ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ҒЫЛЫМ ЖӘНЕ ЖОҒАРЫ БІЛІМ МИНИСТРЛІГІ

МАНАШ ҚОЗЫБАЕВ АТЫНДАҒЫ СОЛТҮСТІК ҚАЗАҚСТАН УНИВЕРСИТЕТІ

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РЕСПУБЛИКИ КАЗАХСТАН

СЕВЕРО-КАЗАХСТАНСКИЙ УНИВЕРСИТЕТ ИМЕНИ МАНАША КОЗЫБАЕВА

MINISTRY OF SCIENCE AND HIGHER EDUCATION
OF THE REPUBLIC OF KAZAKHSTAN

MANASH KOZYBAYEV NORTH KAZAKHSTAN UNIVERSITY

ARIZONA

6B05111 «Биотехнология»
БІЛІМ БЕРУ БАҒДАРЛАМАСЫ

ОБРАЗОВАТЕЛЬНАЯ ПРОГРАММА
6B05111 «Биотехнология»

EDUCATIONAL PROGRAM
6B05111 «Biotechnology»

Ғылыми кеңестің отырысында **қаралды және бекітілді /**
Рассмотрена и утверждена на заседании Учёного совета /
Reviewed and approved at the meeting of the Academic Council

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M.O./M.P./S.P.

Петропавл / Петропавловск / Petropavlovsk, 2022 ж.

Dual degree educational program
North Kazakhstan University named after M. Kozybayev (KU) & University of Arizona (UA)

1. **Name of the educational program:** 6B05111 Biotechnology
2. **The goal of the educational program:** To prepare qualified specialists in industries related to the development of fermented food products and beverages, biologically active substances, and insect-resistant crops in accordance with international standards, as well as in the field of fundamental biotechnological research.
3. **Program advantages:**

1. OHPE – partner of the University of Arizona;
2. Mastery of language competencies – intensive study of the English language, which will enable students to study scientific literature in English, publish articles and abstracts, participate in academic mobility programs, and undertake internships abroad;
3. Academic mobility: annually, students participate in academic mobility programs at universities in the Republic of Kazakhstan, the Russian Federation, China, Latvia, Slovakia, Poland, and other countries;
4. The content of the educational program has been reviewed and recommended by the leading faculty members of the University of Arizona.

4. **Level of education:** Bachelor's degree (Higher).
5. **Form of the study:** full-time.
6. **Duration of study:** The duration of undergraduate studies for students with higher education or technical and vocational education, or post-secondary education, is determined taking into account the recognition of previously achieved learning outcomes from formal and informal education. At the same time, the duration of study may be extended or shortened if the student forms an individual study plan consisting of disciplines and other types of educational activities totaling at least 60 credits per academic year.
7. **Language of instruction:** English.
8. **Total credits:** 274
9. **Degree awarded:** Bachelor of Natural Sciences in the educational program "6B05111 Biotechnology".
10. **The EP was developed on the basis of:**

- National Qualifications Framework: National Framework of Qualifications, approved by the protocol of March 16, 2016 of the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations.

- Professional standards: Yeast Production (26.12.2019), Beverage Production (26.12.2019), Milk and Dairy Products Production (30.05.2023), Dairy Products Production (30.05.2023).

- Sectoral Qualifications Framework:

Sectoral Framework of Qualifications in the field of Environmental Protection, approved in 2016; Sectoral Framework of Qualifications "Food Industry", approved in 2019.

11. Field of professional activity (sections on CED): Professional, scientific, and technical activities (Section M).

12. List of professions: Biotechnologist, Microbiologist, Engineer-microbiologist, Engineer-technologist, Laboratory assistant-microbiologist.

13. Spheres of professional activity: Research, Experimental-research, Organizational and managment, Production and managment.

14. Objects of professional activity: Research Institutes and Universities Specializing in Biotechnology, Biology, Medicine, and Agriculture; Manufacturing Enterprises and Laboratories in the Food and Processing, Microbiological Industries; Environmental Services and Organizations; Laboratories for Quality and Safety Control of Agricultural products.

15. International partners: University of Arizona.

16. External stakeholders (industry associations, enterprises, partner universities, etc.): Branch of the RSE "Kazhydromet" for the North Kazakhstan region, Branch of the JSC "Government for Citizens" for the North Kazakhstan region, LLP "Raduga".

17. PROGRAM STRUCTURE AND ACADEMIC CONTENT

Name of the discipline	Semester	Cycle	Component	Credits	Discipline Descriptor	Formed learning outcomes for the discipline
					1-st semester	
Foreign language	1	GED	RC	10	The course is aimed at understanding a foreign language to a sufficient extent to solve problems of interpersonal and intercultural interaction within the framework of four types of speech activity (reading, listening, writing, speaking).	Knowledge: Recall and use key English vocabulary and grammar structures for communication. Comprehension: Understand main ideas in spoken and written academic texts. Application: Write short essays, summaries, and reports in English. Analysis: Evaluate and discuss scientific texts using appropriate terminology. Synthesis: Integrate reading, writing, and speaking skills in professional contexts. Evaluation: Assess own language performance and identify strategies for improvement.
Module of socio-political knowledge	1	GED	RC	8	The module provides an overview of social, political, and ethical issues affecting modern society and the development of information systems. It covers political systems, civic responsibility, social institutions, globalization, cultural diversity, and sustainable development. Special attention is given to the role of digital technologies in social change and governance	Knowledge: Define basic concepts of political science, sociology, and ethics. Comprehension: Explain relationships between society, government, technology and science. Application: Apply social and political theories to case studies related to information systems and management. Analysis: Critically analyze civic, ethical, and sustainability challenges in professional activity. Synthesis: Integrate political, economic, and ethical knowledge to propose civic and organizational solutions. Evaluation: Assess social policies and digital initiatives and their impact on sustainable innovation and social justice.
Fundamentals of Anti-Corruption Culture	1	GED	CC	5	The discipline explores legal and ethical norms promoting integrity and transparency in professional environments.	Knowledge: Define the key concepts, principles, and legal foundations of anti-corruption policy and ethics. Comprehension: Explain the causes, forms, and social consequences of corruption and the role of citizens in preventing it. Application: Apply anti-corruption principles and ethical standards in academic, professional, and civic contexts. Analysis: Identify and analyze corruption risks and ethical dilemmas in various spheres of activity. Synthesis: Develop

						proposals and initiatives aimed at promoting transparency, integrity, and accountability. Evaluation: Critically assess the effectiveness of anti-corruption measures and contribute to fostering a culture of honesty and responsibility.
Inclusive Practices		GED	CC		The discipline train students to create equitable and accessible professional environments.	Knowledge: Identify key concepts and principles of inclusion, diversity, and equity in educational and professional contexts. Comprehension: Explain the importance of creating accessible and equitable environments for individuals with diverse needs and backgrounds. Application: Apply inclusive strategies and communication techniques to support participation and collaboration among all individuals. Analysis: Analyze barriers to inclusion and evaluate institutional policies or practices that affect accessibility and equality. Synthesis: Design inclusive initiatives or projects promoting diversity, accessibility, and equitable opportunities. Evaluation: Critically assess the effectiveness of inclusive practices and propose improvements for fostering an inclusive culture.
Fundamentals of Scientific Research		GED	CC		The discipline introduces methods of observation, hypothesis formulation, data collection, and analysis in natural sciences.	Knowledge: Identify the main stages, methods, and terminology of scientific research. Comprehension: Explain the logic and structure of scientific inquiry, including hypothesis formulation and literature review. Application: Apply research design principles to plan and conduct small-scale scientific studies or experiments. Analysis: Analyze research data and interpret results using appropriate statistical and analytical tools. Synthesis: Develop a coherent research proposal integrating theoretical background, methodology, and expected outcomes. Evaluation: Critically assess the quality, validity, and ethical aspects of scientific publications and research projects.
Ecology and Sustainable Development		GED	CC		The discipline highlights environmental challenges, ecosystem dynamics, and sustainability principles in the context of biotechnology.	Knowledge: Identify key ecological principles, environmental factors, and concepts of sustainable development. Comprehension: Explain the interdependence between human activities, ecosystems, and global environmental challenges. Application: Apply ecological and sustainability concepts to assess environmental impacts and propose mitigation strategies. Analysis: Analyze ecological data and case studies to evaluate the consequences of resource use and pollution. Synthesis: Develop integrated approaches and projects aimed at promoting sustainable management of natural resources. Evaluation: Critically assess policies, technologies, and practices in terms of their contribution to environmental sustainability and resilience.
Fundamentals of Life Safety		GED	CC		The discipline develops understanding of occupational health, safety, and emergency	Knowledge: Identify key concepts of life safety, risk management, and emergency response. Comprehension: Explain the main causes of emergencies,

