

MINISTRY OF EDUCATION OF THE REPUBLIC OF AZERBAIJAN

Approved by the decision of the
Ministry of Education of the
Republic of Azerbaijan
No. _____ “ ____ ” _____ 2020.

**EDUCATIONAL PROGRAM
FOR THE BACHELOR'S LEVEL (MAIN (BASE) HIGHER EDUCATION)**

Specialty (program) code and name: 050501 Biology

BAKU-2020

1. General Provisions

- 1.1. The Bachelor's Level Educational Program in the specialty **050501 - Biology** (hereinafter referred to as the "Specialization Education Program") has been developed in accordance with the Law of the Republic of Azerbaijan "About Education", relevant decisions of the Cabinet of Ministers of the Republic of Azerbaijan, and the "Classification of Specialties (Programs) at the Bachelor's (main (basic higher) medical education) level of higher education".
- 1.2. The objectives of the Educational Program are as follows:
 - To define the graduate's competencies, the framework of the specialty, teaching and learning methods by subject, assessment methods, learning outcomes, and the requirements for infrastructure and human resources needed to deliver training in this specialty, as well as the opportunities for students in terms of internships, employment, and further education;
 - To inform students and employers about the knowledge, skills, and learning outcomes acquired by graduates;
 - To provide information to experts involved in the evaluation of the compliance of the personnel training with the Education Program.
- 1.3. The Educational Program is mandatory for all higher education institutions operating in the Republic of Azerbaijan regardless of subordination, type of ownership, or organizational legal form that offer bachelor's level (main (basic) medical) education in this specialty.
- 1.4. For a five-day work schedule, the total weekly workload for a student, including both in class and out-of-class activities, is 45 hours (except for special-purpose higher education institutions). The number of in-class hours should not exceed 50% of the total weekly workload. Depending on the nature of the specialty, the weekly workload may be subject to change.

2. Graduate Competencies

- 2.1. By the end of the Educational Program, the graduate should acquire the following general competencies:
 - Oral and written communication skills in Azerbaijani language related to the specialty;
 - Communication skills in at least one foreign language related to the specialty;
 - Systematic and comprehensive knowledge of the historical, legal, political, cultural, ideological foundations of Azerbaijani statehood and its place and role in the modern world, as well as the ability to forecast the perspective development of the national state;

- Ability to identify threats and challenges faced by the national state;
- Ability to use information technologies at the workplace;
- Skills to collect and store data, and to create databases;
- Ability to work in a team and achieve a collaborative approach to problem-solving;
- Ability to adapt to new conditions, take initiative, and strong will to succeed;
- Ability to identify and select additional information resources to solve problems;
- Ability to analyze, summarize, and apply relevant information for professional purposes;
- Ability to plan and organize professional activities, improve existing skills and continue education, manage time effectively, and complete tasks on time;
- Ability to act with social and ecological responsibility, civic consciousness, ethical approach, and prioritize quality;
- Ability to reassess situations and oneself, and to perform self-criticism in order to develop knowledge and skills.

2.2. By the end of the Educational Program, the graduate should acquire the following professional competencies:

- Based on the knowledge of the fundamental sections of mathematics necessary for the specialty, the ability to perform matrix and determinant operations, solve a system of linear algebraic equations with the help of determinants, calculate the limit of a numerical sequence, simple limits of a function at a point and infinity, give examples of functions in biology, find the derivative of a function, calculate indefinite and definite integrals of simple functions, solve systems of ordinary differential equations, apply a number of laws of probability theory, and mathematically and statistically process data obtained as a result of research;
- the ability to explain the essence of physical processes and regularities, the events occurring within or with the participation of physical objects from a physical point of view, the ability to explain the structure and properties of the material world surrounding us from a physical point of view, the ability to explain the regularities of the occurrence of natural phenomena, the ability to interpret phenomena based on knowledge about the properties of various rays, the ability to apply them based on knowledge about the essence of physical methods necessary for the study of biological objects;
- to interpret the basic principles and concepts of general chemistry, to prepare solutions of various concentrations, to determine the composition, structure and properties of chemical substances, to determine the nature, composition and properties of solutions, to explain the effect of various agents on chemical transformations, to be able to apply them based on knowledge of the essence of chemical methods necessary for the study of biological objects;
- the ability to compare the structure, functions and division pathways of prokaryotic and eukaryotic cells, compare the morphology and functions of various tissues, prepare preparations for cytological and histological studies, interpret the origin, microscopic structure, chemical composition, topography,

regeneration and functions of tissues, characterize tissues from a morpho-functional point of view when using histological research methods, and characterize cellular elements from a morpho-functional point of view using cytological research methods;

- to interpret the microscopic structure of cells, tissues and organs in ontogenesis, to study the microscopic structure, functional and topographic features of the embryo through permanent preparations prepared to study the microscopic structure of the embryo, to determine the various stages of ontogenesis experimentally, to interpret the laws, directions, evidence and driving forces of evolution, to understand the mechanisms of the formation of new species and supra-species taxa;
- make prognoses; explain characteristics of embryonic and postembryonic development stages from the evolutionary perspective;
- ability to study morphological and anatomical structures of plants at the cell, tissue, and organ levels based on internal and external structural laws; identify main organs of plants and their metamorphoses; describe morphological and anatomical structures of plants; prepare samples and conduct observations; explain the influence of external environmental factors on plant structures; determine plant adaptations to environmental conditions; justify the formation of structural elements of plants in both evolutionary and ontogenetic processes;
- ability to explain the roles of primitive plants and fungi in nature and human life; determine species of benthic and planktonic algae and mosses based on anatomical structure and taxonomy; identify genera and species of fungi; apply methods of cultivation, storage, and care of fungi cultures; study characteristics of fungi and primitive plants;
- ability to understand modern systematics principles of higher plants based on phylogenetic and ontogenetic features; perform species-level identification of plants; analyze floristic composition, distribution areas, phylogeny, and plant formations of the world and Azerbaijan; propose methods for conservation and protection of plant species in specific areas; prepare samples for research; knowledge of distribution areas and reserves of economically and industrially valuable plants of Azerbaijan;
- Trace the evolutionary path of development based on knowledge of the morphological and anatomical characteristics and biology of invertebrate and vertebrate animals, use scientific-descriptive knowledge about the systematics and classification of the animal kingdom, explain the impact of environmental factors on the main characteristics of the life activity of animals, their internal and external structure, and behavior, analyze the geographical distribution of various systematic groups, determine species by working with collection materials stored both in nature and in scientific funds, make predictions about the use of animals in scientific research and studies, understand their economic and economic importance, apply methods of collecting research material, study zoological material in laboratory conditions, determine its biological characteristics, perform chamber processing, and draw up drawings and diagrams based on dissected and studied material;
- the ability to describe the structure of various parts of the human body, to name them in Latin, to know the regularities of the structure, organization, and

physiology of organ systems, to interpret the essence of the main physiological processes occurring in the human body, to explain the functional characteristics of various organs of the human body based on its anatomical structure, to explain the mechanisms of regulation of their activity based on knowledge of the structural and functional characteristics of tissues and organs in the human body, to apply physiological research methods, to suggest compliance with appropriate hygiene rules for the purpose of preventing the activity of organs, and to provide first aid;

