KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
INSTITUTE OF NATURAL SCIENCE
6B01508 – Chemistry-Biology
Catalog of elective disciplines

CONTENT

1.OPTIONAL COMPONENTS OF THE CYCLE OF GENERAL COURSES

Optional component 1

Course: **Fundamentals of Legal Literacy and Anti-Corruption culture**
Intensity of the Course: 5 academic credits
Module Code: **GES -1**
Module Name: General educational subjects module
Prerequisites: Basics Law (school cours)
Purpose: formation of a legally competent, law-abiding person who knows his rights and duties, intolerant of any manifestations of corruption.
Short Description: The course is aimed at the formation of a legally competent, law-abiding person who knows his rights and obligations, intolerant of any manifestations of corruption. Students will be able to operate with the social, legal and ethical norms of Kazakhstani society.
Learning Outcomes in EP (LOP):
LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential
LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems
LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.
Learning Outcomes in Course (LOC):
LOC 1 - To know the importance and role of legal culture in the life of society, its relationship with the political culture of the individual and the main definitions of corruption;
LOC 2 - Analyze the main obstacles on the way to ensuring the inalienable human rights; the role of human rights in personal life and in the life of society;
LOC 3 - Apply the acquired knowledge in political analysis, in the activities of public authorities, political and public organizations, analyze problems related to corruption and countering it;
LOC 4 - Be able to engage in dialogue as a way of relating to legal culture and society.
Post requisites: no

Optional component 1

Course: **Ecology and Sustainable Development**
Intensity of the Course: 5 academic credits
Module Code: **GES -1**
Module Name: General educational subjects module
Prerequisites: Biology (school program)
Purpose: To develop students' environmental skills, address modern ecological issues, strengthen the relationship between society and nature, and enhance environmental awareness and responsibility for protecting the environment, thereby ensuring their formation as active and responsible citizens.
Short Description: The course aims to develop students' environmental skills, solve modern environmental problems, form ways to develop relationships between society and nature, increase students' awareness of the environment, and their responsibility for protecting it. As a result, students will learn how to maintain vital balance by analyzing environmental trends and identifying priority areas for conserving nature. They will also be able to identify the main directions of modern environmental policy and practical approaches to addressing environmental issues at the global, regional and local levels. In addition, students will gain knowledge of various tools for managing environmental quality that can be used to achieve sustainable development objectives.
Learning Outcomes in EP (LOP):
LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential
LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - Environmental Education and Skills: Students gain deep knowledge about environmental issues and principles of sustainable development, and acquire skills in environmental monitoring and data analysis.

LOC 2 - Environmental Responsibility and Activism: Students recognize their responsibility for protecting the environment and strive to actively participate in environmental initiatives, aiming to make changes in society.

LOC 3 - Understanding the Relationship between Society and Nature : Students comprehend the relationship between society and nature, develop environmental ethics and sustainable development strategies, enabling them to address social and environmental issues.

Post requisites: no

Optional component 1

Course: **Fundamentals of Economics and Entrepreneurship**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: Fundamentals of Entrepreneurship and bissnes (school course)

Purpose: familiarization of students with the basics of economics and entrepreneurship, mastering the conceptual apparatus and basic forms of doing business.

Short Description: The discipline is focused on the formation of students' skills of entrepreneurship and business thinking. Through a comprehensive view of the laws of the functioning of the economy, the conditions for doing business, its internal and external environment, students will have the skills to develop a business plan, create and successfully run their own business.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - Know the basic concepts in the field of economics and entrepreneurship;

LOC 2 - Be able to find and use the necessary economic information; determine the organizational and legal forms of organizations;

LOC 3 - Determine the composition of the material, labor and financial resources of the organization;

LOC 4 - Evaluation of a business idea and development of a business plan.

Post requisites: no

Optional component 1

Course: **Fundamentals of Leadership and receptivity to innovation**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: no

Purpose: in the process of studying the discipline, the student develops the skills of setting goals and objectives, timely planning of group work, problem solving, a sense of responsibility and effective communication.

Short Description: The course contributes to the disclosure and development of leadership qualities in the personality of each student, the development of innovative susceptibility skills in him, as a process of adaptation to innovations caused by innovative processes, as well as the use of the results of scientific and technical processes in his life and professional activities. Studies the current state and prospects for the development of leadership qualities and the human factor in management.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

Learning Outcomes in Course (LOC):

LOC 1 - Understands theoretical and applied research in the field of modern management achievements in Kazakhstan and abroad using modern scientific methods;

LOC 2 - Knows how to work effectively individually and in a team;

LOC 3 - Independently study and continuously improve their qualifications throughout the entire period of professional activity;

LOC 4 - Applies professional knowledge in the field of organizational and managerial activities.

Post requisites: no

Optional component 1

Course: **Emotional Intellect**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: no

Purpose: knowledge and ability to apply modern methods of diagnostics and development of emotional intelligence of students and soft skills, including in the format of distance learning.

Short Description: The discipline is aimed at mastering the role of a tutor by the teacher in the context of strategic guidelines and priority areas of the state educational policy of Kazakhstan. Students determine the place of emotional intelligence and "flexible competencies" in the educational process of the modern school. They apply modern methods and technologies for organizing educational activities, taking into account the development of soft skills, including in the digital environment. They possess technologies for assessing and developing the emotional intelligence of students of different age groups.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - Modern methods and technologies of organizing educational activities taking into account the development of soft skills, diagnostics and evaluation of flexible skills, the formation of individual educational directions and methods of organizing group activities;

LOC 2 - Application of modern methods and technologies for organizing educational activities, taking into account the development of flexible skills, including in the digital environment;

LOC 3 - Flexible skills on the skillfolio platform have the ability to carry out complex diagnostics of soft skills, interpret the results and develop them both in individual and group forms of training.