					preparedness.	accidents, and occupational hazards affecting human health and safety. Application: Apply basic safety measures, first aid techniques, and emergency procedures in various environments. Analysis: Analyze potential risks and hazardous situations to develop effective prevention and protection strategies. Synthesis: Design safety plans and recommendations to ensure personal, workplace, and environmental safety. Evaluation: Assess the effectiveness of safety systems, regulations, and personal preparedness in preventing and mitigating risks.
Climate change		GED	CC		A discipline examines global climatic processes, human impact, and mitigation strategies aligned with the UN Sustainable Development Goals (SDGs).	Knowledge: Identify the scientific foundations of climate systems, greenhouse gases, and global climate change processes. Comprehension: Explain the causes, mechanisms, and consequences of climate change at global, regional, and local scales. Application: Apply knowledge of climate science to assess environmental, economic, and social impacts of climate change. Analysis: Analyze data on temperature, emissions, and environmental indicators to evaluate climate trends and risks. Synthesis: Propose adaptation and mitigation strategies to reduce the effects of climate change and promote sustainability. Evaluation: Critically evaluate international climate policies, agreements, and technological solutions addressing climate change.
Mathematics	1	BD	UC	6	This course provides basic mathematical tools for scientific and technical applications: algebra, functions, limits, derivatives, integrals, and basic statistics.	Knowledge: Recall basic mathematical formulas and operations. Comprehension: Explain mathematical relationships relevant to natural sciences. Application: Solve problems involving derivatives, integrals, and equations. Analysis: Analyze functional relationships and interpret graphs. Synthesis: Combine mathematical methods to model simple physical or biological processes. Evaluation: Assess the appropriateness of mathematical models in problem-solving.
Introduction to Professional Activity	1	BD	UC	4	The course studies the prospects of using living organisms and products of their vital activity for the potential accomplishment of technological tasks and the formation of a professional perspective for the students.	Knowledge: Identify the scope and structure of biotechnological activities. Comprehension: Understand ethical and regulatory aspects of biotechnology. Application: Apply knowledge to analyze examples of biotechnological products. Analysis: Distinguish between research and industrial biotechnology applications. Synthesis: Design a simple project plan related to a biotechnological process. Evaluation: Critically evaluate professional responsibilities and biosafety principles.
Succeeding as a Global Wildcat	1	ATT		1	The course serves as an introduction to studying at the University of Arizona as an international student studying at one of our	Knowledge: Identify the structure, values, and academic culture of the University of Arizona and its global network. Comprehension: Explain the main principles of intercultural communication and the expectations of academic

					many microcampuses. In addition to communicating with fellow students at the main campus in Tucson and familiarizing themselves with the university's online lesson management system D2L (Desire 2 Learn), students will actively develop cultural knowledge and academic skills that are fundamental to university life in the United States.	integrity within the U.S. higher education system. Application: Use the D2L (Desire2Learn) learning management system effectively for communication, assignments, and participation in academic activities. Analysis: Analyze differences and similarities between educational systems and cultural contexts to enhance cross-cultural collaboration. Synthesis: Integrate digital, communication, and cultural competencies to build effective learning strategies in an international environment. Evaluation: Reflect critically on personal academic experiences and cultural adaptation to strengthen global citizenship and intercultural competence.
Leadership and Innovation Management					The course develops leadership and teamwork skills in multicultural and academic environments. Students learn principles of innovation, creativity, and global citizenship.	Knowledge: Recognize the importance of leadership and collaboration. Comprehension: Understand principles of innovation and creative thinking. Application: Apply leadership and teamwork strategies to group projects. Analysis: Evaluate team dynamics and problem-solving effectiveness. Synthesis: Propose innovative solutions to community or academic challenges. Evaluation: Reflect on personal leadership style and growth.
Basics of Economics, Entrepreneurship and Financial Literacy	1	GED	CC	5	This course introduces the fundamentals of economics, entrepreneurship, and financial literacy as essential competencies for biotechnology professionals. Students learn the principles of supply and demand, types of market structures, and the role of government in the economy. The entrepreneurship component covers innovation processes, startup creation, and small business management, with emphasis on financial literacy — budgeting, investment, and basic accounting. Case studies are used to connect economic theory to real-world biotech enterprises and sustainable innovation. Students develop	Knowledge: Define key concepts of economics, entrepreneurship, and finance. Comprehension: Explain how economic systems and innovation affect biotechnological industries. Application: Develop a basic financial plan for a small business or project. Analysis: Analyze market trends and interpret simple financial data. Synthesis: Integrate economic and entrepreneurial principles to propose innovative business ideas. Evaluation: Critically assess business sustainability and ethical financial decision-making.

					analytical and decision-making skills for responsible participation in the bioeconomy.	
Basics of Law and Legal Regulation	1	GED	CC	5	This course provides a foundation in law and legal regulation relevant to professional and scientific activities. It covers the structure of national and international legal systems, key principles of constitutional, civil, and business law, and the protection of intellectual property. Special attention is given to regulatory frameworks governing biotechnology, environmental law, and bioethics. Students learn about anti-corruption mechanisms, compliance procedures, and professional legal responsibility. The course aims to cultivate legal awareness and ethical decision-making in the context of scientific research and entrepreneurship.	Knowledge: Identify the main branches of law and their role in regulating professional and scientific activity. Comprehension: Explain the relationship between legal norms, ethics, and social responsibility. Application: Apply legal principles to real-world scenarios involving business or research. Analysis: Analyze case studies concerning intellectual property or bioethical issues. Synthesis: Integrate legal and ethical considerations into project planning and innovation management. Evaluation: Critically evaluate legal risks and propose compliant, ethical solutions in professional practice.
Total for the semester: 37 credits						
2-nd semester						
Kazakh language	2	GED	UC	5	This course develops communicative competence in Kazakh, focusing on professional and academic vocabulary. It improves reading, writing, and speaking skills required for academic and workplace	Knowledge: Recall key linguistic rules and vocabulary relevant to academic and professional settings. Comprehension: Understand and interpret texts in Kazakh or Russian in the field of biotechnology. Application: Communicate effectively in oral and written forms in professional contexts. Analysis: Analyze language structures and stylistic features of professional texts. Synthesis: Produce

