

CATALOGUE OF ELECTIVE DISCIPLINES

Specialty 6B05101–Biological and related sciences (Biology)

2020/2021 school year

INSTITUTE OF NATURAL SCIENCE AND GEOGRAPHY

| Cycle of disciplines | Name of disciplines and their main sections | Work-Tank (ECTS) |
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| GED 1 | CYCLE OF GENERAL EDUCATION DISCIPLINES (GED) | |
| 1. | <p>Fundamentals of Economics and business</p> <p>Social production. The essence, forms, structure of capital. Production cost. Income production in a market economy. The concept of business. Types of business activity. Theory of property, social forms of management. Goods, money. Socio-economic system. The emergence of the market. Financial system. The role of the state in business development. Macroeconomics. Resource saving. Cyclical economic development. Inflation and unemployment. Kazakhstan in the system of world economic relations.</p> | 5 |
| 2. | <p>Fundamentals of law and anti-corruption culture</p> <p>Basic provisions of the Constitution, current legislation of the RK; the system of state management bodies, the terms of reference, objectives, methods of state regulation of the economy, the role of the public sector in the economy; financial law and Finance, the mechanism of interaction of substantive and procedural law; the essence of corruption, the causes of its origin; the extent of moral and legal responsibility for corruption offences; the legislation in the field of combating corruption</p> | 5 |
| 3. | <p>The safety of human life</p> <p>Life safety, its main provisions. Dangers, emergencies. Risk analysis, risk management. Security of the person. Destabilizing factors of our time. Social dangers, protection from them: dangers in the spiritual sphere, politics, protection from them: dangers in the economic sphere, dangers in everyday life. The system of life safety bodies, and legal regulation of their activities</p> | 5 |
| 4. | <p>Ecology and sustainable development</p> <p>Basic laws of functioning of living organisms, ecosystems of different levels of organization, biosphere as a whole, their stability; interaction of components of biosphere and ecological consequences of economic activity of the person, especially in the conditions of intensification of nature management; modern representations about concepts, strategies and practical tasks of sustainable development in various countries and RK; problems of ecology, environmental protection, sustainable development</p> | 5 |
| BD 2 | CYCLE OF BASIC DISCIPLINES (BD) | |
| 1. | <p>Biocenology</p> <p>Objective: to Study the dynamics of living matter (plant and animal) under certain environmental conditions. Content: Biocenosis as a system of supra-organizational level. Structural and functional organization of the biocenosis. Structure of biogeocenosis and phytocenosis. Taxonomic structure. Community biodiversity. Dynamics of biogeocenoses. Life forms as a reflection of environmental conditions and relationships in the biocenosis. The classification of communities. Patterns of community formation. Competences: the formation of a holistic perception of the biocenosis.</p> | 5 |
| | <p>Population and community ecology</p> <p>Purpose: Formation of concepts about ecological communities and populations. Content: The concept of a population. Population as a biological system.</p> | |