Post requisites: no

Optional component 1

Course: **Fundamentals of mathematical statistics**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: Mathematics (school programe)

Purpose: is to familiarize students with the forms and laws of consistent thinking, to teach students to think consistently, to contribute to the development of skills of sound argumentation.

Short Description: Students understand the process of collecting, processing data and transmitting ideas, develop skills in using quantitative and qualitative data analysis in assessing the state of the object or phenomenon in question.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - The student summarizes the results of pedagogical and scientific research and learns to process them mathematically.

LOC 2 - Learns to systematize, clarify and use statistical data using statistical and mathematical methods.

LOC 3 - Effectively uses Chi-square, SSPP and Jamovi applications that statistically process the collected numbers.

Post requisites: no

Optional component 1

Course: **Financial Literacy**
Intensity of the Course: 5 academic credits
Module Code: **GES -1**
Module Name: General educational subjects module
Prerequisites: no

Purpose: is to develop students' knowledge and practical skills in personal finance management, allowing them to make informed financial decisions and ensure their financial well-being.

Short Description: The discipline is focused on the development of students' knowledge about the financial system, financial institutions and their products, and financial risks. As a result, students will be able to find, analyze, interpret, evaluate financial information from various sources and use it to solve financial problems. In general, the course forms students' competent rational financial behavior in conditions of increased risk of financial fraud.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - To know the basic financial concepts, the principles of financial markets, types of taxes, the basics of insurance, the possibilities of financial technologies.

LOC 2 - Be able to make a personal budget, analyze financial proposals, choose suitable financial products and services, make informed financial decisions, and protect your financial interests.

LOC 3 - Possess the skills of financial planning, investment, and risk management.

LOC 4 - Demonstrate financial literacy in everyday life, make responsible decisions in the field of finance.

Post requisites: no

2. OPTIONAL COMPONENTS OF THE CYCLE OF CORE COURSES

Optional component 1

Course: **English for Academic Purposes**
Intensity of the Course: 5 academic credits
Module Code: **GLC -2**
Module Name: Language communication
Prerequisites: Foreign Language

Purpose: students' mastery of a foreign language as a means of learning and the basics of scientific academic communication.

Short Description: The subject forms knowledge about the genre varieties of the scientific style, mastering modern methods of collecting, storing and processing information and materials in the field of professional activity, as well as the development of skills and abilities of academic communication in four types of speech activity: reading, speaking, writing, listening.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 – They know general scientific terms to the extent sufficient to work with original scientific texts and texts of a professional nature;

LOC 2 – They understand the peculiarities of the organization of the structure and content of an academic text/discourse, compositional and speech types, forms of presentation, methods of analysis and argumentation;

LOC 3 – They are able to conduct scientific research, including the choice of a topic, its justification, determination of relevance, novelty and significance, organization of research stages, registration of results, formulation of conclusions, conclusions and recommendations;

LOC 4 – Apply the acquired knowledge in educational and research activities in the specialty profile.

Post requisites: no

Optional component 1

Course: **Academic writing**
Intensity of the Course: 5 academic credits
Module Code: **GLC -2**
Module Name: Language communication
Prerequisites: Foreign Language
Purpose: students' mastery of the theory of academic writing as a system, as well as concepts and models of academic writing.

Short Description: The discipline develops students' skills in functional style and writing scientific articles, industry-specific subject terminology, office management, and academic literacy. Students also learn how to compile scientific reports, professional text analysis, critical thinking, plagiarism prevention and information retrieval in scientific databases, and systematization of written work.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 – They know the models of academic writing, the logical and syntactic rules of scientific text, the methodology of scientific text execution;

LOC 2 – They are able to collect and process material, structure work and describe bibliographic sources;

LOC 3 – She is able to substantiate the relevance, theoretical and practical significance of the chosen topic of scientific research and present its results;

LOC 4 – He knows the methodology of writing the scientific text of an article, an abstract, an essay, a graduation project.

Post requisites: no

3. OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR COURSES

Optional component 2

Course: **Analytical chemistry**
Intensity of the Course: 6 academic credits
Module Code: **FGCh 202/1**
Module Name: Basics of General Chemistry
Prerequisites: Inorganic chemisty
Purpose: Formation of analytical skills for determining the chemical composition and quantitative content of a substance
Short Description: The course "Analytical Chemistry" deepens the knowledge gained in the course "Inorganic Chemistry" and provides more advanced opportunities for determining the chemical composition of a substance by systemic and fractional methods of analysis. The theoretical foundations of quantitative analysis and the directions of using modern instrumental methods of analysis: spectroscopic, electrochemical, chromatographic, and physical are considered.
Learning Outcomes in EP (LOP):
LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.
LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.
LOP 6 – Analyzes, interprets and processes experimental results of the work.
LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.
Learning Outcomes in Course (LOC):
LOC 1 – Determines the chemical composition of the analyzed object
LOC 2 – Uses an analytical signal to determine specific elementary ions
LOC 3 – Distinguishes methods of analytical chemistry: chemical, physico-chemical and physical
LOC 4 – Uses analytical instruments: analytical scales, pH meter, potentiometer
LOC 5 – Separates the defined component by various separation methods
LOC 6 – Assesses and proves on the basis of laboratory results obtained about the composition of the substance
LOC 7 – Conducts a scientific search for information on new methods for determining substances
Post requisites: Physical chemistry, Methods of solving tasks in chemistry