					contexts.	coherent reports or presentations integrating technical and linguistic accuracy. Evaluation: Assess the quality of communication and language use in academic work.
English Language	2	BD	UC	5	The course is aimed at developing professional English language skills, enabling future specialists to implement various aspects of their professional activities in order to enhance their level of professional competence.	Knowledge: Recall and use key grammar and vocabulary for academic purposes. Comprehension: Understand academic texts and lectures in English. Application: Write structured essays and research abstracts. Analysis: Analyze text organization and coherence in English academic writing. Synthesis: Integrate reading, writing, and speaking skills in professional contexts. Evaluation: Assess the effectiveness of written and spoken communication.
History of Kazakhstan	2	GED	RC	5	The course examines the historical development of Kazakhstan from ancient times to the present. It covers major political, economic, and cultural milestones, emphasizing national identity and modernization processes.	Knowledge: Identify key events and figures in Kazakhstan's history. Comprehension: Explain the relationship between historical events and the country's socio-political development. Application: Apply historical knowledge to understand national identity and policy evolution. Analysis: Analyze historical documents and sources critically. Synthesis: Integrate historical perspectives into understanding modern societal challenges. Evaluation: Assess historical interpretations and their impact on civic values.
General Chemistry	2	BD	UC	8	The course is aimed at acquiring sufficient knowledge and the appropriate application of fundamental ideas related to atomic and molecular structure. It emphasizes the understanding of the local and global significance of chemistry for the environment and industry.	Knowledge: Recall atomic theory, chemical laws, and periodic relationships. Comprehension: Explain the properties and reactions of chemical elements and compounds. Application: Perform basic laboratory experiments following safety regulations. Analysis: Analyze chemical data and reaction outcomes. Synthesis: Develop experimental procedures to test chemical hypotheses Evaluation: Evaluate experimental accuracy and reliability of results.
General Biology	2	BD	EC	8	The course explores the history of the development of modern concepts of living nature, outstanding discoveries in biological science that have become part of human culture; the complex and contradictory paths of development of modern scientific views, ideas, theories, concepts, and hypotheses (about the essence and origin of life, and humans); the role of biological science in shaping the modern natural-scientific worldview; methods of scientific knowledge; biological systems (cell, organism, population, species, ecosystem).	A student who has mastered the discipline should: - be able to apply theoretical knowledge and practical skills for working with living and non-living cells, as required by specialists in research, biotechnology, and other organizations; - know the main research methods in biology, the organization and functions of cells, normal cellular organelles, and the importance of biology for practical activities, including the use of biological data in agriculture and biotechnology; - understand the mechanisms of cell division under normal and pathological conditions.

Introduction to Biology	2	BD	EC	8	The discipline introduces students to the fundamental principles of modern science – biology; teaches students to interpret scientific facts and hypotheses, formulate and justify their own point of view; cultivates skills in independent work with scientific and methodological literature and conducting research for necessary information.	Knowledge: Define fundamental biological concepts and terminology. Comprehension: Explain the organization and function of biological systems. Application: Apply biological principles to simple laboratory and environmental tasks. Analysis: Analyze biological data and phenomena. Synthesis: Integrate biological knowledge to explain complex life processes. Evaluation: Evaluate scientific information and experimental results
Fundamentals of Scientific Research	2	BD	EC	4	This course introduces the basic concepts and tools of scientific research. Students learn to identify research problems, design experiments, analyze results, and plan research projects effectively in biotechnology.	Knowledge: Identify stages of scientific research and project planning. Comprehension: Explain research design and data analysis principles. Application: Develop a small research proposal using proper methodology. Analysis: Analyze the structure and ethics of research publications. Synthesis: Integrate various research methods for solving complex problems. Evaluation: Critically assess research design quality and data interpretation.
Organization and planning of research activities	2	BD	EC	4	The course focuses on the principles and methods of organizing and planning scientific research. Students learn to design research projects, manage resources and timelines, and apply modern approaches to effective research coordination. Emphasis is placed on project structure, documentation, teamwork, and ethical standards in scientific activity.	Knowledge: Define the fundamental principles and organizational structure of scientific research activities. Comprehension: Explain the stages of planning and managing research projects within institutional and funding frameworks. Application: Apply project management tools and scheduling techniques in organizing research work. Analysis: Analyze research resources, risks, and time management strategies to ensure project efficiency. Synthesis: Design a structured research plan integrating interdisciplinary collaboration and innovation. Evaluation: Evaluate the effectiveness of research organization and planning processes using performance indicators and quality criteria.
Succeeding as a Global Wildcat 2	2	ATT		1	The course serves as an introduction to studying at the University of Arizona as an international student studying at one of our many microcampuses. In addition to communicating with fellow students at the main campus in Tucson and familiarizing themselves with the university's online lesson management system D2L (Desire 2 Learn), students will actively develop cultural knowledge and academic skills that are fundamental to university life in the United States.	Knowledge: Identify key aspects of academic culture, communication, and student life at the University of Arizona and its microcampuses. Comprehension: Explain the principles of intercultural communication and the structure of the U.S. higher education system. Application: Use the D2L (Desire2Learn) learning management system and other digital tools for effective academic interaction and coursework management. Analysis: Analyze differences in educational and cultural practices to enhance cross-cultural understanding and collaboration. Synthesis: Integrate academic skills, cultural awareness, and communication strategies to succeed in an international university environment. Evaluation: Reflect critically on personal academic progress and intercultural experiences to develop global competence and adaptability.

Leadership and Innovation Management 2					The course studies aspects of effective leadership, patterns of innovation management; the student is capable of effective verbal, non-verbal and electronic communication, decision-making, team building, conflict and stress management, formation and improvement of leadership qualities, participation in project management, a program for the implementation of technological and product innovations or a program of organizational changes; discussion methods, brainstorming, case method, "orator's tribune", educational dialogue, "laboratory of unsolved problems", POPS formula are used	Knowledge: Describe principles of leadership and innovation. Comprehension: Understand the role of teamwork and global competence. Application: Apply leadership skills in team-based projects. Analysis: Evaluate team performance and problem-solving strategies. Synthesis: Design innovative solutions addressing global challenges. Evaluation: Reflect on personal leadership style and effectiveness.
Educational practice	2	BD	UC	2	Formation of practical professional skills in students, acquisition of initial practical experience in the main types of professional activity for their subsequent acquisition of general and professional competencies in their chosen specialty.	The goal of the educational practice is to deepen and reinforce theoretical knowledge, acquire practical experience and skills in the fundamental principles of biology and general chemistry, and master the methodologies of biological and chemical research.
Total for the semester: 38 credits						
3- rd semester						
Foreign Language Workshop 1	3	BD	UC	6	The course is designed to enhance students' ability to master the English language. Students work on expanding their vocabulary, as well as improving reading comprehension and basic writing skills. The emphasis is placed on acquiring the skills necessary for working in an English-speaking environment and achieving success in studies.	Knowledge: Recall specialized vocabulary and grammar used in scientific English. Comprehension: Understand spoken and written academic texts. Application: Write academic essays, reports, and summaries in English. Analysis: Analyze and interpret scientific information from English sources. Synthesis: Combine different language skills to communicate effectively in a research environment. Evaluation: Assess written and spoken English performance for academic and professional adequacy.
Theoretical foundations of	3	GED	RC	8	The discipline is aimed at acquiring sufficient knowledge and the appropriate	Knowledge: Recall periodic properties and bonding models in inorganic compounds.

inorganic chemistry					application of fundamental concepts related to chemical kinetics, electrochemistry, and thermodynamics. It emphasizes the understanding of the local and global significance of chemistry for the environment and industry.	Comprehension: Explain the structure and reactivity of elements and coordination complexes. Application: Apply inorganic chemistry theories to experimental data and problem-solving. Analysis: Analyze trends in chemical behavior based on atomic and molecular properties. Synthesis: Predict the behavior of new inorganic materials in biological systems. Evaluation: Critically evaluate theoretical models and experimental findings.
Biology with basics of ecology	3	BD	EC	8	The discipline explores the history of the development of modern concepts of living nature, outstanding discoveries in biological science that have become part of human culture; the complex and contradictory paths of development of modern scientific views, ideas, theories, concepts, and hypotheses (about the essence and origin of life, humans); the role of biological science in shaping the modern natural-scientific worldview; methods of scientific cognition; biological systems (cell, organism, population, species, ecosystem).	Knowledge: Describe fundamental principles of ecology and evolution. Comprehension: Explain ecological relationships and evolutionary processes. Application: Apply ecological methods in field and laboratory research. Analysis: Analyze population and environmental data for trends and variability. Synthesis: Integrate ecological and evolutionary theory to explain biodiversity. Evaluation: Evaluate human impacts and propose sustainable solutions.
Evolutionary and ecological biology	3	BD	EC	8	The discipline is aimed at training highly specialized specialists with a broad general biological education, who are knowledgeable about the fundamental principles of the development of living organisms, with a focus on ecology and evolutionary theory.	Knowledge: Identify fundamental concepts of evolution, ecology, and biodiversity. Comprehension: Explain mechanisms of natural selection, adaptation, and ecological interactions. Application: Apply evolutionary and ecological principles to analyze biological systems and environmental issues. Analysis: Distinguish relationships among species, populations, and ecosystems using analytical methods. Synthesis: Integrate evolutionary theory and ecological data to explain complex biological phenomena. Evaluation: Critically assess human impact on ecosystems and evaluate strategies for biodiversity conservation.
Physics 1	3	BD	UC	8	The introductory physics course for first-year students, based on mathematical calculus, introduces classical mechanics.	Knowledge: Recall fundamental physical quantities and laws of motion. Comprehension: Explain the physical meaning of work, energy, and force interactions.

