MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

KYIV NATIONAL UNIVERSITY OF TECHNOLOGIES AND DESIGN

APPROVED BY ACADEMIC COUNCIL
Minute's № 11, June 30 2023
Chairman of Academic Council

Ivan GRYSHCHENKO

Put into effect by order of the rector
Minute's № 213, July 14 2023

EDUCATIONAL - PROFESSIONAL PROGRAM

Biotechnology

Level of higher education	first bachelor's degree
Degree	Bachelor
Subject area	16 Chemical Engineering and Bioengineering
Specialty	162 Biotechnology and Bioengineering
Qualification	Bachelor in Biotechnology and Bioengineering

Kyiv 2023

LETTER OF APPROVAL

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Subject area	16 Chemical Engineering and Bioengineering
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Vice-Rector

26.06.2023 Liudmyla HANUSHCHAK-YEFIMENKO

Director of Staff Training Management Centre

26.06.2023 Olena HRYHOREVSKA

Approved by the Academic Council of the Faculty of *Chemical and Biopharmaceutical Technologies*
Minutes № *11* of «*26th*» *June* 2023

Dean of the Faculty of *Chemical and Biopharmaceutical Technologies*

26.06.2023 Tetiana DERKACH

Discussed and recommended at the meeting of the Department of *Biotechnology, Leather and Fur*
Minutes № *17* of «*26th*» *June* 2023

Head of the Department of *Biotechnology, Leather and Fur*

26.06.2023 Olena MOKROUSOVA

INTRODUCTION

Developed by: Kyiv National University of Technologies and Design

CONTENT BY:

Educational programme support team	Full name, academic degree, academic title, position	Signature	Date
Guarantor of educational programme	**OLENA OKHMAT**, PhD, Associate Professor of Department of Biotechnology, Leather and Fur, Faculty of Chemical and Biopharmaceutical Technologies, Kyiv National University of Technologies and Design		
Working group	**IRYNA VOLOSHYNA**, PhD, Associate Professor of Department of Biotechnology, Leather and Fur, Faculty of Chemical and Biopharmaceutical Technologies, Kyiv National University of Technologies and Design		
	OLGA IYNGIN, PhD, Associate Professor of Department of Biotechnology, Leather and Fur, Faculty of Chemical and Biopharmaceutical Technologies, Kyiv National University of Technologies and Design		
	IHOR HRETSKYI, PhD, Associate Professor of Department of Biotechnology, Leather and Fur, Faculty of Chemical and Biopharmaceutical Technologies, Kyiv National University of Technologies and Design		

Stakeholders are included in the group for the development of the EP:

1. Huseynova Kristina, student of the Department of Biotechnology, Leather and Fur, Faculty of Chemical and Biopharmaceutical Technologies, Kyiv National University of Technology and Design;
2. Kachan Roman, PhD, Production Director at Interdes LLC.

1. Profile of the educational - professional program **Biotechnology**

1.1 – General information	
Full name of a higher education institution and structural unit	Kyiv National University of Technologies and Design Department of Biotechnology, Leather and Fur
Higher Education Level	First (Bachelor)
Educational qualification	Bachelor of Biotechnology and Bioengineering
Qualification in diploma	Higher Education Degree - Bachelor Specialty - 162 Biotechnology and Bioengineering Educational program - Biotechnology
Type of diploma and scope of the educational program	Bachelor's Degree, single, 240 ECTS credits
Accreditation	Certificate of accreditation of the educational and professional programme UD № 11010111 dated 09.07.2019
Cycle/level	National Qualifications Framework of Ukraine: Bachelor - Sixth Level
Prerequisites	Complete general secondary education, professional higher education or junior bachelor's degree (junior specialist). In accordance with the Standard of Higher Education in the specialty based on the degree of junior bachelor (OQR junior specialist), the University recognizes and recalculates no more than 60 ECTS credits received within the previous educational program for junior bachelor (junior specialist)
Language (-s) of teaching	Ukrainian, English
Accreditation certificate of educational program is valid	Until July 1st, 2026
Website for a permanent description of the educational program	http://knutd.edu.ua/ekts/
1.2 – Purpose of the educational program	
Formation and development of general and professional competencies in the field of biotechnology and bioengineering for the complex implementation of project-technological, industry-technological and scientific-research work related to the use of biological agents and their products to obtain biologically active substances and products through biosynthesis and/or biotransformation, aimed at acquiring by the student the knowledge, skills and abilities necessary for the designing and organization of biotechnological production and product quality assessment	
3 – Characteristics of the educational program	
Subject matter	*Object:* Biotechnological processes and production apparatus for obtaining biologically active substances and products through biosynthesis and/or biotransformation. *Educational objectives:* Training specialists capable of performing complex design and technological calculations and carrying out production and technological work related to the use of biological agents and products of its vital activity. *Theoretical content of the subject area:* Fundamental and applied scientific foundations of industrial utilization of the biosynthetic and/or biotransformation potential of living objects for obtaining practically valuable products. The theoretical content of the subject area includes the fundamental and applied scientific foundations of industrial utilization of the biosynthetic and/or biotransformation potential of living organisms for obtaining applied valuable products.