Optional component 2

Course: **Quantitative and qualitative analysis**
Intensity of the Course: 6 academic credits
Module Code: **FGCh 202/2**
Module Name: Basics of General Chemistry
Prerequisites: Inorganic chemisty
Purpose: Formation of the student's analytical skills to determine the composition (quantity or concentration) of any component in the analyzed object.
Short Description: The purpose of the discipline is the formation of students' analytical skills to determine the qualitative and quantitative composition of the components in the analyzed object. In the first part of the course, the theoretical foundations of the classical methods for the separation of anions and cations are studied: sulfide, acid-base, ammonia-phosphate separation systems. The second part of the course is aimed at mastering the chemical methods of analysis, both gravimetric and titrimetric, and physicochemical methods of analysis.
Learning Outcomes in EP (LOP):
LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.
LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.
LOP 6 – Analyzes, interprets and processes experimental results of the work.
LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.
Learning Outcomes in Course (LOC):
LOC 1 - Knows and applies the law of conservation of mass, the law of equivalents
LOC 2 - Accurately (strictly) determines the weight of the analyze in the test substance
LOC 3 - The quantitative composition of the test sample is determined by strict measurement of the volume of the reagent (titrant) of a known concentration, which interacts with the analyze in an equivalent amount.

LOC 4 - Measures the physical parameters of the test substance or solution, which depend on their quantitative composition.

LOC 5 - Uses methods of precipitation, distillation, separation;

LOC 6 - Evaluates and confirms the composition of substance 6 based on the results of laboratory tests.

LOC 7 - Conducts a scientific search for information on new methods of detecting substances.

Post requisites: Structure of matter, Olympiad problems in chemistry

Optional component 3

Course: **Physical chemistry**

Intensity of the Course: 6 academic credits

Module Code: **FGCh 305/1**

Module Name: Basics of General Chemistry

Prerequisites: Inorganic chemisty, Analytical chemistry

Purpose: Formation of knowledge among students, allowing to establish the relationship of chemical and physical phenomena and predict their final result

Short Description: The purpose of the subject of physical chemistry is to form students' fundamental knowledge of thermodynamics, electrochemistry, chemical kinetics and catalysis, to teach the legality of processes and methods of their control in the indicated chapters; be able to characterize and analyze thermal processes and patterns, get acquainted with the methods of regulating the reaction rate;

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – Uses the basic laws of natural science in professional activities

LOC 2 – Uses the basic laws of physical chemistry to master the educational program and in professional activity

LOC 3 – Masters independently new sections of fundamental sciences, using the achieved level of knowledge

LOC 4 – Knows how to calculate energy effects and rates of chemical processes

LOC 5 – Determines electrochemical, molecular-kinetic and rheological characteristics of various systems LOC 6 – Owns physical and chemical methods of analysis

LOC 7 – Possesses the skills of independent experimental work with laboratory equipment and evaluation of its results

Post requisites: Chemical technology, Physico-chemical research methods

Optional component 3

Course: **Structure of matter**

Intensity of the Course: 6 academic credits

Module Code: **FGCh 305/2**

Module Name: Basics of General Chemistry

Prerequisites: Inorganic chemisty, Analytical chemistry

Purpose: To give general information about the structure of an atom, a molecule and methods for determining their structure, to show the relationship between physicochemical properties and structure.

Short Description: As a result of mastering the discipline, the student should know the main modern approaches to describing the properties of gases, liquids and solids using the methods of statistical physics and quantum mechanics; be able to use the information obtained about the electronic and magnetic properties of solids to explain the physical foundations of modern experimental methods for studying substances used in physical and chemical research.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – Knows the basic principles of the structure of chemical particles;

LOC 2 - Can reveal the basic principles of the structure of chemical particles, the relationship between different aspects of the chemical, electronic and spatial structure of compounds;

LOC 3 - Knows how to navigate in the peculiarities of the chemical behavior of various types and classes of chemical compounds, due to their structure;

LOC 4 - Possesses the skills of working on modern educational and scientific equipment when conducting chemical experiments;

LOC 5 - Has experience working on serial equipment used in analytical and physical and chemical research;

LOC 6 - Knows the most important characteristics of the chemical, electronic and spatial structure of stable compounds in various types of chemical reactions, the nature of intermolecular interactions.

LOC 7 - Possesses the skills of analyzing and establishing the nature of the structure on the basis of a set of data on the physical and chemical properties of a substance obtained by experimental and theoretical methods.

Post requisites: Chemical technology of inorganic substances, Modern methods of analysis

Optional component 4

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Course: **Methods of solving tasks in chemistry**

Intensity of the Course: 6 academic credits

Module Code: **FGCh 306/1**

Module Name: Basics of General Chemistry

Prerequisites: Inorganic chemisty, Analytical chemistry

Purpose: to form the skills and abilities of solving complicated problems in chemistry.

Short Description: The purpose of this course is to acquaint future teachers of chemistry with the methodology for solving computational chemical problems and to acquire practical skills in organizing the solution of problems in chemistry by students in the process of teaching chemistry in high school. The study of this discipline allows you to equip students with knowledge, practical skills and abilities in solving chemical problems, tasks of increased complexity, monitoring learning outcomes.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

Learning Outcomes in Course (LOC):

LOC 1 - Owns methodological techniques for solving problems of varying degrees of complexity in the main sections of chemistry.

LOC 2 - Owns methodological techniques for solving Olympiad problems.

LOC 3 - Knows how to solve complex creative problems of a theoretical and applied nature.

LOC 4 - Knows how to solve problems using a computer and a personal computer.

LOC 5 – Owns computer programs for solving problems.

LOC 6 - Proficient in the use of multimedia for teaching students to solve chemical problems.

LOC 7 - Knows how to draw up conditions and draw up solutions to problems and exercises of increased complexity.