					The science of mechanics describes and explains the causes of changes in the motion of bodies. Key concepts such as space, time, mass, and force are given clear working definitions, which serve as the foundation for empirical discovery and verification of Newton's laws of motion. Concepts such as center of mass, momentum, torque, angular momentum, work, kinetic, and potential energy are introduced in a well-motivated manner, and the 'conservation laws' (more accurately, theorems in the context of mechanics) are derived from Newton's laws.	Application: Apply physical principles to analyze mechanical systems. Analysis: Analyze data from physical experiments and interpret graphical results. Synthesis: Integrate theoretical and experimental understanding in biophysical contexts. Evaluation: Evaluate experimental accuracy and theoretical consistency.
Kazakh Language	3	GED	UC	5	This course develops communicative competence in Kazakh, focusing on professional and academic vocabulary. It improves reading, writing, and speaking skills required for academic and workplace contexts. The formation of a socio-humanitarian worldview in students within the context of the national idea of spiritual modernization, which involves the development of qualities such as internationalism and tolerance towards world cultures and languages based on national consciousness and cultural codes. These qualities serve as conveyors of world-class knowledge, advanced modern technologies, the use and transfer of which can ensure the modernization of the country and the personal career growth of future specialists.	Knowledge: Recall academic and professional vocabulary in Kazakh. Comprehension: Interpret professional and academic texts in the chosen language. Application: Write structured reports and deliver oral presentations on biotechnological topics. Analysis: Analyze linguistic and stylistic aspects of professional texts. Synthesis: Combine grammar and vocabulary skills to produce coherent scientific communication. Evaluation: Evaluate oral and written scientific communication for accuracy and style.
Total for the semester: 35 credits						
4-th semester						
Statistics	4	BD	UC	6	The course provides a foundation in descriptive and inferential statistics for	Knowledge: Identify main statistical concepts, variables, and data types. Comprehension: Explain statistical measures and probability distributions.

					biological and chemical data analysis. Students learn to apply statistical methods for hypothesis testing, correlation, regression, and experimental design.	Application: Use statistical software to analyze experimental data. Analysis: Interpret statistical results and assess data variability. Synthesis: Integrate statistical reasoning into scientific research.Evaluation: Critically evaluate statistical approaches in published studies.
Foreign Language Workshop 2	4	BD	UC	6	This course develops students' communicative competence in academic and professional contexts, focusing on speaking, listening, reading, and writing skills. Emphasis is placed on scientific terminology and effective presentation of research results.	Knowledge: Identify lexical and grammatical structures relevant to academic English. Comprehension: Explain meanings and use of professional terminology in context. Application: Demonstrate effective communication in academic discussions and writing. Analysis: Analyze linguistic features of research articles and presentations. Synthesis: Compose academic texts integrating information from various sources. Evaluation: Assess and improve one's own language performance for clarity and precision.
Organic Chemistry 1	4	BD	EC	8	This course explores the structure, bonding, and reactivity of organic compounds, focusing on functional groups, stereochemistry, and reaction mechanisms. It provides the theoretical basis for understanding organic synthesis and biomolecular transformations.	Knowledge: Identify main statistical concepts, variables, and data types. Comprehension: Explain statistical measures and probability distributions. Application: Use statistical software to analyze experimental data. Analysis: Interpret statistical results and assess data variability. Synthesis: Integrate statistical reasoning into scientific research. Evaluation: Critically evaluate statistical approaches in published studies.
Theoretical foundations of organic chemistry	4	BD	EC	8	The course provides a theoretical understanding of the structure, bonding, and reactivity of organic molecules. Students explore mechanisms of organic reactions, stereochemistry, and the role of electronic effects in chemical transformations. Emphasis is placed on applying theoretical principles to predict reactivity and design synthetic pathways.	Knowledge: Identify types of organic compounds, bonding, and isomerism. Comprehension: Explain reaction mechanisms, stereochemical configurations, and electron effects. Application: Predict outcomes of organic reactions under various conditions. Analysis: Analyze mechanisms, intermediates, and transition states in multistep reactions. Synthesis: Combine theoretical concepts to design reaction sequences and molecular structures. Evaluation: Assess the reliability of mechanistic and structural predictions using modern theoretical tools.
Microbiology	4	BD	EC	8	The goal of the course is to study traditional and modern information related to the morphology, structure, metabolism, taxonomy, genetics, ecology of microorganisms, and their practical significance.	Knowledge: Identify major types of microorganisms and cell structures. Comprehension: Explain cellular processes and microbial metabolism. Application: Perform basic microbiological and cytological techniques. Analysis: Interpret microscopic and culture data to identify cell types and microorganisms. Synthesis: Integrate cellular and microbial knowledge to explain biological systems. Evaluation: Evaluate experimental results for accuracy and biological significance

Cell biology with fundamentals of histology and embryology	4	BD	EC	8	The discipline studies the microscopic and submicroscopic structure and development of cells, tissues, and organs of living organisms, as well as the basic biological laws of organism development. Upon completion of this course, the learner will be able to use chemical and biological equipment, work with magnification tools, prepare temporary slides, and conduct experiments.	Knowledge: Identify the structure and functions of cellular organelles, tissues, and embryonic stages. Comprehension: Explain fundamental processes of cell division, differentiation, and tissue organization. Application: Apply microscopy and histological techniques to study cellular and tissue samples. Analysis: Analyze the relationship between cellular morphology and physiological function in various tissues. Synthesis: Integrate cell biological, histological, and embryological concepts to explain organismal development. Evaluation: Critically assess experimental observations and interpret histological and embryological data in a biological context.
Agrobiotechnology	4	PD	UC	4	The discipline forms knowledge and understanding of the development directions of modern biotechnology, the physiological foundations of agricultural biotechnology, and the main areas of microbiological biotechnology and their application in agriculture.	Knowledge: Identify core concepts of agricultural biotechnology and plant genetics. Comprehension: Explain principles of plant transformation and biotechnology applications. Application: Utilize biotechnological tools to analyze or modify plant material. Analysis: Examine case studies on genetic modification and bioresource use. Synthesis: Develop strategies for sustainable agricultural biotechnology projects. Evaluation: Assess ethical, ecological, and economic implications of agrobiotechnology.
Fundamentals of Artificial Intelligence	3	BD	UC	5	The course introduces fundamental concepts of Artificial Intelligence, including knowledge representation, search algorithms, neural networks, and machine learning. Students explore applications of AI in science, biotechnology, and data analytics.	Knowledge: Identify key principles, terminology, and historical foundations of artificial intelligence. Comprehension: Explain the structure and functioning of intelligent systems and algorithms. Application: Apply AI models to solve basic classification and prediction tasks. Analysis: Analyze the performance and limitations of machine learning models. Synthesis: Integrate AI tools into problem-solving processes in interdisciplinary research. Evaluation: Critically assess the ethical and societal impacts of AI technologies.
Total for the semester: 37 credits						
5-th semester						
Foreign Language Workshop 3	5	BD	UC	6	The discipline studies the fundamentals of intercultural communication and professional competencies, encompassing all types of speech activities, which are	Knowledge: Recognize vocabulary, grammatical structures, and common expressions used in academic and professional communication. Comprehension: Explain main ideas and details from spoken and written texts in a foreign language.