- describe the structural and functional properties of the chemical components of the living world (amino acids, proteins, nucleic acids, carbohydrates, lipids, etc.), explain the regulation of the interaction of metabolic processes in the body based on theoretical knowledge of the metabolic pathways of bioorganic substances that make up living organisms, determine the presence of the main groups of bioorganic substances (proteins, lipids, carbohydrates, nucleic acids, monomers that make up polymers, some vitamins and hormones, free energy carriers, etc.) in solutions, and be able to apply them based on knowledge of the chemical nature, properties, and characteristics of biologically active substances, the biochemical properties of various living organisms, and the essence of biochemical research methods;
- ability to describe adaptations of organisms to different environmental and ecological-geographical conditions; determine distribution areas; evaluate the role of organisms in ecosystems, biosphere, and human life; describe poorly studied or unknown species and determine their evolutionary status; assess species composition of Azerbaijan's fauna and flora; understand status of rare, poorly studied, and endangered species; knowledge of Red Book status; propose measures for biodiversity conservation; knowledge of natural resource protection laws and ecosystem sustainability;
- ability to understand microbial diversity and classification principles; knowledge of life activity laws of microorganisms; understand influence of environmental factors on microorganisms; apply methods for isolation, cultivation, and preservation of fungal and bacterial cultures; study cultural, physiological, and biochemical properties; propose applications of biosynthetic properties of microorganisms in various industries; explain role of microorganisms in metabolism and element cycles; comparatively analyze physiological and biochemical properties;
- ability to explain main laws of plant life activity and physiological processes; explain mechanisms of regulation of physiological processes in plants; explain adaptation mechanisms to external environment; apply physiological analysis methods in experiments; describe relationships between plant structure and physiological phenomena; prepare proposals to improve plant productivity in various conditions;
- ability to understand fundamental concepts of genetics, laws of linked and non-linked inheritance, principles of heredity, structure and organization of prokaryotic and eukaryotic genomes, distinguish types and causes of variability, analyze significance of variability in selection and evolution, apply genetic research methods, use modern molecular-genetic technologies, knowledge of heredity and variability laws application in agriculture and

medicine, explain mechanisms of genetic information realization and regulation.

- to justify and apply methods for obtaining and partially purifying enzyme preparations from plant and animal tissues, to determine the activity of enzymes and express it through activity units, to determine the degree of purity of the enzyme preparation, to study the effect of various factors on the rate of enzymatic reactions, to calculate the main catalytic parameters (K_m , K_s , V_o , V_{max}), to present the results obtained in a graphical form, to explain the effect of inhibitors on the activity of enzymes, to determine the type of inhibition, to justify the application of enzymes in production, medicine, biotechnology, and science, based on modern knowledge of the chemical structure of enzymes, their properties as biocatalysts, classification and nomenclature, regulation of their activity, and knowledge of the kinetics of enzymatic reactions;
- knowledge of the organization and functional characteristics of the immune system; ability to explain the principles of operation of immune system components and their interactions; based on knowledge of the molecular and cellular foundations of immune system function; evaluate the role of the immune system in organism ontogenesis and its importance for human health; explain the mechanisms of immune pathologies caused by immune system dysfunction and propose potential ways to prevent them; ability to describe mechanisms of antibacterial and antiviral immunity.
- knowledge of the essence of the basic research methods of molecular biology, the ability to comparatively interpret the molecular mechanisms of DNA replication and repair in prokaryotes and eukaryotes, compare the organization of prokaryotic and eukaryotic genomes, comparatively explain the molecular mechanisms of the transcription process in pro- and eukaryotes, explain the molecular mechanisms of translation, and interpret modern problems, achievements, and prospects of molecular biology;
- Ability to solve tasks in molecular biology and biotechnology using computers; work with modern programming methods and bioinformatics resources; apply methods of obtaining, organizing, and analyzing biological data; construct phylogenetic trees to identify homologous sequences and evolutionary relationships; model data; process and present experimentally obtained results using appropriate software.
- knowledge of selection, cultivation, purification, and modification methods of biological objects in culture; understanding the nature, importance, types, and application areas of immobilization; ability to justify biochemical and genetic bases of biotechnology; knowledge of gene engineering methods, theoretical foundations of cell engineering methods; ability to determine application areas and prospects of biotechnology;
- knowledge of the theoretical foundations of biophysical processes occurring in living systems, knowledge of the physicochemical properties of photo biological and radiobiological processes, the ability to study the regularities of changes in a number of physicochemical indicators of the cellular system, to explain the processes occurring in living systems from a biophysical point of view, to justify the application of the laws of thermodynamics in biology, and to apply basic biophysical research methods;

- knowledge of civil defense fundamentals, forces and means; knowledge about emergencies and their characteristics; protection of population during emergencies; awareness about civil defense education; ability to use individual and collective protective equipment; ability to assess and ensure industrial facility resilience in emergencies; knowledge of organization and implementation of elimination of emergency consequences;
- ability to operate modern equipment used in biological research and production; ability to plan, carry out biological research, work in teams, and improve knowledge and skills;
- ability to process, present, and report results obtained from field and laboratory research; ability to collect biological specimens and create herbarium collections.