Post requisites: Physicochemical research methods, Chemical synthesis

Optional component 4

Course: **Olympiad problems in chemistry**

Intensity of the Course: 6 academic credits

Module Code: **FGCh 306/2**

Module Name: Basics of General Chemistry

Prerequisites: Inorganic chemisty, Analytical chemistry

Purpose: To develop the creative abilities of students and teach them to use the basic laws and concepts of chemistry in solving experimental, computational and other problems of increased complexity

Short Description: In the course of studying the course, develop the creative abilities of students and teach them how to use them; to teach students to solve problems in several alternative ways, to choose the most elegant solutions; formation of

students' knowledge and skills to teach students to solve chemical problems. An important component of this course is the ability to solve problems and exercises in chemistry, tasks of increased complexity.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

Learning Outcomes in Course (LOC):

LOC 1 - Owns methodological techniques for solving problems of varying degrees of complexity in the main sections of chemistry;

LOC 2 - Owns methodological techniques for solving Olympiad problems;

LOC 3 - Knows how to solve complex creative problems of a theoretical and applied nature;

LOC 4 - Knows how to solve problems using a computer and a personal computer;

LOC 5 – Owns computer programs for solving problems;

LOC 6 - Proficient in the use of multimedia for teaching students to solve chemical problems;

LOC 7 - Knows how to draw up conditions and draw up solutions to problems and exercises of increased complexity.

Post requisites: Modern methods of analysis

Optional component 5

Course: **Cytology, histology and embryology**

Intensity of the Course: 5 academic credits

Module Code: **PAB 203/1**

Module Name: Plant and animal biodiversity

Prerequisites: Botany

Purpose: to introduce students to the structure of cells, tissues and organs.

Short Description: In the course of studying the discipline, students master the structure and chemical composition of cells, functions, general patterns of reproduction and cell structure. Knowledge is formed about the classification of tissues, the function and formation of germ cells, the process of development and fertilization, the main stages of embryonic development. He is proficient in methods of studying the microscopic structure of cells and tissues. Defines the organic connection of histology between the sciences of anatomy, biochemistry and physiology.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Formulates definitions and General concepts about the laws of the structure of cells, tissues and organs

LOC 2 - Determines the structure and function of cells and their derivatives

LOC 3 - Applies the main histological methods in practice

LOC 4 - Explains terms and concepts related to the study of Cytology and histology.

LOC 5 - Explains the mechanisms of changes in the normal structure of cells and tissues in pathological conditions

Post requisites: Genetics

Optional component 5

Course: **Cellular pathology**

Intensity of the Course: 5 academic credits

Module Code: **PAB 203/2**

Module Name: Plant and animal biodiversity

Prerequisites: Botany

Purpose: Formation of scientific bases on the origin, development and result of pathological processes and diseases in the cell.

Short Description: In this discipline, students consider typical pathological processes characterized by a violation of intracellular homeostasis. Studies what limits the functionality of the cell and leads to its death or a decrease in life expectancy. She supplemented her knowledge of pathological disorders of cells in tissues and the body, histopathology and phytopathological molecular methods, the initial levels of malignant neoplasms.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Knows terms and concepts related to pathological diseases

LOC 2 – Knows pathologies of cellular organelles

LOC 3 – Can analyze pathologies in the cell that occur under the influence of radiation

LOC 4 – It can detect disorders of intracellular metabolism

LOC 5 – Knowledge of the disease caused by changes in chromosomes

Post requisites: Molecular Biology

Optional component 6

Course: **Ecophysiology**

Intensity of the Course: 5 academic credits

Module Code: **PAB 204/1**

Module Name: Plant and animal biodiversity

Prerequisites: Botany

Purpose: The main goal of the course is to understand the functioning of a plant organism in changing environmental conditions, to determine the adaptive and acclimatization abilities of various types of plants, ways to increase plant resistance to adverse environmental factors.

Carrying out this work through digital resources and developing the research skills of students.

Short Description: On the course, the student studies the biochemical foundations, the variability of plants on physiological and environmental factors. Analyzes the interaction of plant activity in the environment with physiological processes, temperatures, global changes under abiotic stress. Students acquire new competencies in studying whether living organisms interact with factors of the physical environment or biophysical, biochemical and physiological processes used in ecological communication with other organisms.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – The presence of ideas about the general patterns of the influence of environmental factors on the activity of the plant organism;

LOC 2 – Can track changes in physiological processes in a plant organism under various environmental conditions caused by abiotic and biotic influences;

LOC 3 – Can analyze the adaptive and acclimatization abilities of different plant species;

LOC 4 – Can evaluate the resistance of plants and cells to abiotic and biotic stresses;

LOC 5 – In the process of mastering the discipline, the student develops personal, professional and professional competencies: working time planning, cooperation and work in a small group, communication skills, a creative approach to solving professional problems (creativity).

LOC 6 – The student can grow plants in natural and laboratory conditions, study plants with the help of special instruments and installations, general laboratory equipment;

LOC 7 – Formirovaniya navykov okhrany okruzhayuschey sredy;

Post requisites: Evolutionary Doctrine

Optional component 6

Course: **Teaching about the environment**

Intensity of the Course: 5 academic credits

Module Code: **PAB 204/2**

Module Name: Plant and animal biodiversity

Prerequisites: Botany

Purpose: to understand the causes and general laws of the historical development of the place of existence of living matter

Short Description: In the course of studying the discipline, students study the ecological situation of the environment, the components and evolution of the biosphere, the patterns of development of processes. Examine the concept of a living being and the concepts of life support and sustainable development. Form scientific thinking and outlook and a scientific approach to the biosphere, the genesis of human settlements, the structure of the fauna and flora of urban areas, the methodology of environmental monitoring.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 - Mastering knowledge about the environment using modern information and educational technologies.

LOC 2 - Knowledge of skills and methods of studying places and objects of living matter habitat.

LOC 3 - Is capable of critical analysis of modern scientific research and practical evaluation of new ideas when solving research projects, including in interdisciplinary fields.

LOC 4 - Comparison of the problems of the global social environment.