					developed based on the subject content at the given level.	Application: Use appropriate language structures and terminology to express opinions and arguments in discussions and written tasks. Analysis: Distinguish between formal and informal language styles and analyze linguistic features in authentic materials. Synthesis: Integrate diverse linguistic and cultural elements to create coherent oral presentations and written compositions. Evaluation: Critically assess one's own language use and peer performance, identifying strengths and areas for improvement.
Organic Chemistry 2	5	BD	EC	8	The study of the diversity and characteristics of functional derivatives of organic compounds; the main mechanisms of chemical reactions in organic chemistry of functional derivatives of organic molecules	Knowledge: Identify fundamental concepts of organic chemistry including hybridization, bonding, nomenclature, and functional groups. Comprehension: Explain mechanisms of basic organic reactions such as substitution, elimination, and addition. Application: Predict products of organic reactions and apply IUPAC rules for naming complex organic molecules. Analysis: Distinguish between reaction mechanisms based on structure, reagents, and reaction conditions. Synthesis: Design synthetic pathways for simple organic compounds using fundamental reaction principles. Evaluation: Assess the efficiency, selectivity, and environmental impact of organic synthesis methods.
The chemistry of functional derivatives of organic molecules	5	BD	EC	8	The discipline focused on the study of the diversity and characteristics of functional derivatives of organic compounds; the main mechanisms of chemical reactions in the organic chemistry of functional derivatives of organic molecules.	Knowledge: Identify fundamental theoretical principles governing the structure, bonding, and reactivity of organic molecules. Comprehension: Explain electronic effects, resonance, and stereochemical concepts that determine reaction mechanisms. Application: Apply theoretical models to predict the stability, acidity, and reactivity of organic compounds. Analysis: Analyze reaction mechanisms using molecular orbital theory and energy profile diagrams. Synthesis: Develop theoretical explanations for experimental outcomes and propose reaction pathways based on mechanistic reasoning. Evaluation: Critically assess the validity and limitations of theoretical models in explaining organic transformations.
Biochemistry	5	BD	UC	6	The discipline that studies the molecular foundations of life: the chemical composition, structure, properties, and localization of substances that make up organisms, the pathways and regularities of	Knowledge: Identify the structure, properties, and functions of major biomolecules such as proteins, lipids, carbohydrates, and nucleic acids. Comprehension: Explain the principles of enzyme catalysis, metabolic pathways, and energy transformation in living systems. Application: Apply biochemical concepts to analyze metabolic regulation and

					their formation, the sequence and mechanisms of transformations, as well as the functional role of biomolecules.	interpret experimental data. Analysis: Distinguish between normal and altered biochemical processes occurring in cells under physiological and pathological conditions. Synthesis: Integrate biochemical knowledge to model metabolic networks and propose mechanisms for biochemical reactions. Evaluation: Critically assess experimental approaches, methodologies, and recent advances in biochemistry relevant to biotechnology and health sciences.
Introduction to Biotechnology	5	BD	UC	6	The course is focused on the study of the application of biological organisms and systems for the processing of raw materials into socially beneficial products. It explores the possibility of gene transfer between organisms; by transferring a gene, we can endow the recipient with a new function. As a society, we must consider the pros and cons of various achievements in the field of biotechnology; to do so, we must first understand how they work.	Knowledge: Identify the main concepts, history, and applications of biotechnology in agriculture, medicine, and industry. Comprehension: Explain fundamental biological principles and molecular techniques that form the basis of biotechnological processes. Application: Apply basic laboratory techniques used in biotechnology, such as DNA extraction, microbial culture, and enzyme assays. Analysis: Analyze the role of biotechnology in solving global challenges related to food security, health, and the environment. Synthesis: Integrate knowledge from biology, chemistry, and technology to design simple biotechnological solutions or projects. Evaluation: Assess ethical, legal, and social implications of biotechnological innovations and their impact on society and the environment.
Philosophy	5	GED	RC	5	The discipline is focused on developing students' critical and analytical thinking, enabling them to understand fundamental principles of knowledge, morality, and human existence. It cultivates intellectual independence and the ability to reason logically in addressing ethical and social issues. The course contributes to forming a holistic worldview and responsible citizenship aligned with modern global challenges.	Knowledge: Understand fundamental philosophical concepts, categories, and theories in the context of classical and modern philosophy. Comprehension: Interpret philosophical texts and identify key arguments, ethical positions, and worldviews. Application: Apply philosophical reasoning to analyze contemporary social, cultural, and professional issues. Analysis: Compare different philosophical schools and critically evaluate their relevance to modern challenges. Synthesis: Integrate philosophical knowledge with professional and personal decision-making, forming a coherent system of values. Evaluation: Assess moral and intellectual perspectives, demonstrating independent judgment and reflective thinking.
Total for the semester: 31 credits						
6-th semester						
Physics 2	6	BD	UC	8	The physics course, based on mathematical calculus, introduces electromagnetism. The	Knowledge: Identify fundamental physical quantities, laws, and concepts of electromagnetism, including Coulomb's law, Gauss's law, and Ampère's law.

					course begins with a focus on everyday observations of electrostatics and the description of fundamental measurements that led to the discovery of Coulomb's law. Electrostatics, based on Coulomb's law, is developed into a mathematical theory. Topics include electric charges, fields, dipoles, continuous charge distributions, Gauss's law, electric potential, conductors, and capacitors. The course then introduces electric current circuits and direct current, which leads to magnetic fields, Biot-Savart law, Ampère's law, and magnetic forces.	Comprehension: Explain the relationships between electric and magnetic fields, charge distributions, and their effects on matter. Application: Apply mathematical calculus to solve problems involving electrostatics, electric circuits, and magnetic fields. Analysis: Analyze electric potential, field configurations, and current distributions using theoretical and experimental approaches. Synthesis: Combine principles of electricity and magnetism to model physical systems and design simple circuits or electromagnetic devices. Evaluation: Critically assess experimental data, the accuracy of physical models, and the applicability of electromagnetic theory to real-world phenomena.
Food Biotechnology	6	PD	EC	6	The discipline studies the history of the development of microorganism biotechnology and the technology of food production based on the use of microorganisms. The goal and objectives of the discipline are to provide students with knowledge about the features of biological processes occurring in the cells of various groups of microorganisms that form the basis of food production.	Knowledge: Identify the principles of biotechnology applied in food production, processing, and preservation. Comprehension: Explain the role of microorganisms, enzymes, and genetic modification in the development of functional and safe food products. Application: Apply biotechnological techniques such as fermentation, enzyme technology, and microbial culture in food systems. Analysis: Analyze the biochemical and microbiological parameters affecting food quality, stability, and safety. Synthesis: Develop innovative approaches for improving nutritional value and sustainability through biotechnological processes. Evaluation: Assess the ethical, environmental, and regulatory aspects of food biotechnology and their implications for human health.
Fermentation of Food and Beverages	6	PD	EC	6	The discipline is aimed at teaching students to perform tasks in production related to the production of essential human products through the use of the biosynthetic potential of microorganisms, plant, and animal cells cultured on artificial nutrient media in fermentation modes.	Knowledge: Identify the principles and microbiological basis of food and beverage fermentation. Comprehension: Explain metabolic pathways of microorganisms involved in the production of fermented products and beverages. Application: Apply fermentation techniques for the production, preservation, and enhancement of food quality. Analysis: Analyze factors influencing fermentation efficiency, flavor development, and product safety. Synthesis: Design controlled fermentation processes integrating microbial, biochemical, and technological parameters. Evaluation: Evaluate the quality, nutritional value, and safety of fermented products, considering industrial standards and sustainability principles.

