and to choose the optimal conditions of carrying out of technological processes; to identify the main characteristics of composition and properties of products, preventive nutrition and functional purpose, to use modern methods of control of technological operations, the quality of raw materials and finished products.</p> <p>Skills: application of the basic principles of regulation of functional and technological parameters on the basis of commutative and distributive dairy and non-conventional raw materials.</p> |
| 23. | <p>- general professional competences - GPC 1;</p> <p>- professional (industrial-technological) competences - PC 3.</p> | Bases of biosafety | 3 | <p>Knowledge about biosafety levels; biosafety issues in the modern development of the foundations of processes of bioinvasion aquatic ecosystems.</p> <p>Abilities: to identify and investigate potential biological threats; to arrange for ensuring biological safety; to operate knowledge on biological invasions; have basic knowledge of Kazakhstan and international legislation in the field of biological safety.</p> <p>Skills: mastery of methods of assessing the impact of</p> |

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| | | | | invaders on native species of living organisms and on ecosystems as a whole; the major approaches to the assessment and redress of bioinvasion. |
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Table 2. The sequence of mastering the disciplines of social and professional interaction

| Course | Supporting disciplines | Competencies | Expected results |
|--------|-----------------------------------|--|---|
| 1 | History and philosophy of science | <p>- general cultural competences - GCC;</p> <p>- professional (scientific-research) competences - PC 1.</p> | <p>Knowledge: about the nature, structure, principles of organization and functioning of science; the genesis of science in terms of its history, models, images and the formation of types of thinking; interaction of scientific and philosophical thought; basic concepts of the history and philosophy of science; formation of knowledge, patterns of formation and development of scientific disciplines; basic principles of research activity.</p> <p>Abilities: formulate and solve problems arising in research activities and requiring in-depth professional knowledge; choose the necessary research methods, improve the previous ones and develop new methods arising in the tasks of a specific search; analyze and understand the reality of modern theory and practice based on the history and philosophy of science, methodology of natural, socio-humanitarian and technical knowledge; application of methodological and practical knowledge in scientific research, pedagogical and educational work.</p> <p>Skills: to conduct research and scientific and pedagogical activities that require fundamental knowledge of the relevant direction; to write scientific articles, theses, speak at conferences, symposiums, round tables, discussions and exchanges of opinions.</p> |
| 1 | Foreign language (professional) | <p>- general cultural competences - GCC;</p> <p>general professional competences - GPC 2.</p> | <p>Knowledge: about functional and stylistic characteristics of the scientific presentation of the material in the studied foreign language; general scientific terminology and terminological sublanguage of the relevant specialty in a foreign language.</p> <p>Abilities: freely read the original literature of the relevant field of knowledge in a foreign language, followed by analysis, interpretation and evaluation of the extracted information; explicate in writing (abstract, annotation, summa-</p> |

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| | | | <p>ry) scientific information; participate in professional discussions, scientific debates, discussions, round table discussions; make a presentation of scientific research (at seminars, conferences, symposiums, forums); perceive by ear and understand public speeches in direct and indirect communication (lectures, reports, and TV and Internet programs).</p> <p>Skills: oral communication in monologue and dialogic form in the specialty in monologue and dialogic form in the specialty (report, message, presentation, round table discussion, discussion, debate, debate); written scientific communication in the specialty (scientific article, theses, report, translation, abstracting and annotation); work with lexicographic sources in a foreign language; use of modern approaches to learning a foreign language.</p> |
| 1 | Pedagogy of higher education | <p>- general cultural competences - GCC;</p> <p>- professional (pedagogical, upbringing) competences - PC 5.</p> | <p>Knowledge: about modern paradigms of higher education; the history of pedagogical thought in the history of the development of higher education in the Republic of Kazakhstan and the modern experience of educational activities.</p> <p>Abilities: identify the main provisions of managerial activity and managerial relations, apply methods of organizing the learning process based on the credit system of education in higher education; think creatively and creatively approaches the solution of pedagogical situations.</p> <p>Skills: own methodological approaches to the choice of theoretical tools, the culture of communication in professional and everyday life.</p> |
| 2 | Management psychology | <p>- general cultural competences - GCC;</p> <p>- professional (industrial-technological) competences - PC 2.</p> | <p>Knowledge: about the essence and structure of the management process; the theoretical foundations of the psychology of management and its conceptual and categorical apparatus; the characteristics of the individual as an object and subject of management.</p> <p>Abilities: to apply managerial skills in working with groups and teams; build communication within the group and beyond; apply psychological methods of influence and motivation in the group.</p> <p>Skills: own the conceptual apparatus of management psychology, the skills of delegation of authority and time management.</p> |