LOC 5 - Sustainable Development Goals and ways of implementation.

LOC 6 - The ability to analyze the safety of life.

Post requisites: Evolutionary Doctrine

Optional component 7

Course: **Human anatomy**

Intensity of the Course: 5 academic credits

Module Code: **SHDLO-301/1**

Module Name: Structure, heredity and development of living organisms

Prerequisites: Cytology, histology and embryology, Ecophysiology

Purpose: Deep assimilation by students of the structure of the human body, organ system and individual organs based on modern achievements of anatomy, physiology and biology; the ability to use the acquired knowledge in the study of other fundamental disciplines, as well as in future research and production activities.

Short Description: When mastering the course "Human Anatomy", students study the shape and structure, origin and development of the human body. Anatomy provides a systematic description of the shape, structure, position and topographic relationships of parts and organs of the body, taking into account age, gender and individual characteristics.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Knowledge of basic terms of human anatomy and development of anatomical research methods.

LOC 2 – Knowledge of the anatomical structure and function of organs and systems of the human body, patterns of mental and physical development and features of their manifestation in different age periods.

LOC 3 – Mastering the methods of medical-biological, pedagogical and psychological control over the condition of students.

LOC 4 – the Ability to apply various forms of classes, taking into account the current methods of training and education in professional activities, age, morphofunctional and psychological characteristics of students, their level of physical and athletic training, health status, choose tools and methods in accordance with the tasks.

LOC 5 – Improvement of medical and biological, sanitary and hygienic, psychological and pedagogical bases of physical activity.

LOC 6 – Planning of various forms of classes taking into account climatic, regional, and national characteristics in order to protect the health, recovery, rehabilitation, and recreation of students; determining the functional state, level of physical development, and fitness of students at various stages of age development.

LOC 7 – Develops skills of rational use of educational, laboratory and management equipment, special equipment and modern computer equipment.

Post requisites: Molecular Biology

Optional component 7

Course: **Biology of individual development**
Intensity of the Course: 5 academic credits
Module Code: **SHDLO-301/2**
Module Name: Structure, heredity and development of living organisms
Prerequisites: Cytology, histology and embryology

Purpose: to acquaint students with the laws of reproduction and individual development of organisms, as the fundamental basis of life processes.

Short Description: When mastering the course, students study the patterns of ontogenetic development of organisms. The course gives an idea of the macro- and micro-morphological, physiological-biochemical, molecular and genetic processes occurring in developing organisms, as well as the factors and mechanisms that control development processes at all stages of the ontogenesis of animal and plant organisms.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Know the basic laws of the individual development of animals and plants at all stages of ontogenesis in close connection with their historical development;

LOC 2 - They know how to understand about macro- and micromorphological, physiological-biochemical, molecular and genetic processes occurring in developing organisms;

LOC 3 - Possess basic knowledge in the field of developmental biology, understand the social significance of this knowledge, be able to predict the consequences of their professional activities;

LOC 4 - Use in practice the knowledge gained about the mechanisms of morphophysiological differentiation of the organism in ontogenesis; to attract the knowledge gained to solve scientific and practical problems

LOC 5 - Applies modern experimental methods of working with biological objects in field and laboratory conditions, forms the skills of working with modern equipment.

LOC 6 - Has a basic understanding of the patterns of reproduction and individual development of biological objects.

LOC 7 - Uses methods of obtaining and working with embryonic objects.

Post requisites: Evolutionary Doctrine

3. OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR COURSES

Optional component 1

Course: **Professional Ethics and Identity**
Intensity of the Course: 5 academic credits
Module Code: **GER – 3**
Module Name: Global Ethics and Research
Prerequisites: no

Purpose: is to acquaint students with the attitudes, values, knowledge, beliefs and skills adopted in the professional pedagogical environment.

Short Description: Students develop leadership and proactivity skills in the context of pedagogical activity or outside it, develop a commitment to the national and cultural values of Kazakhstan, get acquainted with and accept as a value the strict observance of professional ethics. Students plan their career path, develop introspection and self-management skills.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 – Be able to work in a team, be tolerant social, ethnic, religious and cultural differences

LOC 2 – They know classical and modern theories in the field of professional ethics and identity;

LOC 3 – Apply theoretical knowledge and practical skills in the subject area in solving professional tasks;

Post-requisites: no

Optional component 1

Course: **Basics of artificial intelligence**

Intensity of the Course: 5 academic credits

Module Code: **GER – 3**

Module Name: Global Ethics and Research

Prerequisites: Information – communication technologies

Purpose: The aim of teaching this discipline is to form theoretical knowledge and practical skills in artificial intelligence (AI), including implementing the contemporary tools and methods of AI..

Short Description: Students will be introduced to fundamental AI concepts, study its basic principles and methods, gain the skills to apply these theories, methods, and principles in simple intelligent software systems.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1- know about the basic concepts of artificial intelligence (machine learning, neural networks, natural language processing), algorithms and artificial intelligence tools.

LOC 2- create simple artificial intelligence tools (for example, chatbots, recommendation systems, applications) adapted to the needs of their industry.

LOC 3 - be able to use practical AI tools and techniques to solve specific tasks.

Post-requisites: no

Optional component 2

Course: **Molecular Biology**

Intensity of the Course: 5 academic credits

Module Code: **SHDLO-404/1**

Module Name: Structure, heredity and development of living organisms

Prerequisites: Genetics

Purpose: The discipline "Molecular Biology" aims to form students' modern ideas about the basic molecular genetic and cellular mechanisms of the body's functioning and their application to theoretical and practical biotechnology.