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| | <p>Population structure of the species. Population range of the species. Population interactions. Biotic relationships in the biocenosis. Interspecies relationships. Basic forms of relationships.</p> <p>Competencies: ability to apply modern methods of processing, analysis and synthesis of field, production and laboratory biological information, rules for drawing up scientific and technical projects and reports.</p> | |
| 2. | <p>The teaching of evolution</p> <p>Purpose: to Understand the causes and General laws of the historical development of living matter. Contents: the Emergence and development of evolutionary concepts. The role of variability in the evolutionary process. Driving forces of evolution. Natural selection, its forms. The definition of "species". Forms and mechanisms of speciation. Ways to improve agricultural plants and animals. Competence: Ability to justify the role of the evolutionary idea in the biological worldview; possession of modern ideas about the basics of evolutionary theory, micro-and macroevolution.</p> | 5 |
| | <p>Evolution of the organic world</p> <p>Goal: formation of the unity of origin and organization of all living beings, including humans.</p> <p>Content of the discipline: Modern theory of evolution. The concept of speciation. The role of variability in the evolutionary process. Driving forces of evolution. Natural selection, its forms. The main stages of organic evolution. Modern ideas about the origin of life. Hypotheses of prokaryotic and eukaryotic origin. Evolution of the plant and animal world. Anthropogenesis. Competence: Formation of knowledge about basic biological concepts, biological laws.</p> | |
| 3. | <p>The flora of Kazakhstan</p> <p>Purpose: to get Acquainted with the diversity of the flora of Kazakhstan. The main distribution of the plant world. Protected areas (nature reserves, national parks, nature reserves) and their significance in the conservation of flora. Flora as an object of legal protection and regulation of use. Methods of legal regulation of relations on protection and use of flora. Competencies: demonstrates and applies basic concepts about the basics of General, system and applied ecology, principles of optimal nature management and nature protection.</p> | 5 |
| | <p>Phytogeography</p> <p>The goal is to introduce the geographical distribution patterns of plant taxa on the planet. Contents: Phytogeography as a science, its place among the biological Sciences. Divisions of phytogeography. Area as a natural phenomenon. Features of the behavior of the species within the range: unevenness and mass. Criteria of discontinuity. Classification of areas - General and relative. Competencies: the ability to apply basic concepts about the principles of optimal environmental management.</p> | |
| 4. | <p>Animal world of Kazakhstan</p> <p>Purpose: to get Acquainted with the diversity of the animal world of Kazakhstan. Zoning of the animal world distribution. Protected areas (nature reserves, national parks, nature reserves) and their significance in the conservation and reproduction of animals. Animal world as an object of legal protection and regulation of use. Methods of legal regulation of relations for the protection and use of wildlife. Competencies: demonstrates and applies basic concepts about the basics of General, system and applied ecology,</p> | 5 |

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| | principles of optimal nature management and nature protection. | |
| | Zoogeography | |
| | Purpose: to Form knowledge about the patterns of placement of individual species and other systematic categories and communities of animals on the surface of The globe. Contents: conditions of animal existence and geographical distribution. Environment, arena of life, biocycles. The fauna of the sea. The fauna of fresh waters. Terrestrial fauna. The main land landscapes and features of their fauna. Area. The dependence of the shape of the areas from external factors. The specificity of the distribution area. Competencies: Knowledge of the basic principles of optimal environmental management. | |
| 5. | Genetics | 5 |
| | Purpose: to Study the laws of heredity and variability, to find ways of practical use. Contents: Cytological bases of inheritance of traits.Independent distribution of chromosomes in dihybrid crossing. Gender-linked inheritance. Solve problems. Interaction of allelic and non-allelic genes.Complementarity. Epistasis. Polymerization. Multiple allelism. Modification variability. Variational series of feature variability. Spontaneous and induced mutations. Human chromosomal diseases. Competencies: Apply the basic laws of heredity and variability in practice. | |
| | Human genetics | |
| | Purpose: to form a complete system of knowledge about the features of the implementation and transmission of hereditary information in humans. Contents: types of inheritance. Allelic interaction of genes. Codominant type of inheritance: Multiple allelism. Non-allelic interaction of genes. Inheritance of X-linked dominant human traits.. Y-concatenated inheritance. Modification, combinative, and mutational variability. Genomic chromosomal and gene mutations in humans. Medical and genetic counseling Competencies: be able to apply basic scientific and theoretical knowledge to solve theoretical and practical problems. | |
| 6. | Human anatomy | 5 |
| | Purpose: to Study the structure of the human body in relation to the function of its organs, the peculiarities of human origin and age development. Contents: Musculoskeletal system. Splanchnology. Vascular system. Nervous system: Central and peripheral divisions. Autonomic nervous system. Sense organs. Competence: Formation of knowledge about the structural and functional organization of human organs and systems, their age, gender, and individual characteristics, taking into account the influence of external and internal forces. | |
| | Human biology | |
| | Goal: to Form a system of knowledge about human biology. Content: The position of man in nature. Theories of human origin and evolution. Levels of organization of the human body as an integral biological system. General overview of the human body. Forms of human behavior. Psychophysiological and biosocial characteristics of a person. The concept of human ecology; health problems. Competencies: Formation of scientific ideas about the main stages of anthropogenesis, problems of human health and ecology, and features of its demography. | |
| 7. | Introduction to biology | 4 |