III. LIST OF MODULES INCLUDED IN THE MEP

| Module No. | Name module | List of disciplines included in the module | Block | Semester | Volume of credits | Form of control | Total credits by module |
|------------|---|--|---------|----------|-------------------|-----------------|-------------------------|
| M.1 | Methodology of scientific research | History and philosophy of science | BD (UC) | 1 | 5 | exam | 19 |
| | | Foreign language (professional) | BD (UC) | 1 | 4 | exam | |
| | | Methodological bases of scientific research in biotechnology and experimental planning / Methodology of scientific research in environmental biotechnology | BD (CC) | 1 | 5 | exam | |
| | | Modern methods in biotechnology | PD (UC) | 1 | 5 | exam | |
| M.2 | Psychological and pedagogical foundations of teaching in higher education | Pedagogy of higher education | BD (UC) | 1 | 4 | exam | 18 |
| | | Management psychology | BD (UC) | 2 | 4 | exam | |
| | | Pedagogical ethics of a modern teacher / Modern pedagogical technologies | BD (CC) | 1 | 3 | exam | |
| | | Teaching methodology of specialty disciplines / Theory and technology of teaching in the university | BD (CC) | 2 | 4 | exam | |
| | | Pedagogical practice | BD (UC) | 3 | 3 | dif.offset | |
| M.3 | Molecular fundamentals of biotechnology | Molecular genetic bases of biotechnology / Ecological aspects of modern biotechnology | BD (CC) | 3 | 3 | exam | 3 |
| M.4 | Pharmaceutical biotechnology | Biotechnology of medicines and genetically modified products / Biotechnology of biologically active substances taking into account the rules of GMP | PD (CC) | 2 | 5 | exam | 10 |
| | | Biotechnology of biologically active substances and additives / Phytoresources of medicinal plants | PD (CC) | 2 | 5 | exam | |
| M.5 | Biotechnology management | Quality management of biotechnological products / Ecological management in biotechnology | PD (CC) | 2 | 5 | exam | 5 |
| M.6 | Microorganisms in the biotechnological process | Bases of microorganism cultivation in biotechnological production / Biotechnological methods of wastewater treatment and emissions of industrial enterprises | PD (CC) | 3 | 5 | exam | 10 |
| | | Biotechnology of dairy and probiotic products / Bioindication of pollution of water and soil ecosystems | PD (CC) | 3 | 5 | exam | |

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| M.7 | Food biotechnology and biosafety | Food biochemistry and biotechnology / Bases of toxicology and ecotoxicology | PD (CC) | 3 | 5 | exam | 10 |
| | | Biotechnology of therapeutic, preventive foods, and foods with special purpose / Bases of biosafety | PD (CC) | 3 | 5 | exam | |
| M.8 | Scientific-research work of undergraduates | Research practice | PD (CC) | 4 | 9 | dif.offset | 33 |
| | | Scientific-research work of undergraduates, including internships and implementation of the master's dissertation | | 1-4 | 24 | report | |
| M.9 | Final attestation | Design of the master's dissertation | | 4 | 10 | pre-defense | 12 |
| | | Master's dissertation defense | | 4 | 2 | defense | |
| Total | | | | | | | 120 |