Short Description: In the course, students study the structure and functions of complex high-molecular compounds that make up the cell, the mechanisms of preservation and expression of genetic information. Know the structure and functional features of protein, DNA, RNA. Understand the principles of cellular organization of biological objects, biophysical and biochemical foundations, membrane processes and molecular mechanisms of life.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – To study the features of the structure, properties, classification and function of proteins.
LOC 2 –To study the features of the structure and function of DNA and RNA.
LOC 3 –To study the features of viral genomes, the types of their replication.
LOC 4 –To study the features of the structure of the genome of prokaryotes.
LOC 5 –To study the levels of DNA compaction, features of the structure of the eukaryotic genome.
LOC 6 –To study the mechanisms of transcription, processing of RNA and translation in prokaryotes and eukaryotes.
LOC 7 –To study the mechanism of DNA replication in prokaryotes and eukaryotes.

Post requisites: no

Optional component 2

Course: **Biology of Nucleic Acids**
Intensity of the Course: 5 academic credits
Module Code: **SHDLO-404/2**
Module Name: Structure, heredity and development of living organisms
Prerequisites: Genetics and selection
Purpose: Mastering the important components of the cell that store and transport genetic information in living organisms.

Short Description: In the course "Nucleic Acid Biology" students study the structure and functions of nucleic acids, the principles and mechanisms for the implementation of hereditary information, the molecular basis of the structure and functions of cells, the growth, development, division, and changes in tumors. Use basic knowledge in the field of natural sciences in cognitive and professional activities, appliy the methods of mathematical analysis and modeling, theoretical and experimental research.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Knows the composition and structure of nucleic acids.
LOC 2 – Knows the value of nucleic acids.
LOC 3 – can analyze the role of mRNA in transcription
LOC 4 – can analyze the role of tRNA in protein synthesis.
LOC 5 – can determine the role of rRNA in termination.
LOC 6 – Knows the role of the genetic code in living organisms.
LOC 7 – Knows the physical properties of nucleic acids.

Post requisites: no

Optional component 3

Course: **Chemical technology**
Intensity of the Course: 5 academic credits
Module Code: **FSR-402/1**
Module Name: Fundamentals of synthesis and research
Prerequisites: Inorganic chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds
Purpose: acquaintance of students with the theoretical foundations of chemical technology and the general principles of organizing chemical production.

Short Description: The course "Chemical Technology" is aimed at studying standard methods for the production of inorganic and organic substances in chemical technology, the scope of their application, classification of technological processes, identification and investigation of the properties of the compounds obtained, rules for processing and registration of experimental results, TB standards. The course forms the skills of conducting an experiment according to the developed methods and processing the results.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – Basic principles of the organization of chemical production

LOC 2 – Hierarchical structure of chemical production

LOC 3 – Calculate the basic characteristics of the chemical process

LOC 4 – Choose a rational scheme of production of the product

LOC 5 – To evaluate the technological efficiency of production

LOC 6 – Methods of analysis of the efficiency of chemical production

LOC 7 – Ability and readiness to carry out the technological process in accordance with regulations and use of technical means for measurement of basic parameters of technological process, properties of raw materials and products

Post requisites: no

Optional component 3

Course: **Chemical technology of inorganic substances**

Intensity of the Course: 5 academic credits

Module Code: **FSR-402/2**

Module Name: Fundamentals of synthesis and research

Prerequisites: Inorganic chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds

Purpose: The basics of theories and foundations of all modern years; - senseless chemical properties of inorganic acids and bases;

Short Description: The purpose of teaching the discipline is to study the most important typical productions of the main chemical industry of inorganic substances. The study of physico-chemical properties, synthesis and kinetics of the main products, the types of raw materials used, industrial methods of production of inorganic substances. Using the example of existing production facilities, the possibilities of rational complex processing of raw materials, optimal technological solutions are studied and technical and economic indicators are compared taking into account scientific achievements in industry.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – The basics of theories and foundations of all modern years; - senseless chemical properties of inorganic acids and bases;

LOC 2 - Deudin's technology and the schemes and technology of chemical raw materials are used further in the distillation process.

LOC 3 - Technology for obtaining inorganic acids and bases from mineral raw materials; - applied inorganic acids and non-producer technologist.

LOC 4 - The ability to distinguish between volatile and basic substances in systems;

- for cleaning raw materials from impurities;

LOC 5 - I get a description of natural raw materials; - selection of optimal conditions, synthesis of inorganic fibers and bases from sinizate;

LOC 6 - Assessment of the strengths and weaknesses of the scheme of a particular technology, conducting a disciplinary analysis of the established technology for processing raw materials;

LOC 7 - Chemical technology and experience in neutral chemistry

Post requisites: no

Optional component 4

Course: **Chemical synthesis**
Intensity of the Course: 5 academic credits
Module Code: **FSR-403/1**
Module Name: Selected branches of chemistry
Prerequisites: Inorganic chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds
Purpose: teach students to synthesize chemical compounds using modern techniques and technology in the laboratory and industry.
Short Description: The course of the discipline "Chemical synthesis" is aimed at developing the ability to develop strategies and tactics for the synthesis of chemicals. The course provides the theoretical foundations of modern ideas about the structure and properties of substances, fundamental approaches to the design and synthesis of new chemical compounds, the choice of the method and conditions of synthesis, kinetic and thermodynamic control of chemical reactions, techniques for preparing and implementing synthesis, purification and analysis of synthesized substances.
Learning Outcomes in EP (LOP):
LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.
LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.
LOP 6 – Analyzes, interprets and processes experimental results of the work.
LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.
Learning Outcomes in Course (LOC):
LOC 1 –Uses natural science and mathematical knowledge to navigate the modern information space.
LOC 2 –Knows the most relevant research areas in modern experimental chemistry.
LOC 3 –Knows the simplest methods for obtaining chemicals, their isolation, purification and identification.
LOC 4 –Analyzes the results obtained, makes the necessary conclusions.
LOC 5 –Conducts laboratory syntheses of chemical substances.
LOC 6 –Has skills in working with reference literature, tables, and calculation diagrams.
LOC 7 –Focuses on the conditions of production activities, make decisions in non-standard situations.
Post requisites: no