3. Structure of the Educational Program

3.1. The Education Program should consist of 240 ECTS credits (4 years).
The credits distributed as follows:

Number of subjects	Name of the subject	Credit of the AKTS
General Subjects		
1.	History of Azerbaijan During the teaching of this subject, special attention should be paid to general knowledge about the history of Azerbaijan, group it according to the content lines of historical space, historical time, state, personality, economy and culture, and conveying it to the younger generation, providing students and young people with in-depth knowledge about the historical past of our Motherland, forming historical thinking in them, instilling the ability to objectively assess events in society, forming the ideology of statehood, feelings of respect for the past, and faith to the future, special attention should be paid to instilling knowledge and skills in young people, such as fostering a spirit of patriotism.	5
2.	Business and Academic Communication in Azerbaijani language. Within the framework of this subject, special attention should be paid to instilling in students the skills of presentation, public speaking, academic and business writing in Azerbaijani.	4
3.	Business and Academic Communication in a Foreign Language. Within the framework of this subject, special attention should be paid to instilling in students the skills of making presentations, public speaking, academic and business writing, and oral and written communication skills in one of the foreign languages in their specialization.	15
Elective Subjects		
4.	Philosophy	3
	Sociology	
	Constitution of the Republic of Azerbaijan and the foundations of Law.	
	Logic	
	Ethics and aesthetics	

	Introduction to multiculturalism	
5.	Application of information technologies in biology	3
	Information management and database creation	
	Entrepreneurship basics and introduction to business	
	Political science	
Total:		30
Specialization subjects		
6.	Mathematics and Biostatistics for Biological Sciences. This course provides theoretical knowledge and practical exercises on fundamental mathematical topics essential for biologists (basic matrix and determinant operations, systems of linear equations, limits of numerical sequences, simple limits of functions at points and infinity, derivatives, calculation of definite and indefinite integrals of simple functions, differential equations, laws of probability theory). It teaches mathematical and statistical processing of research data and methods for determining the accuracy of results.	5
7.	Physics The course covers classical mechanics, relativity theory, molecular physics and thermodynamics, electrodynamics, optics, quantum physics, and basic laws of atomic and nuclear physics. It provides theoretical knowledge of physical methods necessary for studying biological objects and develops skills in their application.	5
8.	Chemistry This course teaches the fundamental principles and concepts of general chemistry, preparation of various concentration solutions, determination of the composition, structure, and properties of chemical substances, nature, composition, and properties of solutions. It explains the effects of various factors on chemical transformations and provides theoretical knowledge of chemical methods required for studying biological objects, along with skills in their application.	5
9.	Cytology and Histology This course covers the structure, functions, and division processes of prokaryotic and eukaryotic cells; morphology and functions of various tissues. It teaches preparation of samples for cytological and histological studies. Knowledge includes tissue origin, microscopic structure, chemical composition, topography, regeneration, and functions. It develops skills in applying cytological and histological research methods.	6
10.	Individual Development and Evolution The course studies microscopic features of cells, tissues, and organs during ontogenesis; microscopic, functional, and topographic features of the embryo; practical skills in experimentally determining different stages of ontogenesis. It provides knowledge of laws, directions, evidence, and driving forces of evolution; mechanisms of formation of new species and higher taxa; ability to make predictions based on these; and discusses embryonic and post-embryonic development from an evolutionary perspective.	5
11.	Morphology and Anatomy of Plants Within the framework of this subject, the internal and external structural regularities of plants should be taught, practical skills should be instilled to study morphological and anatomical structures at the cellular tissue, and organ levels, to distinguish the main organs of plants and their metamorphoses, to prepare samples from plants,	5

	to conduct observations on preparations, to explain the effect of external environmental factors on the structure of plants, to determine the adaptation of plants to external environmental conditions, and to justify the formation of structural elements of plants both in the evolutionary process and in ontogenesis.	
12.	Primitive Plants and Fungi This course provides theoretical knowledge on the role of lower plants and fungi in nature and human life; anatomical structure and classification of benthic and planktonic algae, mosses; species identification; identification of fungi's sex and species; cultivation and storage methods of fungal cultures; and study of fungi and lower plant characteristics.	5
13.	Higher Plants Within the framework of this subject information should be provided on the principles of modern systematics based on the phylogenetic and ontogenetic characteristics of higher plants, the determination of plants up to the species category should be taught, information should be provided on the number of species of plants distributed in the world and on the territory of our republic, floristic analysis, distribution area, and phylogeny, analysis of vegetation formations should be taught, information should be provided on the ways of protecting and preserving plant species in a certain area, the ability to prepare samples from higher plants for research should be instilled, and special attention should be paid to the distribution area and reserves of useful and industrially important plants of Azerbaijan.	5
14.	Invertebrates Within the framework of this subject the morphological and anatomical characteristics, biology, and classification of invertebrates should be taught, information should be provided about the impact of environmental factors on the main characteristics of the vital activity of animals, their internal and external structure, and behavior, the ability to analyze the geographical distribution of various systematic groups and determine species should be instilled, methods of collecting and studying invertebrates should be taught, and information should be provided about their economic and economic importance.	5
15.	Vertebrates Within the framework of this subject, the morphological and anatomical characteristics, biology, and classification of vertebrates should be taught, the evolutionary path of development should be traced, information should be provided about the influence of environmental factors on the main characteristics of life activity - the internal and external structure and behavior of animals, the ability to analyze the geographical distribution of various systematic groups, determine species by working with collection materials stored both in nature and in scientific collections, the ability to use animals in scientific research and studies should be instilled, information should be provided about the economic and economic importance of vertebrates, the ability to apply methods of collecting research material, to study zoological material in laboratory conditions, to determine its biological properties, to perform chamber processing, and to draw up drawings and diagrams based on dissected and studied material.	5