Plant Biotechnology	6	PD	EC	6	The course studies the issues of plant reproduction biotechnology (including cell, tissue, organ cultures, and plant clones). Modern biotechnologies offer fundamentally new methods for generating new and valuable genetic diversity in plants for human life by selecting forms and clones of individuals with desirable characteristics.	Knowledge: Identify the principles, concepts, and terminology related to plant tissue culture, genetic engineering, and molecular breeding. Comprehension: Explain the mechanisms of gene transfer, plant transformation, and regulation of gene expression in plant systems. Application: Apply biotechnological techniques such as micropropagation, somatic embryogenesis, and Agrobacterium-mediated transformation. Analysis: Analyze physiological, biochemical, and genetic factors affecting plant growth and development in vitro. Synthesis: Design biotechnological strategies for crop improvement, stress resistance, and increased productivity. Evaluation: Critically assess ethical, ecological, and biosafety issues associated with genetically modified plants and biotechnological innovations in agriculture.
Technology of Storage and Processing of Crop Production	6	PD	EC	6	The goal of the discipline is to prepare future specialists for successful independent work in production conditions by mastering practical techniques for handling, storage, and processing of agricultural products.	Knowledge: Identify the fundamental principles of post-harvest technology, storage methods, and processing of agricultural crops. Comprehension: Explain the physical, chemical, and biological processes affecting crop quality during storage and processing. Application: Apply technological operations and equipment for drying, cleaning, sorting, and preserving crop products. Analysis: Analyze the factors influencing product stability, nutrient retention, and microbial safety during storage and processing. Synthesis: Develop technological schemes and strategies for improving crop preservation, minimizing losses, and ensuring food quality. Evaluation: Assess the efficiency, sustainability, and economic feasibility of storage and processing technologies in agricultural production.
Plant and Animal Genetics	6	PD	UC	8	The course is designed to help students explore and apply the fundamental concepts of the broad field of genetics, including areas such as transmission genetics, cytogenetics, cytoplasmic inheritance, quantitative inheritance, population genetics and evolution, as well as molecular genetics. Students will be able to solve a wide range of genetic problems using core concepts and selecting appropriate and effective approaches. Students will also acquire some basic laboratory skills that will enhance their understanding of the concepts presented in the course.	Knowledge: Identify fundamental genetic concepts, including inheritance laws, gene structure, chromosomal organization, and variation in plants and animals. Comprehension: Explain molecular mechanisms of heredity, mutation, recombination, and their influence on phenotype expression and evolution. Application: Apply classical and molecular genetic techniques – such as hybridization, selection, and marker-assisted analysis – to study and improve biological traits. Analysis: Analyze inheritance patterns, population genetics data, and gene interactions in plant and animal species. Synthesis: Integrate genetic principles with biotechnological approaches to develop breeding strategies for enhanced productivity and sustainability. Evaluation: Critically assess genetic data, experimental outcomes, and the ethical, ecological, and social implications of genetic manipulation in agriculture and animal breeding.

Microbial Genetics	6	PD	UC	6	The discipline studies the structure and functions of prokaryotic genes; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. It also covers practical computer analysis of DNA sequences and gene cloning strategies. The principles of gene expression regulation, as well as the biology of plasmids and bacteriophages, are also explored.	Knowledge: Identify the structure, organization, and function of microbial genomes, plasmids, and mobile genetic elements. Comprehension: Explain mechanisms of genetic variation in microorganisms, including mutation, recombination, transduction, transformation, and conjugation. Application: Apply molecular and genetic techniques to study microbial gene expression, regulation, and adaptation. Analysis: Analyze genetic interactions, operon systems, and horizontal gene transfer in prokaryotic populations. Synthesis: Design experimental approaches for genetic manipulation of microorganisms in biotechnology and environmental microbiology. Evaluation: Critically assess the significance of microbial genetics in antibiotic resistance, metabolic engineering, and industrial applications.
Production Pactice I	6	BD	UC	2	The course provides students with initial practical experience in professional environments such as laboratories, research centers, or industrial enterprises. It aims to develop professional competencies through the application of theoretical knowledge in real work conditions. Students observe production processes, participate in routine technical operations, and familiarize themselves with workplace organization, safety protocols, and quality control systems. The practice serves as an essential step in forming professional responsibility, discipline, and teamwork skills.	Knowledge: Identify the basic principles, objectives, and organization of industrial or laboratory practice in the chosen professional field. Comprehension: Explain the structure, workflow, and safety requirements of production or research environments. Application: Apply theoretical knowledge and technical skills to perform assigned professional tasks under real working conditions. Analysis: Analyze practical problems, operational data, and technological processes to identify areas for improvement. Synthesis: Develop proposals for optimizing production procedures or laboratory techniques based on practical experience. Evaluation: Evaluate one's own performance, workplace efficiency, and compliance with quality and safety standards during practice.
Total for the semester: 36 credits						
7-th semester						
Core Concepts in Molecular Microbiology	7	PD	UC	6	In this course, students work individually and in teams to deepen their understanding of microbiology by studying how microbes function at the molecular level. Topics include microbial communities, evolution, information flow, gene regulation, pathogenesis, and immunology. It is important to note that this course will help students specializing in microbiology to complete other mandatory or elective	Knowledge: Identify the molecular structures and functions of microbial macromolecules, including DNA, RNA, proteins, and membranes. Comprehension: Explain key molecular processes such as DNA replication, transcription, translation, and gene regulation in microorganisms. Application: Apply molecular techniques for studying microbial metabolism, gene expression, and interactions with the environment. Analysis: Analyze molecular mechanisms underlying microbial adaptation, pathogenicity, and antibiotic resistance. Synthesis: Integrate molecular microbiology concepts to design experiments and interpret results related to microbial genetics and physiology.

					courses.	Evaluation: Critically assess current advances in molecular microbiology and their applications in biotechnology, medicine, and environmental science.
Biotechnology Laboratory	7	PD	UC	4	The course is aimed at providing students with practical experience in fundamental laboratory techniques used in biotechnology: PCR, molecular cloning, genetic engineering, DNA sequencing, microorganism cultivation, and protein production.	Knowledge: Identify fundamental concepts, laboratory equipment, and safety rules in biotechnology experimentation. Comprehension: Explain the principles of molecular cloning, PCR, and protein expression in biotechnology workflows. Application: Perform standard biotechnological techniques such as DNA isolation, amplification, sequencing, and microbial culture. Analysis: Analyze experimental data and troubleshoot problems arising during molecular and microbiological procedures. Synthesis: Design and conduct experiments integrating multiple techniques for gene or protein manipulation. Evaluation: Critically assess the reliability of experimental data and evaluate biotechnological methods in terms of accuracy, reproducibility, and biosafety.
Industrial Biotechnology	7	PD	UC	6	This course is dedicated to the key technologies underlying biotechnology research, including enzyme discovery and engineering, systems and synthetic biology, as well as biochemical and process engineering. Broader issues related to sustainable production are discussed, including scientific innovations and bioethics, and how these technologies are embodied in real-world applications that benefit society and impact our daily lives.	Knowledge: Identify the main principles and technologies of enzyme engineering, microbial fermentation, and bioprocess optimization. Comprehension: Explain the mechanisms and applications of metabolic and synthetic biology in industrial biotechnology. Application: Apply biochemical and process engineering concepts to design and optimize biotechnological production systems. Analysis: Analyze the efficiency of industrial bioprocesses, including enzyme kinetics, bioreactor performance, and product yield. Synthesis: Develop innovative biotechnological strategies for sustainable production of biofuels, pharmaceuticals, and biomaterials. Evaluation: Evaluate technological, ethical, and environmental aspects of industrial biotechnology and its contribution to a sustainable bioeconomy.
Scientific Writing for Environmental, Agricultural and Life Sciences	7	PD	UC	4	This course will focus on advanced technical writing skills necessary for effective scientific communication. Ultimately, completing this course will improve students' ability to write general research papers, theses with honors, technical reports, grant applications, and journal articles to advance their careers in the future. The goal is to help students become strong writers by analyzing what constitutes good scientific writing, developing a "toolkit for the writer-	Knowledge: Identify the structure, components, and conventions of scientific writing across different types of academic documents. Comprehension: Explain the principles of clarity, precision, and coherence in scientific communication. Application: Apply academic writing conventions to compose abstracts, introductions, methods, results, and discussion sections of scientific papers. Analysis: Analyze examples of scientific texts to identify strengths, weaknesses, and rhetorical strategies used by authors. Synthesis: Integrate data interpretation, visualization, and argumentation into cohesive written documents for publication or presentation. Evaluation: Critically assess the quality of scientific manuscripts and peer