Optional component 4

Course: **Methods for the synthesis of new chemicals**
Intensity of the Course: 5 academic credits
Module Code: **FSR-403/2**
Module Name: Selected branches of chemistry
Prerequisites: Inorganic chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds
Purpose: Teaching students the synthesis of chemical compounds using modern technologies and methods.
Short Description: The course promotes the application of the student's knowledge of the basics of chemical thermodynamics and kinetics in inorganic synthesis, basic methods of raw material preparation and purification, effective methods for obtaining simple and complex substances from the elements of the periodic system in laboratory and production conditions.The course develops the ability to analyze standard methods of obtaining and develop new synthesis methods, process experimental results.
Learning Outcomes in EP (LOP):
LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.
LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.
LOP 6 – Analyzes, interprets and processes experimental results of the work.
LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.
Learning Outcomes in Course (LOC):
LOC 1 - Knows the subject of nanochemistry and nanotechnology, the main types of nanoobjects and nanomaterials, devices and devices developed on the basis of nanomaterials, the principle of dimensional quantization and conditions for observing quantum-dimensional phenomena, physical and chemical systems of reduced dimension;
LOC 2 - Knows the features of the energy spectrum and transport of particles in multilayer structures with sharp potential boundaries, the main scientific and technical problems of nanotechnology and the prospects for the development of this fundamental field of knowledge.

LOC 3 - understands the role of natural sciences (including chemistry) in the development of a scientific worldview;
LOC 4 - Understands the need and is able to acquire new knowledge using modern scientific methods
LOC 5 - Knows how to predict the stability and physical and chemical properties of nanoobjects and nanomaterials; navigate modern literature and conduct a discussion on nanochemistry and nanotechnology;
LOC 6 - Is able to independently set tasks for the creation or practical application of nanoobjects and nanomaterials for solving specific problems of nanotechnology; navigate the methods of obtaining and studying nanostructures: scanning tunneling microscopy and spectroscopy;
LOC 7 - Possesses the skills of creative generalization of the acquired knowledge, concrete and objective presentation of his knowledge in written and oral form, fundamental knowledge about the specific behavior of a substance in the nanometer size range, understand the mechanism of occurrence of dimensional physical and chemical effects.
Post requisites: no

Optional component 5

Course: **Evolutionary Doctrine**
Intensity of the Course: 5 academic credits
Module Code: **PAB 405/1**
Module Name: Biodiversity of plants and animals
Prerequisites: Genetics
Purpose: to know the main methodological methods of studying the evolutionary process, the laws of the historical development of organic nature, the stages of evolutionary development
Short Description: The course is aimed at studying: the history of the formation of modern evolutionary theory and its main provisions; features of the processes of micro- and macroevolution; speciation concepts; the genetic structure of populations; causes of modification and mutational variability; consequences of the influence of abiotic, biotic and anthropogenic factors on the heredity and variability of living organisms. In addition, exhibits environmental literacy and uses basic knowledge of biology in life situations.
Learning Outcomes in EP (LOP):
LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.
LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.
LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.
Learning Outcomes in Course (LOC):
LOD 1 – Students use their knowledge of evolutionary theory to form worldviews.
LOD 2 – students ' Mastery of the theory of evolution develops their ability to independently analyze and synthesize complex materials of modern biology.
LOD 3 – knows about organic evolution, the genetic and ecological foundations of evolution, the driving forces and results, and the main stages of life development
LOD 4 – analyses of evolutionary processes
LOD 5 – understands the main signs and stages of the evolution of life on earth
LOD 6 – Understands the differences and similarities of Macro-and microevolutions with evidence of macroevolution, their main paths and patterns.
LOD 7 –Evolutionary progress. Evolutionary regression. The main ways of evolutionary progress. Analyzes the ratio of evolutionary trends
Post requisites:no

Optional component 5

Course: **Anthropology**
Intensity of the Course: 5 academic credits
Module Code: **PAB 405/2**
Module Name: Biodiversity of plants and animals
Prerequisites: Ecophysiology
Purpose: to indicate the presence of morphological, physiological and genetic associations in the development of Homo sapiens
Short Description: This course studies the origin and evolution of man and human races, the physical structure of man, the morphological and physiological characteristics of ethnic and other communities of people. Students study the

formation of human culture and civilizations, the structure of human society in different historical periods and in different territories.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOD 1 – Knows historical materials and methods

LOD 2 – analyzes the main theories of human origin

LOD 3 – is able to explain the content of the questions raised in a reasoned and complete manner;

LOD 4 – can participate in the discussion, giving a reasoned opinion;

LOD 5 – knows the basic terms and concepts of anthropology

Post requisites:no

Optional component 6

Course: **Biochemistry**

Intensity of the Course: 6 academic credits

Module Code: **SHDLO-303/1**

Module Name: Structure, heredity and devel-opment of living organisms

Prerequisites: Inorganic chemistry

Purpose: Assimilation of the chemical composition of living organisms, their metabolism and its role in life processes, biochemical processes in the growth and development of plants and the formation of professional skills of students.

Short Description: When mastering the course of biochemistry, students study the chemical composition of living organisms and the chemical processes occurring in them. They study the structure and properties of the most important biological compounds - proteins, nucleic acids, carbohydrates, lipids; their chemical transformations in the body and the significance of these transformations for understanding the physical and chemical foundations of the vital activity of all life on Earth.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Knows the main types, chemical composition and structure, properties, functions and features of metabolism of important high-molecular and low-molecular metabolites in living organisms.

LOC 2 – Masters methods of research of proteins, carbohydrates, lipids, enzymes and other compounds.