16.	Human anatomy and physiology Within the framework of this subject, information should be provided about the structure and Latin names of various parts of the human body, knowledge should be provided about the structure, organization, physiology, and mechanisms of regulation of the functioning of organ systems, the essence of the main physiological processes occurring in the human body should be explained, the ability to explain the functional characteristics of various organs of the human body based on its anatomical structure should be instilled, the ability to apply physiological research methods, provide first aid, and information should be provided about hygiene rules.	7
17.	Biochemistry Within the framework of this subject, the structure, properties, diversity, functional properties, chemical transformations, interaction and regulation of metabolic pathways of the chemical components of the living world (amino acids, proteins, nucleic acids, carbohydrates, lipids, biologically active substances, etc.) should be taught, the ability to determine the presence of the main groups of bioorganic substances in solutions, and the ability to apply biochemical research methods should be instilled.	5
18.	Biodiversity Within the framework of this subject, the adaptations of living beings to various environmental conditions and ecological-geographical environments should be described, the ability to determine the distribution areas in nature, to assess the role of living beings in a certain ecosystem, nature, biosphere and human life, to describe unstudied or little-studied species and determine their evolutionary status, to assess the species composition of the fauna and flora of Azerbaijan should be instilled, information should be provided about rare, little-studied and endangered species, the current status of the Red Book, and ways to protect biodiversity.	5
19.	Microbiology Within the framework of this subject, knowledge should be provided about the diversity and classification principles of microorganisms, the general regularities of their vital activity, their physiological and biochemical properties, the characteristics of the effects of various environmental factors on microorganisms, the application of microorganisms in various fields of industry, their role in metabolism and the circulation of elements, the ability to apply methods for separating and preserving fungal and bacterial cultures from nature in the form of pure cultures, and the ability to use methods for studying their cultural, physiological and biochemical properties.	5
20.	Plant physiology Within the framework of this subject, knowledge should be provided about the basic laws of plant life, the characteristics and regulation of physiological processes, their adaptation to the external environment, ways to increase plant productivity under various conditions, and the ability to apply plant physiological analysis methods in experiments should be instilled.	5
21.	Genetics Within the framework of this subject, knowledge should be given about the basic concepts of genetics, the laws of linked and unlinked inheritance, the principles of heredity, the structure and organization	7

	of prokaryotic and eukaryotic genomes, the possibilities of applying the laws of heredity and variation in various fields of the agricultural industry, medicine, the mechanisms of realization and regulation of hereditary information, the ability to distinguish types of variation, analyze the causes and mechanisms of its formation, its importance in selection and evolution, apply genetic research methods, and use modern molecular-genetic technologies.	
22.	Enzymology Within the framework of this subject, knowledge should be provided about the chemical structure of enzymes, their properties as biocatalysts, classification and nomenclature, regulation of their activity, kinetics of enzymatic reactions, intracellular localization, application of enzymes, the ability to apply methods for obtaining and partially purifying enzyme preparations from biological objects, determine the activity of enzymes and express them in terms of activity units, determine the purity of the enzyme preparation, study the effect of various factors on the rate of enzymatic reactions, calculate the main catalytic indicators (K_m , K_s , V_o , V_{max}), explain the effect of inhibitors on the activity of enzymes, and determine the type of inhibition.	5
23.	Immunology Within the framework of this subject, knowledge should be provided about the organization and functional properties of the immune system, the molecular and cellular basis of its activity, and research methods, and the ability to explain the mechanisms of immune pathologies resulting from dysfunction of the immune system, propose potential ways to prevent them, and interpret the mechanisms of antibacterial and antiviral immunity.	5
24.	Molecular Biology This subject should provide knowledge about the essence of the main research methods of molecular biology, the molecular mechanisms of DNA replication and repair in prokaryotes and eukaryotes, the organization of prokaryotic and eukaryotic genomes, the molecular mechanisms of transcription and translation processes, and modern problems, achievements and prospects of molecular biology.	7
25.	Bioinformatics Within the framework of this subject, the ability to solve tasks in the fields of molecular biology and biotechnology using computers, to work with modern programming methods and bio information resources, to apply methods for obtaining, organizing and analyzing biological data, to construct a phylogenetic tree in order to identify relevant sequences and detect evolutionary relationships, to determine related sequences, to build a model, and to process experimentally obtained results using appropriate programs should be instilled.	5
26.	Biotechnology Within the framework of this subject, the biochemical, molecular and genetic foundations of biotechnology, genetic and cellular engineering methods should be taught, knowledge should be provided on the methods of selecting, cultivating, purifying and modifying bio objects, information should be provided on the essence, importance, types, application areas of the immobilization phenomenon, application areas and prospects of biotechnology.	5
		5

27.	Biophysics Within the framework of this subject, the theoretical foundations of biophysical processes occurring in living systems, the physicochemical properties of photo biological and radiobiological processes should be taught, the ability to study the regularities of changes in a number of physicochemical indicators of the cellular system, to explain the processes occurring in living systems from a biophysical point of view, to justify the application of the laws of thermodynamics in biology, and to apply basic biophysical research methods should be instilled.	
28.	Civil Defense Within the framework of this subject, information should be provided on the basics, forces and means of civil defense, emergencies and their characteristics, protection of the population in emergencies, education of the population on civil defense, ways to eliminate the consequences of emergencies, the use of individual and collective protective equipment, the basics and assessment of the stability of the operation of industrial facilities in emergencies.	3
Total:		120
Subjects determined by the higher education institution.		60
Internship and Graduation Work		
	Internship	21
	Graduation Work	9
Total:		30
Total Number:		240

4. Teaching and learning

- 4.1. The teaching and learning environment should be organized in such a way that students can achieve the learning outcomes intended in the educational program.
- 4.2. Teaching and learning methods should be described in relevant documents (e.g., teacher syllabus, etc.) and should be publicly available (e.g., on the university website, program brochures, etc.).
- 4.3. Teaching and learning methods should be continuously reviewed and improved, taking into account innovative educational practices. Regular improvement of teaching and learning methods should be part of the university's quality assurance system.
- 4.4. Different teaching methods should be used in the learning process. These methods should promote a student-centered approach and the active role of students in the learning process. Examples of teaching and learning methods that can be used include:
 - lectures, seminars, practical assignments;
 - presentations and discussions, debates;
 - independent work/research (e.g., work with practical examples);
 - projects;
 - problem-based learning;
 - fieldwork;
 - role-playing;
 - reports;

- group assessment;
 - expert method;
 - video and audio conferencing technologies;
 - video and audio lectures;
 - distance learning;
 - simulations;
 - and etc.
- 4.5.** A balance between theory and practical training should be maintained in education. The main focus should be on strengthening practical skills in accordance with the changing needs of the labor market.
- 4.6.** The educational program should support the independence of students and develop the concept of lifelong learning. At the end of the educational process, the student should be able to work independently in any direction and continue his education throughout his life.