	Methods, techniques, and technologies. The learner should acquire knowledge of chemical, physicochemical, biochemical, microbiological, molecular, biological and genetic research methods, as well as information and computer technologies. *Tools and equipment*: for the analysis of biological agents and its vital products, equipment for the cultivation of biological agents, extraction and purification of target products, automation tools, and automated design systems for biotechnological production. Compulsory educational components account for 75%, including practical training (13%), foreign language studies (13%), and diploma project (13%). The remaining 25% consists of selective disciplines chosen by the learner from the university catalog, following the approved procedure at the University.
Orientation of the program	The bachelor's degree program focuses on training professionals who can use biological agents and their products at the professional level to obtain biologically active substances and products through biosynthesis and/or biotransformation, considering the bioethics and biosafety of society.
The main focus of the program and specialization	Emphasis is placed on the formation and development of professional competencies to solve applied problems in the field of biotechnology and bioengineering through research, development, creation, and production of biotechnological products for medicine, health, agriculture, ecology, energy, light industry and more.
Features of the program	The program provides in-depth theoretical and practical training, generalization of the results of project-technological and industry-technological solutions, scientific-research work, implementation, and defense of qualifying work. The program develops employment prospects in modern biotechnological enterprises. Provides opportunities for the implementation of international academic mobility of participants in the educational process.
1.4 – Suitability of graduates for employment and further study	
Suitability for employment	The graduate is suitable for the employment at enterprises of any legal form (state, municipal, commercial, non-commercial), in organizations and institutions operating in the fields of biotechnology and bioengineering, in educational institutions, research and design institutes. He can hold the following positions: laboratory assistant/laboratory technician (chemical, biochemical, microbiological and physical research), technician (biotechnology), technician-laboratory assistant (biotechnology production), trainee researcher, technologist. Professional titles: Biotechnology Specialist, Laboratory Assistant (biological research), Laboratory Technician, Laboratory Assistant (biotechnology)
Academic rights for graduates	Opportunity to pursue education under the educational-scientific and/or educational-professional program at the second (master's) level of higher education.
1.5 – Teaching and assessment	
Teaching and learning	Student-centered and problem-oriented learning, hands-on training and self-study are used. The system of teaching methods is based on the principles of purposefulness and binarity-active direct involvement of the teacher and the student. Teaching is carried out in the form of lectures, seminars, practical classes in small groups, laboratory practical training, independent work, consultations with teachers, development of professional projects.
Assessment	Oral and written exams, credits, tests, coursework, presentations, reports.
1.6 – Program competencies	

Integral competency (IC)	The ability to solve complex specialized problems and practical problems, characterized by the complexity and uncertainty of the conditions in biotechnology and bioengineering, or in the process of learning, which involves the application of theories and methods of biotechnology and bioengineering.	
General competencies (GC)	GC 1	Ability to apply knowledge in practical situations.
	GC 2	Proficiency in written and oral communication in Ukrainian (professional direction).
	GC 3	Ability to communicate in a foreign language.
	GC 4	Skills in using information and communication technology.
	GC 5	Ability to learn and master a modern knowledge.
	GC 6	Safe practice skills.
	GC 7	The desire to preserve the environment.
	GC 8	Ability to realize the rights and responsibilities as a member of society, realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, rights and freedoms of the man and citizen in Ukraine.
	GC 9	Ability to store and multiply moral, cultural, scientific values and achievements of the society on the basis of understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, processes and technology, use different types and forms of motor activity for the active rest and healthy way life.
Professional competencies (PC)	PC 1	Ability to use knowledge of math and physics to the extent necessary to reach other results of the educational program.
	PC 2	Ability to use a thorough knowledge of chemistry and biology to the extent necessary to reach other results of the educational program.
	PC 3	The ability to analyze regulatory documentation, necessary to provide engineering activities in the industry of biotechnology.
	PC 4	Ability to work with biological agents, which are used in biotechnological processes (microorganisms, fungi, plants, animals, viruses, their individual components).
	PC 5	Ability to conduct experimental studies connected with the improvement of biological agents, and cause changes in the structure of the hereditary apparatus and functional activity of biological agents.
	PC 6	Ability to analyze raw materials, semi-finished products, target products of biotechnology production.
	PC 7	Consideration of the commercial and economic context in the design of biotech productions of various applications (industrial, food, pharmaceutical, agricultural, etc.).
	PC 8	Ability to use design techniques for the production of biotechnological products of various applications.
	PC 9	Ability to use knowledge of math and physics to the extent necessary to reach other results of the educational program.
	PC 10	Ability to draw up production flow charts of biotechnological products of various applications.
	PC 11	Ability to draw up production hardware configurations of biotechnological products of various applications.
	PC 12	Ability to put into practice methods and measures of computer-aided design for biotechnological productions of products of various applications.
	PC 13	Ability to evaluate biotechnological efficiency of the process.