LOC 3 – A graduate arguments advantages and disadvantages comparing photosynthesis, respiratory tract, mineral types, phytohormones, growth and development stages.

LOC 4 – A graduate proves the laws of life of living organisms and the relationship between biological processes.

LOC 5 – A graduate can systematize theoretical knowledge and practical skills acquired during the study of the discipline and transfer them to others.

LOC 6 – A graduate can use equipments to biochemical research.

LOC 7 – Professionally uses the materials of the course on the subject of "Biochemistry" when performing individual thematic and project studies.

Post requisites: Molecular Biology, Chemical technology

Optional component 6

Course: **Basics of Enzymology**

Intensity of the Course: 6 academic credits

Module Code: **SHDLO-303/2**

Module Name: Structure, heredity and development of living organisms

Prerequisites: Biology of individual development

Purpose: The objectives of mastering the discipline "Enzymology" is to acquaint students with the basics of modern concepts in the field of the structure and function of proteins, to give the basic concepts of enzymatic catalysis, to consider the participation of enzymes in the basic biological processes of the cell.

Short Description: In the Basics of Enzymology course, students learn about enzymes. They study the principles of operation of protein molecules that catalyze or inhibit biochemical reactions that underlie all biological processes and are used in various industries, agriculture and medicine. Use modern methods of processing, analysis and synthesis of field and laboratory biological information, demonstrate knowledge of the principles of compiling scientific and technical projects and reports.

Learning Outcomes in EP (LOP):

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

LOP 9 – Applies the principles of distribution, systematization, evolution and phylogenetic relationships of plants, animals and microorganisms in the environment in the learning process.

Learning Outcomes in Course (LOC):

LOC 1 – Master the system of knowledge about the strategy of structural and functional research of proteins and enzymes.

LOC 2 – Has an understanding of the laws underlying enzymatic catalysis in biological systems.

LOC 3 – Owns methods for determining the activity of proteins and enzymes, bioregulators.

LOC 4 – Analyzes the main mechanisms of the active centers of enzymes.

LOC 5 – Compares knowledge of proteins and enzymes for practice in biotechnology.

LOC 6 – Interprets the system of knowledge characterizing modern methods of enzymatic research.

LOC 7 – Systematizes theoretical knowledge and practical skills acquired in the study of the discipline and transfer them to others.

Post requisites: Molecular Biology

Optional component 7

Course: **Physicochemical research methods**
Intensity of the Course: 4 academic credits
Module Code: **FSR-401/1**
Module Name: Fundamentals of synthesis and research

Prerequisites: Physical chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds

Purpose: The objectives of the development of the discipline is to form the skills, abilities and competencies of students in the field of basic theoretical knowledge related to the classification, capabilities and limitations of modern physical research methods, to instill an understanding of the fundamental principles of methods and methods of their practical implementation.

Short Description: The discipline is aimed at mastering the theoretical foundations of physical research methods, acquaintance with modern advanced instrumental methods of analysis, experimental techniques, methods of solving chemical problems. The course "Physico-chemical research methods" forms knowledge and skills that allow using the possibilities of physico-chemical methods in chemical research to establish and identify the structure of a substance.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – To acquaint with the basic principles and regularities of the methods of physical and chemical analysis.

LOC 2 - Proficient in methods of physical and chemical analysis.

LOC 3 - Study the methods of physical and chemical analysis, work with chemical reagents and process the analysis results

LOC 4 - It can process the results of chemical and physicochemical analysis to determine the composition of substances.

LOC 5 - Strengthens the basic theoretical knowledge of the methods of physical and chemical analysis with practical work.

LOC 6 - Knows how to determine the qualitative composition of a substance in the laboratory

Post requisites: no

Optional component 7

Course: **Modern methods of analysis**

Intensity of the Course: 4 academic credits

Module Code: **FSR-401/2**

Module Name: Fundamentals of synthesis and research

Prerequisites: Physical chemisty, Organic chemistry of aliphatic compounds, Organic chemistry of cyclic compounds

Purpose: The development of modern physical methods of research used in chemistry.

Short Description: The course "Modern methods of analysis" examines the latest methods of analysis of compounds: methods of mass spectroscopy, IR, NMR 1H and 13C, UV spectroscopy, X-ray structural analysis. It is aimed at mastering the basics and principles of analyzing the empirical results obtained and processing the analysis data, forms the skills of conducting preliminary calculations, comparing the results of the experiment with preliminary calculations.

Learning Outcomes in EP (LOP):

LOP 4 – Knows the basics of fundamental concepts and laws of chemistry, atomic and molecular theory, structure and physico-chemical properties of substances.

LOP 5 – Has the skills of staging, planning chemical and biological experiments using the latest achievements of science and technology, knows and complies with safety regulations in chemical and biological laboratories.

LOP 6 – Analyzes, interprets and processes experimental results of the work.

LOP 7 – He is oriented in the information and conceptual field of natural science knowledge, knows how to use them to solve various practice-oriented tasks of a scientific laboratory and educational nature.

Learning Outcomes in Course (LOC):

LOC 1 – Knows the basics of chemical thermodynamics and their application to various branches of chemistry (solution theory, electrolyte behavior, homogeneous and heterogeneous equilibria, surface phenomena, colloidal systems, etc.);

LOC 2 – Develops the most appropriate method for analyzing an object, taking into account the tasks and time and economic costs;

LOC 3 – Find the causes of deviations, perform preliminary calculations for the problem, make an experiment plan, compare the results of the experiment with preliminary calculations, make the experiment and calculations clarifying points, and repeat the operation;

LOC 4 – Analysis of modern physical and chemical processes.

LOC 5 – Determine the optimal conditions for using physical methods in solving experimental problems.

Post requisites: no