5. Assessment

- 5.1.** Assessment should be organized in such a way that the expected learning outcomes of students can be effectively measured. This should help monitor the progress achieved, evaluate the extent to which educational program outcomes have been attained, facilitate communication with students, and create preliminary conditions for the improvement of educational programs.
- 5.2.** Assessment methods should be described in relevant documents (e.g., course syllabus, program documents, etc.) and be accessible to everyone (e.g., on the university website, program brochures, etc.).
- 5.3.** Assessment methods should be continuously reviewed and improved, taking into account innovative teaching practices. Regular updating of assessment methods should be part of the higher education institution's quality assurance system.
- 5.4.** Different assessment methods should be used during the teaching process. These methods should promote a student-centered approach and encourage active participation of students in the learning process. Examples of assessment methods include:
- written assignments;
 - tests of knowledge and skills, computer-based tests;
 - oral presentations;
 - surveys;
 - open discussions;
 - practical reports, fieldwork reports;
 - skills assessment based on observations in practice and laboratories;
 - project reports;
 - portfolio assessment;
 - oral questioning;
 - group and self-assessment;
 - and etc.

- 5.5. The methods used to assess learning achievements should be based on clearly defined criteria and allow for accurate and reliable determination of the student's level of knowledge, skills, and competencies gained during the education process. During the assessment of learning outcomes, instructors should adhere to principles of transparency, impartiality, mutual respect, and humanism.
- 5.6. Students should be given the opportunity to discuss all aspects of their education, including the assessment process, with instructors and evaluators. The higher education institution should establish procedures for the assessment process and appeal mechanisms related to grades.
- 5.7. Academic ethics plays an important role in the educational process. Students are taught to observe academic integrity and understand the problem of plagiarism. They should be informed about intellectual property rights related to intellectual work.

6. Learning Outcomes of the Program and Each Subject

- 6.1. Determining the learning outcomes of the educational program, as well as the learning outcomes of each course and the preparation of each course syllabus, is within the authority of the higher education institution/academic staff.
- 6.2. Learning outcomes are determined by each higher education institution in accordance with the form in Appendix 1. The learning outcomes matrix (Appendix 2) should reflect the relationship between subjects and learning outcomes.
- 6.3. To ensure that the educational program provides theoretical and practical content that meets the changing needs of society and the labor market, course syllabus must be regularly updated.

7. Infrastructure and Human Resources

- 7.1. The teaching, learning, and assessment processes of the educational program require the higher education institution to have the following infrastructure:
 - lecture halls equipped with appropriate facilities;
 - teaching and research laboratories equipped with devices and reagents for training and practical lessons in various fields of biology;
 - computer rooms equipped with modern software and internet access;
 - rooms for workshops and group work;
 - electronic libraries, scientific databases, and traditional library rooms.
- 7.2. Faculty members of higher education institutions generally hold academic degrees. Persons from other state or private institutions and/or other relevant organizations may also be involved in teaching.

8. Internship (Practical Training)

- 8.1. Internship is important for the practical application of students' theoretical knowledge and for strengthening professional skills.

- 8.2** Internships can be organized in nature, private companies, government institutions, research laboratories (including universities, Azerbaijan National Academy of Sciences, private local or international organizations and companies, etc.).
- 8.3.** Before the internship, the higher education institution must sign an agreement with the company/institution/laboratory where the internship will be held. At the same time, based on the student's individual request, permission may be given to do the internship in another company/institution/laboratory appropriate to the specialty, including abroad. The agreement shall outline conditions, students' rights and responsibilities, and other necessary details.
- 8.4.** Internship evaluation is conducted based on the student's presentation of a report on the internship before a commission. The commission is formed with the participation of specialists from the relevant departments of the faculty where the student studies.

9. Graduation Thesis (Final Project)

- 9.1.** The educational program is completed with a graduation thesis.
- 9.2.** The graduation thesis must be an independent scientific-methodological research by the student, the content of which is based on new facts or generalization of known propositions from a different scientific perspective, proving the practical significance of the proposed theses. The thesis must be defended before the relevant commission organized with the participation of the leading faculty academic staff and leading specialists invited from potential employers of the graduates.

10. Employment and Lifelong Learning

- 10.1.** Graduates of this program can work in private organizations, companies, government institutions corresponding to their specialty degree, in research institutes, laboratories, and centers requiring deep biological knowledge for transition to a sustainable and green society, in universities, laboratories of the food industry, pharmaceutical, food, natural resource evaluation sectors, as well as in fields requiring biological sciences, innovation, and other cross-sectoral competencies.
- 10.2.** The higher education institution must regularly conduct surveys on the employment of the program graduates and post information about vacant job positions on its website.
- 10.3.** Graduates of the bachelor's program can continue their education in Master's programs in Biology, Biology Teaching, Ecology, and other relevant specialties.
- 10.4.** The knowledge, skills, and approaches acquired during the education period form the initial conditions for graduates to independently pursue lifelong learning.

Agreed by:

Deputy Head of the Ministry of Education of the Republic of Azerbaijan,
Head of the Department of Science, Higher and Secondary Specialized Education

_____ Yagub Piriyeu
“ _____ ” _____ 2020

Chairman of the Working Group for the Development of State Educational Programs
for the Humanitarian and Social Specialties Group

_____ Fariz Ismayilzadeh
“ _____ ” _____ 2020

Educational Program and learning outcomes by subject

Learning outcomes of the Educational Program (PLO)
PLO 1 - Creates business and academic communication in Azerbaijani and foreign languages in the specialty, identifies additional information resources for solving problems, analyzes, summarizes and presents relevant information, processes and presents the results obtained from research conducted in field and laboratory conditions
PLO 2 - Demonstrates systematic and comprehensive knowledge of the historical, legal, political, cultural, ideological foundations of the Azerbaijani people and independent statehood and its place and role in the modern world, the ability to predict the prospective development of our state, the ability to protect the interests of the Azerbaijani state in the international arena, knows the norms and rules of secular law, the basics of development in accordance with a market economy
PLO 3 - Demonstrates social and environmental responsibility in his activities, as well as civic awareness and ethical approach, as well as the ability to prioritize quality, the ability to reassess the situation and himself and self-criticism in order to develop his knowledge and skills, draws conclusions from sociological surveys and is able to manage himself and society, self-management in emergency situations is able
PLO 4 - In explaining biological phenomena, studying them from the whole organism level to molecular and nanoscales, based on theoretical knowledge in the relevant sections of physics and chemistry, applies modern physical and chemical approaches and methods
PLO 5 - Demonstrates knowledge of the diversity of viruses, justifies their reproduction and spread characteristics, understands the principle of operation of defense systems in living beings and, based on knowledge of physiology, immunology and biotechnology, knows the mechanisms of combating infections, including viruses, explains the ways of creating immunity
PLO 6 - Demonstrates modern knowledge of the molecular organization of living beings, morphological and anatomical structure, biochemical and physiological properties, classification, diversity, distribution areas, onto, genetics, genomics, epigenetics, evolutionary studies
PLO 7 - Proposes new ideas in the specialty, reveals fundamental problems, determines the tasks and methods of research, applies modern experimental methods to biological objects in field and laboratory conditions (observation, recording, identification, work with collections, comparative analysis, classification, determination of ecological status, cytological, histological, biochemical, biophysical, microbiological, genetic, physiological, etc. methods)
PLO 8 - Justifies, evaluates, and makes appropriate predictions about the behavior of living things, their role in human life, and their economic essence
PLO 9 - Demonstrates practical work in a production team, professional adaptation, and the ability to master new technologies