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| | Goal: History of biology development. Content of the discipline: Modern development of biology. Modern theory of the origin of life. The main stages of the formation of life on the planet. Forms of life manifestation. The main patterns that characterize life. Organisms of cellular structure. Hierarchy of life in the biosphere. Structural elements of each level of the organization. Forms of reproduction. Experimental study of ontogenesis. The main directions of the evolutionary process. Competence: formation of knowledge about the laws of evolution of the organic world. | |
| | General biology | |
| | Objective: to Develop knowledge about basic biological theories, ideas, and principles. Contents: Methods of biological Sciences; structure, diversity and features of Biosystems. Outstanding biological discoveries. Modern research in biological science. Biological bases for increasing the productivity of animals and plants. Competencies: modern biological theories and concepts, the structure of biological objects, the essence of biological processes and phenomena, the basics of the structural organization and functioning of living systems, mechanisms for ensuring their homeostasis. | |
| 8. | Biochemistry | 5 |
| | Goal: Studying the structure and functions of biomolecules of living matter; expanding knowledge about the processes of metabolism. Content. Sections of biochemistry. Proteins: structure, properties, funktsii. Carbohydrates: structure, properties, functions. Lipid. Nucleic acid. Vitamins. Enzymes. Hormones. Metabolism and energy in the cell. Metabolism of proteins and carbohydrates. Anaerobic and aerobic breakdown of carbohydrates Energy balance. Competencies: integration and generalization of knowledge in various areas of biochemistry, the use of practical skills in professional activities. | |
| | Plant metabolism | |
| | Purpose: to study the processes of metabolism in plant organisms. Content: The concept of metabolism in plants. Plastic and energy exchanges. Plastic metabolism: synthesis of proteins, carbohydrates, and other compounds). Protein biosynthesis (translation and transcription). Photosynthesis (light and dark stages).. Energy metabolism: breakdown of proteins and carbohydrates. The way the breakdown of carbohydrates. Energy balance. Genetic link between respiration and fermentation. Competencies: use of theoretical information and practical skills in professional activities. | |
| 9. | Plant physiology | 5 |
| | Purpose: to Study the physiological and biochemical processes occurring in plant organisms. Content. Plant cell physiology. Water regime of plants. Plant nutrition with carbon (photosynthesis). Chemistry of photosynthesis. Light and dark stages. The Calvin Cycle. The Hatch-Slack Cycle. SELF-metabolism. Mineral nutrition. Plant growth and development. Phytohormones. The way the breakdown of carbohydrates: anaerobic and aerobic. Fermentation. Chemistry of cellular respiration. Apotomini decay. Mechanisms of plant protection and resistance. Competencies: use of theoretical information and practical skills in professional activities. | |
| | Fundamentals of plant growth and development regulation | |
| | Purpose: to study the main patterns of plant growth and development. Content. Plant growth. Growth criteria. The movement of plants (tropism and nastie). Rest of plants. Development of plants. The main stages of development of | |

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| | higher plants (embryonic, juvenile, reproductive, old age). Systems of regulation and integration in plants. Growth stimulants and inhibitors. Influence of external factors on plant growth and development. Competencies: formation of a holistic view of the regulation of plant growth and development processes. | |
| 10. | Human and animal physiology | 5 |
| | Purpose: to Study the vital activity of the whole organism, physiological systems, organs and individual cellular structures. Content of the discipline: Subject and methods of human and animal physiology. Excitable tissues. Nervous system (coordination and regulation). Integrative activity of the nervous system. Sensor system. Endocrine system (feedback principle). Blood system. Circulation. Breath. Highlighting. Digestion (rational nutrition). Metabolism and energy. Competence: Formation of ideas about the regulatory mechanisms of homeostasis in humans and animals. | |
| | Physiology of adaptation | |
| | Purpose: to study the theoretical and practical foundations of the manifestation of the human body's vital activity and mechanisms of regulation of functions under the influence of various external factors and when performing physical activities of various types, power, and duration. Content of the discipline: Classification and characteristics of adaptive mechanisms. Mechanism of development of resistance and maladaptation. Adaptation of the body to various environmental factors. Competencies: Formation of ideas about the dynamics of morphofunctional changes in the human body under various conditions. | |
| 11. | Neurobiology | 5 |
| | Objective: to Form students ' complete theoretical understanding of the basic principles of human conditioned reflex activity, the physiological mechanisms of behavior. Content: Structure of the nerve cell, synapses. Structure of the Central nervous system (structure and functions of the spinal cord and brain). Conditional and unconditional reflexes. Coordination of the body's activity. Functional system. Types of higher nervous activity. Competencies: Readiness to use knowledge of modern problems of neurobiology in solving educational and professional tasks. | |
| | Physiology of higher nervous activity | |
| | Objective: to Form a holistic theoretical understanding of the basic principles of higher nervous activity in students. Content of the discipline: Conditional and unconditional reflexes. Inhibition of conditioned reflexes. Coordination of the body's activity. Functional system. Types of higher nervous activity. Memory, types of memory. Competence Readiness to use knowledge of modern problems of physiology of higher nervous activity in solving educational and professional tasks. | |
| PD 3 | CYCLE OF PROFILE DISCIPLINES (PD) | |
| 1. | Workshop on botany | 5 |
| | Purpose: to Study the biological characteristics of plants in the laboratory. The classification systems of the plant world. Main taxonomic categories of plants. The main classes of archegonial and flowering plants. Basic techniques of working in the laboratory. Working with determinants. The preparation of the keys, dichotomous schemes. Methods and rules for collecting plants, as well as methodological features of collecting material by | |