					researcher," and working with these tools. This course will teach students critical thinking and writing skills necessary for a successful and productive career in environmental, agricultural, and life sciences.	reviews, ensuring compliance with ethical standards and citation norms.
Microbial Genetics Laboratory	7	PD	UC	4	A laboratory course related to the lecture course on the structure and functions of prokaryotic genes; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Practical computational analysis of DNA sequences and gene cloning strategies. Principles of gene expression regulation. Biology of plasmids and bacteriophages.	Knowledge: Identify the fundamental methods and tools used in microbial genetics, including gene mapping, cloning, and sequencing. Comprehension: Explain the mechanisms of DNA replication, transcription, translation, and horizontal gene transfer in prokaryotes. Application: Apply laboratory techniques for DNA isolation, bacterial transformation, and plasmid characterization. Analysis: Analyze genetic data using computational tools to map genes and predict protein-coding regions. Synthesis: Design experiments to investigate gene function and regulation using microbial systems. Evaluation: Evaluate experimental results, troubleshoot procedures, and assess the accuracy and reproducibility of molecular data.
Statistical Foundations of the Information Age	7	PD	EC	6	Understanding the uncertainty and variability of contemporary data: summarization and description of data, counting rules and basic probability, data visualization, graphical summaries of data, working with large datasets, forecasting stochastic outcomes based on quantitative input data. Operations with statistical software packages such as R.	Knowledge: Identify key concepts of descriptive statistics, probability, and data distribution. Comprehension: Explain the role of uncertainty and variability in data interpretation and forecasting. Application: Apply statistical methods and software tools (e.g., R) for data analysis, visualization, and hypothesis testing. Analysis: Analyze large datasets using quantitative techniques to reveal patterns, relationships, and stochastic trends. Synthesis: Develop predictive models and integrate statistical results into evidence-based decision-making. Evaluation: Critically assess the accuracy, reliability, and ethical use of statistical methods and data representations.
Dealing with Data	7	PD	EC	6	The goal of this course is to introduce the tools, techniques, and issues related to data processing: where the data comes from, how to store and retrieve it, how to extract knowledge from data through analysis, and the social, ethical, and legal issues associated with its use. Throughout the	Knowledge: Identify key concepts, tools, and terminology in data processing, analysis, and visualization. Comprehension: Explain the processes of data collection, storage, cleaning, and ethical use. Application: Apply data analysis techniques using real-world datasets and common software tools. Analysis: Analyze data quality, detect patterns, and interpret results from

					course, students will gain practical experience working with real datasets from various sources, including social media and citizen science projects, as well as hands-on experience with commonly used analysis and visualization tools.	multiple data sources. Synthesis: Design data-driven projects integrating collection, analysis, and visualization components. Evaluation: Critically evaluate the social, legal, and ethical implications of data-driven decisions and data privacy practices.
Total for the semester: 30 credits						
8-th semester						
Introduction to Theater	8	GED	RC	5	The course explores the fundamental aspects of theatrical art, as well as its impact on society, culture, and science. Students will learn the basic principles of theatrical production, understand the structure of dramatic works, study acting techniques and directing methods, and analyze the aesthetic and sociocultural contexts that influence the creation and perception of theatrical works.	Knowledge: Identify the fundamental concepts, terminology, and historical development of theatrical art. Comprehension: Explain the structural elements of dramatic works and the principles of theatrical performance and direction. Application: Apply basic acting, staging, and analytical techniques in performance and dramatic interpretation. Analysis: Analyze theatrical texts and performances in relation to their cultural, social, and aesthetic contexts. Synthesis: Develop original performance concepts or interpretations integrating theoretical and creative perspectives. Evaluation: Critically assess theatrical productions and creative processes, demonstrating understanding of artistic value, cultural impact, and ethical considerations.
Features of Entrepreneurial Activity	8	BD	UC	6	The aim of the discipline is to form a systematic understanding of the nature and characteristics of entrepreneurial activity, to study the basics, forms, and methods of organizing entrepreneurial activity, and to learn how to apply the acquired knowledge to optimize economic activities in enterprises of any form of ownership.	Knowledge: Identify key concepts, principles, and terminology related to entrepreneurship and business organization. Comprehension: Explain the economic, social, and legal characteristics of entrepreneurial activity and its role in market economies. Application: Apply business planning, management, and financial analysis methods to real or simulated entrepreneurial projects. Analysis: Analyze market environments, risks, and resource allocation in entrepreneurial decision-making. Synthesis: Develop innovative business ideas and design organizational strategies for effective enterprise development. Evaluation: Assess the effectiveness, sustainability, and ethical implications of entrepreneurial decisions and business models.
Plant Genetics and Genomics	8	PD	UC	6	The course is aimed at studying the field of science related to the study and use of DNA-based data in the life sciences. Genetics is the study of how DNA is the foundation of	Knowledge: Identify key principles of plant genetics, genome organization, and inheritance mechanisms. Comprehension: Explain the role of DNA, RNA, and gene regulation in plant development and adaptation.

					the functionality of each cell, as well as the code that transfers information from one generation to the next. New sequencing technologies can now generate vast amounts of data from DNA. Genomics is the study of this data with the goal of making significant discoveries in areas such as medicine, agriculture, evolution, the environment, and biotechnology.	Application: Apply genetic and genomic methods to analyze gene sequences, molecular markers, and genome mapping. Analysis: Analyze large-scale genomic data to identify genetic variation and functional genes related to agronomic traits. Synthesis: Design genomic research strategies for plant improvement and stress resistance using modern sequencing and bioinformatics tools. Evaluation: Critically assess genomic technologies, experimental designs, and ethical considerations in plant genetics research.
Pre-Diploma Practice	8	PD	CC	5	The course provides students with the opportunity to apply theoretical and practical knowledge gained throughout their studies to real research, technological, or production tasks in preparation for their final diploma project. During the practice, students collect, analyze, and interpret data; conduct experiments or case studies; and prepare analytical materials forming the foundation of their thesis. The course fosters independence, critical thinking, and professional responsibility, enabling students to formulate solutions to real-world scientific or industrial problems within their field.	Knowledge: Identify the structure, objectives, and methodological requirements of pre-diploma research and project preparation. Comprehension: Explain the connections between theoretical knowledge and practical applications relevant to the diploma project. Application: Apply professional, analytical, and research skills to collect, process, and interpret data necessary for the final thesis. Analysis: Analyze the effectiveness of existing technological, scientific, or organizational solutions related to the diploma topic. Synthesis: Develop independent solutions, models, or recommendations for improving processes or systems in the chosen field of study. Evaluation: Critically evaluate the quality, originality, and practical significance of one's own pre-diploma work in accordance with academic and ethical standards.
Production practice 2					This course is designed to consolidate students' professional skills and competencies through direct participation in industrial, laboratory, or research activities aligned with their field of study. It provides practical experience in solving complex technical, organizational, or experimental tasks, as well as familiarization with modern	Knowledge: Identify advanced principles of industrial, laboratory, or field practice in accordance with the professional profile of the program. Comprehension: Explain the organization, workflow, and technological processes of the enterprise or research facility. Application: Apply theoretical and methodological knowledge to perform complex professional tasks under minimal supervision. Analysis: Analyze technological, organizational, or research data to assess efficiency, quality, and innovation potential.