Learning outcomes for the subject "History of Azerbaijan" (SLO)
SLO 1 - Knows the emergence, formation and development of modern statehood traditions of Azerbaijan
SLO 2 - Demonstrates knowledge about the Azerbaijani statehood in the ancient and medieval periods and the creation of great empires in the East by the Azerbaijani people in the 15th-18th centuries
SLO 3 - Is able to analyze and study the role of political, ideological, economic, cultural factors in the formation of modern Azerbaijani statehood
SLO 4 - Acquires knowledge about the loss of Azerbaijani statehood in the first decades of the 19th century and its political, economic, social consequences, the struggle for national statehood in Azerbaijan, the establishment of the Azerbaijan People's Republic - the period of the first republic, the second republic, Azerbaijani statehood during the Soviet Empire, the beginning of the struggle for independence in the second half of the 19th century and the restoration of independent statehood
SLO 5 - Is able to systematically analyze the place and role of the Azerbaijani state in the modern world
SLO 6 - Create a secure international environment for the protection of independent statehood, the struggle for the restoration of the territorial integrity of our state. The leader in the Caucasus acquires knowledge about statehood

Learning outcomes for the subject "Business and academic communication in the Azerbaijani language" (SLO)
SLO 1 - Knows the history of the Azerbaijani language, ways of its development and enrichment
SLO 2 - Knows that in certain periods of history our language was subjected to pressure and aggression by enemy forces, but our people succeeded in protecting it thanks to national unity and national pride, and the services of prominent leaders and statesmen in this matter
SLO 3 - Analyzes scientific information in the Azerbaijani language, prepares oral and written presentations
SLO 4 - Demonstrates academic and business oratory skills in the Azerbaijani language
SLO 5 - Is able to protect the uniqueness of the Azerbaijani language, get acquainted with the cultural heritage of other peoples through translation, and communicate with them
SLO 6 - Is able to fight for the purity of the Azerbaijani language, protect the language from foreign elements, and keep it alive

Learning outcomes for the subject "Business and academic communication in a foreign language" (SLO)
SLO 1 - Analyzes scientific articles read in one of the foreign languages on his/her specialty, prepares their summary
SLO 2 - Is able to analyze the grammatical, lexical, semantic structures of a foreign language
SLO 3 - Is able to convey the national-moral values of his/her people and the achievements he/she has gained to others by entering the international arena
SLO 4 - Exchanges ideas and experiences in a foreign language, creates business communication
SLO 5 - Having foreign language skills, forms the competence of working in a team, interpersonal communication
SLO 6 - Presents scientific information in his/her specialty orally and in writing in one of the foreign languages

Learning outcomes for the subject "Mathematics and Biostatistics for Biological Sciences" (SLO)
SLO 1 - Able to perform basic matrix and determinant operations, solve a system of linear algebraic equations with the help of determinants
SLO 2 - Know the basic concepts and laws of statistics, determine the validity of the results obtained as a result of biological research, be able to apply statistical rules and theories when analyzing biological processes
SLO 3 - Be able to calculate the limit of a numerical sequence, simple limits of a function at a point and infinity, give examples of functions in biology
SLO 4 - Know the basic concepts of probability theory and be able to apply a number of laws of probability theory
SLO 5- Find the derivative of a function, calculate indefinite and definite integrals of simple functions
SLO 6- Know the methods of solving ordinary differential equations and systems of ordinary differential equations, some types of ordinary differential equations and ordinary differential equations is able to solve systems of equations

Learning outcomes for the subject "Physics" (SLO)
SLO 1 - Explains the essence of physical processes and laws
SLO 2 - Explains the phenomena occurring within or with the participation of physical objects from a physical point of view
SLO 3 - Explains the structure and properties of the material world surrounding us from a physical point of view
SLO 4 - Interprets phenomena based on knowledge about the properties of various rays
SLO 5 - Explains the laws of occurrence of natural phenomena
SLO 6 - Apply them based on knowledge about the essence of physical methods necessary for the study of biological objects

Learning outcomes for the subject "Chemistry" (SLO)
SLO 1- Explains the basic principles and concepts of general chemistry
SLO 2 - Able to prepare solutions of various concentrations
SLO 3 - Determines the composition, structure and properties of chemical substances
SLO 4 - Determines the nature, composition and properties of solutions
SLO 5 - Explains the influence of various factors on chemical transformations
SLO 6 - Based on knowledge of the essence of chemical methods necessary for the study of biological objects, applies them

Learning outcomes for the subject "Cytology and Histology" (SLO)
SLO 1 - Compares the structure, functions and ways of division of prokaryotic and eukaryotic cells
SLO 2 - Compares the morphology and functions of various tissues
SLO 3 - Prepares preparations for cytological and histological studies
SLO 4 - Interprets the origin, microscopic structure, chemical composition, topography, regeneration and functions of tissues
SLO 5 - Morpho-functionally characterizes tissues using histological research methods
SLO 6 - Morpho-functionally characterizes cellular elements using cytological research methods

Learning outcomes for the subject "Individual development and evolution" (SLO)
SLO 1- Interprets the microscopic structure of cells, tissues and organs in ontogenesis
SLO 2 - Able to work with permanent preparations to study the microscopic structure of the embryo and through them can study the microscopic structure, functional and topographic features of the embryo
SLO 3- Determines the various stages of ontogenesis experimentally
SLO 4- Interprets the laws, directions, evidence, and driving forces of evolution
SLO 5 - Understands the mechanisms of the formation of new species and supra-species taxa, makes predictions
SLO 6- Explains the characteristics of the embryonic and post-embryonic stages of development from an evolutionary point of view