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| | class. Competencies: Knowledge of the main methods of landscape taxation, monitoring the state and inventory of the plant world. | |
| | Experimental botany | |
| | Goal: based On evolutionary theory it is necessary to show the development of the entire vegetable world from the most ancient and primitive to the modern and the most complex; to establish kinship, the origin of plants, to give a correct, coherent picture of the development of the whole vegetable world, or its phylogeny in which each species has its place in the system in connection with other related forms. Competencies: Mastering modern experimental methods of working with biological objects in field and laboratory conditions. | |
| 2. | Workshop on Zoology | 5 |
| | Purpose: to Study the biological characteristics of the animal in the laboratory. Basic techniques for working with invertebrates in the laboratory. Methods of their content. Working with determinants. The preparation of the keys, dichotomous schemes. Methods and rules for collecting animals, methodological features of collecting material by class. Keeping in captivity and observing animals. Competencies: Knowledge of the main methods of landscape taxation, monitoring of the state and inventory of the animal world. | |
| | Entomology | |
| | Purpose: knowledge about the reproduction and development of different groups of insects, their biology and ecology. Contents: Modern classification of insects, the main pathogens of human and domestic animals. Insects used in agriculture as a source of raw materials. Competencies: apply the acquired theoretical knowledge and practical skills in the field of entomology to solve urgent problems of agriculture, forestry, medicine, ecology and protection of the surrounding world and ecosystems. | |
| 3. | Immunogenetics | 5 |
| | Objective: to Form ideas about modern achievements in the field of immunology, research methods, assessment of the state of the humoral and cellular components of the immune system, processes responsible for the immune response in various organisms Contents: Basic concepts of immunity. Immunology of reproduction. Genetic control of the immune response. Abnormalities of the immune system. Competencies: Use of knowledge in the field of immunology in the implementation of activities in the research field, General education and special educational institutions. | |
| | Bioinformatics | |
| | Goal: to Create convenient and easy-to-use bioinformatic programs. Contents: Biological objects and their computer representation. Computer representation: genome Assembly, finding and studying gene functions, predicting gene expression, predicting protein functions, searching for genomic variants and associated phenotypes, neonatal diagnostics for genetic diseases. Simulation of evolution. The development of new drugs. Competencies: Obtaining, analyzing, storing, organizing, and visualizing biological data. | |
| 4. | Modern technologies for teaching biology | 5 |
| | Goal: to Master practical skills of biology training technology. Modern methods and techniques, training technologies. Form of training. Updated content of biological education. The introduction of applied courses in biology. Criteria-based assessment technology. Material base for teaching biology. Classification | |

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| | of pedagogical training technologies. The relationship between traditional education and innovative pedagogical technologies. Sources of innovative ideas. Catalog of innovative methods (interactive teaching methods). Competencies: development of professional practical skills in teaching biology. | |
| | Computer technologies and modeling in biology | |
| | Goal: system Modeling is the main approach of computer biology. Contents: General concepts of the system model. Model type. Features of biological models. Modern computer technology. Formats for representing biological data. Data storage. Principles of database organization. Data processing. Preparation of scientific data for publication. The construction of applied models. Competencies: Mastering modern computer technologies in biology. | |