					production technologies, management systems, and quality assurance procedures. The practice helps students gain independence in professional decision-making, apply analytical thinking, and prepare for pre-diploma or research projects.	Synthesis: Develop proposals for improving technological processes, quality control, or research methodologies based on collected data. Evaluation: Evaluate personal performance, professional competence, and compliance with safety, ethical, and quality standards during practice.
Diploma Thesis Defense	8	FC		8	This course represents the final stage of the undergraduate program and is aimed at consolidating the student's research and professional competencies through the preparation, presentation, and defense of a diploma thesis. It involves the independent execution of research or applied work under the supervision of a scientific advisor, with an emphasis on analytical, creative, and critical thinking skills. The course culminates in the public defense of the thesis before an academic committee, demonstrating the student's ability to conduct research, interpret results, and communicate findings effectively in both written and oral forms.	Knowledge: Identify the structure, requirements, and academic standards for writing and defending a diploma (bachelor's) thesis. Comprehension: Explain the principles of scientific reasoning, academic integrity, and effective communication in thesis preparation. Application: Apply research methods, data analysis techniques, and professional formatting standards in the preparation of the final thesis. Analysis: Analyze research findings and theoretical frameworks to draw substantiated conclusions and practical recommendations. Synthesis: Integrate theoretical knowledge and empirical results into a coherent scientific work demonstrating independent research competence. Evaluation: Defend the diploma thesis before an academic committee, demonstrating critical thinking, professionalism, and the ability to justify one's scientific position.
Preparation and Passing of Complex Examination					This course is designed to prepare students for the final comprehensive examinationof their study program. It provides a structured review of key theoretical concepts, methodologies, and applications developed throughout the curriculum. The course emphasizes integration of multidisciplinary knowledge, analytical reasoning, and critical evaluation skills. Students engage in exam-focused practice through case analyses, problem-solving, and discussion of real-world scenarios relevant to their field, ensuring readiness for final assessment and	Knowledge: Identify the key theoretical and practical concepts across the selected discipline based on the cumulative learning outcomes of the program. Comprehension: Explain interconnections between fundamental theories, methods, and applications within the chosen field of study. Application: Apply acquired knowledge and problem-solving skills to answer integrated questions and case studies from the selected discipline. Analysis: Analyze complex academic or professional problems, integrating knowledge from multiple modules and sources. Synthesis: Develop coherent arguments and structured responses demonstrating a holistic understanding of the discipline. Evaluation: Critically assess scientific concepts, methods, and evidence, and justify conclusions during oral or written examination.

					professional application of knowledge.	
Total for the semester: 30 credits						
TOTAL: 274 credits						

18. Learning outcomes

№	Learning outcome of the EP	Code
1	Applies the acquired knowledge in studying and mastering the material, have a clear understanding of the chosen profession, and justify the selection of microorganisms, plants, or animals as objects for scientific research and practical work with the aim of applying them in various areas of biotechnology.	**LO1**
2	Establishes the relationship between the structure of chemical compounds and their properties, identify general patterns in chemical processes; calculate the kinetic and thermodynamic characteristics of chemical reactions, predict the direction and feasibility of their progression; apply methods of theoretical and experimental research; conduct chemical experiments and process their results.	**LO 2**
3	Knows the structure and properties of the main classes of substances in living nature, the relationship between the structure and functions of biomolecules, the primary metabolic pathways of substance and energy transformations in organisms, and the key principles of organizing biological molecules into systems with properties of self-assembly, self-organization, and self-replication. The student understands the processes occurring at different levels of organization: physical, physicochemical, and biophysical processes – molecular, subcellular, cellular, tissue, organ, organismal, and biocenotic.	**LO 3**
4	Designs biotechnological processes using computer-aided design systems and supports a unified information space for planning and managing the enterprise at all stages of the product life cycle.	**LO 4**
5	Uses methods of scientific research and existing information technologies to obtain and apply enzymes, viruses, microorganisms, animal and plant cell cultures, products of their biosynthesis, and biotransformation in the field of biotechnology.	**LO 5**
6	Knows the characteristics of the structure of cells, tissues, and organs of living organisms, the laws of organism development; general patterns of structure, life activity, and physiology of microorganisms, as well as cultivation methods. The student is able to investigate the composition of nutrient media and culture liquids during fermentation; determine the composition of target products of cultivation; use biological equipment, work with magnification techniques, prepare temporary preparations, and conduct experiments; perform microbiological control of production.	**LO 6**
7	Participates in the preparation and formatting of technical, analytical, scientific, and reporting documentation for completed and planned work, processes raw data, laboratory analysis results, and experiment outcomes using modern resources and computer technologies, and conducts theoretical and experimental research in various fields of applied biotechnology.	**LO 7**
8	Monitors the organization of technological processes to ensure the standard mode of production of finished biotechnological products and addresses engineering analysis tasks to create innovative processes and products.	**LO 8**
9	Is able to independently search for information, interpret it to form judgments based on a developed worldview, civic, and moral stance, and argue their own opinions regarding phenomena and events in the social and industrial spheres.	**LO 9**
10	Demonstrates a desire for self-improvement, including physical and professional development, works effectively in a team, makes decisions, resolves conflict situations, exhibits leadership qualities, and is oriented toward a healthy lifestyle.	**LO 10**
11	Knows the fundamental concepts and facts of classical branches of mathematics and physics, and is able to apply theoretical knowledge to solve practical problems in natural sciences; applies theoretical knowledge to model phenomena and processes on a computer. The student demonstrates the ability to comprehensively apply the studied	**LO 11**

	statistical techniques and methods in the analysis of specific phenomena and processes.	

19. Competency modules

Module name	Name of the components of the OP	Code
Key Competencies Module 1	Foreign language Kazakh language English language Foreign Language Workshop 1 Foreign Language Workshop 2 Foreign Language Workshop 3	KCM 1
Key Competencies Module 2	Module of socio-political knowledge	KCM 2
Key Competencies Module 3	History of Kazakhstan Succeeding as a Global Wildcat/Leadership and Innovation Management Succeeding as a Global Wildcat 2/Leadership and Innovation Management 2 Fundamentals of Law and Anti-Corruption Culture/Economics and Entrepreneurship Fundamentals/Scientific Research Methods/Ecology and Sustainable Development/Life Safety Fundamentals/Climate Change Philosophy Features of Entrepreneurial Activity Introduction to Theater	KCM 3
General professional competencies module 1	General Chemistry Theoretical Fundamentals of Inorganic Chemistry Organic Chemistry 1 / Theoretical Fundamentals of Organic Chemistry Organic Chemistry 2 / Chemistry of Functional Derivatives of Organic Molecules Biochemistry	GPCM 1
General professional competencies module 2	General Biology / Introduction to Biology Biology with Basics of Ecology / Evolutionary and Ecological Biology Microbiology / Cell Biology with Fundamentals of Histology and Embryology	GPCM 2
General professional competencies module 3	Mathematics Physics 1 Physics 2 Statistics	GPCM 3
Professional competencies module 1	Introduction to Professional Activity Agrobiotechnology Introduction to Biotechnology Statistical Foundations of the Information Era / Data Processing Educational Practice Production Practice 1	PCM 1
Professional competencies module 2	Food Biotechnology / Fermentation of Food Products and Beverages Plant Biotechnology / Technology of Storage and Processing of Crop Products Industrial Biotechnology	PCM 2
Professional competencies module 3	Plant and Animal Genetics Microbial Genetics Key Concepts of Molecular Microbiology	PCM 3

	Plant Genetics and Genomics	
Professional competencies module 4	Biotechnology Laboratory Applied Biotechnology Senior Capstone Microbial Genetics Laboratory	PCM 4
Final assessment module	Diploma Thesis Defense / Preparation and Passing of Complex Examination Pre-graduation practice// Production Practice 2	FAM

20. CRITERIA FOR ASSESSING LEARNING RESULTS

Control of knowledge, abilities, skills and competencies of Bachelors of Science in the educational program "6B05111 Biotechnology" is carried out during the final certification.

The final certification is carried out in the form of writing and defending a diploma thesis (project) or preparing and passing a comprehensive exam.

The assessment of knowledge, abilities, skills and professional competencies of graduates is carried out by the certification committee using a point-rating letter system.

The learning outcome of the EP is the achievement of the goal	Letter Grading	Digital equivalent	Points (% content)	Traditional system assessment	Method of assessing learning outcomes
Professional training of specialists in industries related to the development of fermented food products and beverages, biologically active substances, and insect-resistant crops in accordance with international standards, as well as in the field of fundamental biotechnological research.	A	4	95-100	excellent	Writing and defending a thesis (project) / Preparing and passing a comprehensive exam
	A-	3,67	90-94		
	B+	3,33	85-89	good	
	B	3,0	80-84		
	B-	2,67	75-79		
	C+	2,33	70-74		
	C	2,0	65-69	satisfactory	
	C-	1,67	60-64		
	D+	1,33	55-59		
	D	1,0	50-54		
	FX	0,5	25-49	unsatisfactory	
	F	0	0-24		

21. Program Coordinator (contacts):

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