Learning outcomes for the subject "Morphology and Anatomy of Plants" (SLO)
SLO 1 - Based on knowledge of the internal and external structural regularities of plants, studies their morphological and anatomical structures at the cellular, tissue, and organ levels
SLO 2 - Distinguishes the main organs of plants and their metamorphoses
SLO 3 - Describes the morphological and anatomical structures of plants
SLO 4 - Prepares samples from plants and conducts observations on preparations
SLO 5 - Explains the influence of external environmental factors on the structure of plants, determines the adaptation of plants to the external environment
SLO 6 - Justifies the formation of structural elements of plants both in the evolutionary process and in ontogenesis

Learning outcomes for the subject "Primitive plants and fungi" (SLO)
SLO 1 - Explains the role of primitive plants and fungi in nature and human life
SLO 2 - Determines the types of benthic and planktonic algae, lichens based on knowledge of their anatomical structure and classification
SLO 3 - Determines the genus and species of fungi
SLO 4 - Apply methods of cultivation and preservation of mushroom cultures
SLO 5 - Investigates the properties of fungi
SLO 6 - Investigates the properties of primitive plants

Learning outcomes for the subject "Higher plants" (SLO)
SLO 1 - Understands the principles of modern systematics based on the phylogenetic and ontogenetic characteristics of higher plants
SLO 2 - Determines plants up to the species category
SLO 3 - Analyzes the number of species, floristic analysis, distribution area, phylogeny, and vegetation formations of plants distributed in the world and on the territory of our republic
SLO 4 - Suggests ways to protect and preserve plant species in a certain area
SLO 5 - Prepares samples of higher plants for research
SLO 6 - Knows the distribution area and resources of useful and industrially important plants of Azerbaijan

Learning outcomes for the subject "Invertebrate Zoology" (SLO)
SLO 1 - Classifies invertebrates based on their morphological and anatomical characteristics, basic principles of life activities
SLO 2 - Evaluates the impact of environmental factors on invertebrates
SLO 3 - Applies methods for collecting research material
SLO 4 - Examines research objects in laboratory conditions
SLO 5-Determines the biological characteristics of the research object
SLO 6 - Processes samples according to certain methods

Learning outcomes for the subject "Vertebrate Zoology" (SLO)
SLO 1 - Traces the evolutionary path of development based on knowledge of the morphological and anatomical characteristics and biology of vertebrates
SLO 2 - Uses scientific-descriptive knowledge of the systematics and classification of the animal kingdom
SLO 3 - Explains the influence of environmental factors on the main characteristics of life activity - the internal and external structure and behavior of animals
SLO 4 - Analyzes the geographical distribution of various systematic groups, knows how to determine species by working with collection materials stored both in nature and in scientific funds
SLO 5 - Understands the economic and economic importance of vertebrates in scientific research and studies, makes predictions
SLO 6 - Compiles drawings and diagrams based on the chambering of zoological material, dissected and studied material

Learning outcomes for the subject "Human Anatomy and Physiology" (SLO)
SLO 1 - Describes the structure of various parts of the human body, names them in Latin, knows the regularities of the structure, organization, and physiology of organ systems
SLO 2 - Explains the functional properties of various organs of the human body based on its anatomical structure
SLO 3 - Understands the mechanisms of regulation of the activity of tissues and organs in the human body based on knowledge of the structural and functional properties of their activity
SLO 4 - Apply physiological research methods
SLO 5 - Suggests compliance with appropriate hygiene rules for the purpose of preventing the activity of organs, provides first aid
SLO 6-Interprets the essence of the main physiological processes occurring in the human body

Learning outcomes for the subject "Biochemistry" (SLO)
SLO 1 - Describes the structural and functional properties of the chemical components of the living world
SLO 2 - Explains the interaction and regulation of metabolic processes in our body, based on theoretical knowledge about the pathways of metabolism of bioorganic substances that make up living organisms
SLO 3 - Determines the presence of the main groups of bioorganic substances (proteins, lipids, carbohydrates, nucleic acids, monomers that make up polymers, some vitamins and enzymes, free energy carriers, etc.) in solutions
SLO 4 - Demonstrates knowledge about the chemical nature, properties, and characteristics of biologically active substances
SLO 5 - Demonstrates knowledge about the biochemical properties of various living organisms
SLO 6 - Apply them, based on knowledge about the essence of biochemical research methods

Learning outcomes on the subject "Biodiversity" (SLO)
SLO 1 - Describes the adaptation of living organisms to various environmental conditions, ecological and geographical environments, determines their distribution areas in nature
SLO 2 - Has an idea of the diversity of living organisms, evaluates their role in a certain ecosystem, as well as in nature as a whole, the biosphere and human life
SLO 3 - Is able to describe unstudied or little-studied species and determine their evolutionary status
SLO 4 - Evaluates the species composition of the fauna and flora of Azerbaijan, recognizes what they are, little-studied and endangered species, has an idea of the current status of the Red Book
SLO 5 - Puts forward proposals for the protection of biodiversity
SLO 6 - Knows the laws of protection of natural resources in the sustainable development of the ecosystem

Learning outcomes for the subject "Microbiology" (SLO)
SLO 1 - Understands the diversity and classification principles of microorganisms, knows the general regularities of their vital activity, understands how various environmental factors affect microorganisms
SLO 2 - Separates fungal and bacterial cultures from nature in the form of pure cultures, applies methods for their preservation and study
SLO 3 - Comparatively analyzes the physiological and biochemical properties of microorganisms
SLO 4 - Can suggest ways of application in various fields of industry based on the biosynthetic properties of microorganisms
SLO 5 - Evaluates the impact of various environmental factors on microorganisms
SLO 6 - Evaluates the role of microorganisms in the circulation of substances and elements

Learning outcomes for the subject "Plant Physiology" (SLO)
SLO 1 - Has knowledge of the basic regularities of plant life, the characteristics of physiological processes
SLO 2 - Explains the mechanisms of adaptation of plants to the external environment
SLO 3 - Applies methods of physiological analysis of plants in experiments
SLO 4 - Interprets the relationships between the structure of the plant organism and physiologically important phenomena
SLO 5 - Prepares proposals for increasing the productivity of plants in various conditions
SLO 6 - Has knowledge of the mechanisms of regulation of physiological processes in plants

Learning outcomes in the subject "Genetics" (SLO)
SLO 1 - Knows the basic concepts of genetics, has knowledge of the laws of linked and unlinked inheritance, the principles of heredity
SLO 2 - Is able to distinguish types of variability, understands the causes, mechanisms of their formation, their importance in selection and evolution
SLO 3 - Knows the structure and organization of prokaryotic and eukaryotic genomes
SLO 4 - Has mastered the research methods of genetics, is able to use modern molecular-genetic technologies
SLO 5 - Knows the possibilities of applying the laws of heredity and variability in various fields of the agricultural industry, in medicine
SLO 6 - Has mastered the mechanisms of realization and regulation of hereditary information

Learning outcomes in the subject "Enzymology" (SLO)
SLO 1 - Justifies and applies methods for obtaining and partially purifying enzyme preparations from plant and animal tissues
SLO 2 - Determines the activity of enzymes and expresses it through activity units, knows the purity criteria of enzyme preparations, determines the degree of purity
SLO 3 - Demonstrates modern knowledge of the chemical structure of enzymes, their properties as biocatalysts, classification and nomenclature, regulation of their activity, intracellular localization
SLO 4 - Based on knowledge of the kinetics of the enzymatic reaction, studies the effect of various factors on the rate of the enzymatic reaction, calculates the main catalytic indicators (K_m , K_a , V_o , V_{max}), presents the results obtained in a graphic form
SLO 5 - Explains the effect of inhibitors on the activity of enzymes, determines the type of inhibition
SLO 6 - Justifies the application of enzymes in production, medicine, biotechnology, science

Learning outcomes for the subject "Immunology" (SLO)
SLO 1 - Knows the organization and functional characteristics of the immune system
SLO 2 - Justifies the principles of functioning of the components of the immune system and the interaction between them
SLO 3 - Based on knowledge of the molecular and cellular basis of the functioning of the immune system, evaluates the role of the immune system in the ontogenesis of the organism and its importance for human health
SLO 4 - Suggests the mechanisms of the formation of immunopathologies resulting from the dysfunction of the immune system, and potential ways to prevent them
SLO 5 - Interprets the mechanisms of antibacterial immunity
SLO 6 - Knows the basics of antiviral immunity

Learning outcomes for the subject "Molecular Biology" (SLO)
SLO 1 - Explains the essence of the main research methods of molecular biology
SLO 2 - Comparatively interprets the molecular mechanisms of DNA replication and repair in prokaryotes and eukaryotes
SLO 3 - Compares the organization of prokaryotic and eukaryotic genomes
SLO 4 - Comparatively explains the molecular mechanisms of the transcription process in pro- and eukaryotes
SLO 5 - Explains the molecular mechanisms of translation
SLO 6 - Interprets modern problems, achievements and prospects of molecular biology

Learning outcomes for the subject "Bioinformatics" (SLO)
SLO 1 - Solves tasks in the fields of molecular biology and biotechnology using a computer
SLO 2 - Is able to work with modern programming methods and bio information resources
SLO 3 - Applies methods for obtaining, organizing and analyzing biological data
SLO 4 - Constructs a phylogenetic tree in order to identify compatible sequences and reveal evolutionary relationships
SLO 5 - Determines related sequences, builds a model
SLO 6 - Is able to process and present experimentally obtained results using appropriate programs

Learning outcomes for the subject "Biotechnology" (SLO)
SLO 1 - Knows the methods of selection, cultivation, purification, modification of bio objects
SLO 2 - Knows the essence, importance, types, and areas of application of the immobilization phenomenon
SLO 3 - Understands the biochemical and genetic foundations of biotechnology
SLO 4 - Knows the basics of genetic engineering methods
SLO 5 - Knows the theoretical foundations of cell engineering methods
SLO 6 - Determines the areas and prospects of application of biotechnology

Learning outcomes for the subject "Biophysics" (SLO)
SLO 1 - Applies basic biophysical research methods
SLO 2 - Investigates the regularities of changes in a number of physicochemical indicators of the cellular system
SLO 3 - Explains the processes occurring in living systems from a biophysical point of view
SLO 4 - Justifies the application of the laws of thermodynamics in biology
SLO 5 - Knows the theoretical foundations of biophysical processes occurring in living systems
SLO 6 - Demonstrates knowledge of the physicochemical properties of photo biological and radiobiological processes

Learning outcomes for the subject "Civil Defense" (SLO)
SLO 1 - Knows the basics, forces and means of civil defense
SLO 2 - Knows emergencies and their characteristics
SLO 3 - Acquires knowledge about protecting the population in emergencies, educating the population on civil defense
SLO 4 - Able to use individual and collective means of protection
SLO 5 - Able to understand the basics and assess the stability of the operation of industrial facilities in emergencies
SLO 6 - Have knowledge about organizing and implementing ways to eliminate the consequences of emergencies

Additional 2

Matrix of Learning Outcomes of Subjects and the Educational Program

Block name	Subjects	PTN 1	PTN 2	PTN 3	PTN 4	PTN 5	PTN 6	PTN 7	PTN 8	PTN 9
General Subjects	Business and academic communication in Azerbaijani	X	X							
	History of Azerbaijan		X							
	Business and academic communication in a foreign language	X	X							
	Elective subjects			X					X	
Specialized Subjects	Mathematics and biostatistics for biological sciences	X								
	Physics				X					
	Chemistry				X					
	Cytology and histology							X		
	Individual development and evolution						X			
	Morphology and anatomy of plants						X	X		
	Primitive plants and fungi						X	X		
	Higher plants						X	X		
	Invertebrates						X	X	X	
	Vertebrates						X	X	X	
	Human anatomy					X	X			
	Human and animal physiology					X	X	X		
	Biochemistry				X			X		
	Biodiversity						X		X	

Block name	Subjects	PTN 1	PTN 2	PTN 3	PTN 4	PTN 5	PTN 6	PTN 7	PTN 8	PTN 9
	Microbiology					X		X		
	Plant physiology						X	X		
	Genetics						X	X		
	Enzymology					X	X	X		
	Immunology					X	X			
	Virology					X				
	Molecular biology						X	X		
	Bioinformatics						X	X	X	X
	Biotechnology					X	X	X	X	
	Biophysics				X			X		
	Civil defense			X						