	PC 14	The ability to use modern automated biotechnology production management systems of various purposes, their technical, algorithmic, information and software to solve professional tasks.
	PC 15	Ability to comply with biosafety, biosecurity and bioethics.
1.7 – Program learning outcomes		
PLO 1	Be able to apply modern mathematical methods to solve practical problems related to research and design of biotechnological processes. Use knowledge of physics to analyze biotechnological processes	
PLO 2	Be able to perform qualitative and quantitative analysis of substances of inorganic, organic and biological origin, using appropriate methods.	
PLO 3	Be able to measure nutrient media composition, to determine points of their preparation and sterilization, to control the quality of raw materials and finished products based on knowledge of the physicochemical properties of organic and inorganic substances.	
PLO 4	Be able to apply the regulations about products certification, requirements for the organization of quality management systems in enterprises, rules for technical documentation and technological process, based on knowledge gained during practical training.	
PLO 5	Be able to analyze normative documents (state and industry standards, technical guidelines, etc.), compile separate sections of technological and analytical documentation for biotechnological products for various purposes; analyze technological situations, choose rational technological solutions.	
PLO 6	Be able to determine and analyze the basic physicochemical properties of organic compounds that are part of biological agents (proteins, nucleic acids, carbohydrates, lipids).	
PLO 7	Be able to apply knowledge of the composition and structure of different cell types in order to determine the optimal conditions for cultivation and the potential of the cells in biotechnology.	
PLO 8	Be able to isolate and identify microorganisms of different systematic groups from natural ecosystems. Determine the morphological, cultural, physiological, biochemical properties of various biological agents.	
PLO 9	Be able to prepare the basic nutrient media for the cultivation of various biological agents. Evaluate the growth of biological agents in media of different composition.	
PLO 10	Be able to do experimental research to determine the impact of physicochemical and biological factors of the environment on the viability of cells of living organisms.	
PLO 11	Be able to perform basic genetic and cytological studies to improve and enhance the biosynthetic capacity of biological agents, taking into account the principles of biosafety, biosecurity and bioethics (induced mutagenesis using physical and chemical mutagenic factors, selection and accumulation of auxotrophic mutants, etc.).	
PLO 12	Using microbiological, chemical, physical, physicochemical and biochemical methods, be able to perform chemical control (determination of the concentration of disinfectant solutions, titrants, concentration of nutrient components, etc.), technological control (concentration of carbon and nitrogen sources in the culture fluid during the process; target product); microbiological control of nutrient media after sterilization, microbiological purity of biological agent, etc.), microbiological purity and sterility of biotechnological products for various purposes.	
PLO 13	Be able to carry out a feasibility study for the production of biotechnological products for various purposes (determination if there is a need in target product and calculation of production capacity).	
PLO 14	Be able to justify the choice of biological agent, the composition of the nutrient medium and method of cultivation, the necessary additional work and the main stages of the technological process.	

PLO 15	Based on knowledge about the laws of mechanical, hydromechanical, heat and mass transfer processes and basic design characteristics, be able to choose the appropriate equipment in the process of designing the production of biotechnological products for various purposes to ensure their maximum efficiency.
PLO 16	Based on the knowledge gained during the internship at enterprises and institutions, be able to carry out product calculation and calculation of technological equipment.
PLO 17	Be able to compile a material balance for one cycle of the production process, equipment specifications and a map of step-by-step control with the indication of production control points.
PLO 18	Be able to substantiate and select the appropriate technological equipment and graphically depict technological process according to the requirements of regulatory documents using the knowledge gained during practical training.
PLO 19	Be able to use computational design systems to develop technological and hardware schemes of biotechnological productions.
PLO 20	Be able to calculate the main criteria for effectiveness estimation of the biotechnological process (growth parameters of biological agents, the rate of synthesis of the target product, the synthesizing capacity of biological agents, economic coefficient, yield of the target product from the substrate, productivity, nutrient value, etc.).
PLO 21	Be able to formulate tasks for development of automation systems for production of biotechnological products for various purposes.
PLO 22	Be able to apply social, environmental, ethical, economic aspects, the requirements of labor protection, industrial sanitation and fire safety in the formation of technical solutions. Be able to use different types and forms of physical activity for active recreation and healthy lifestyle.
PLO 23	Be able to use in product and social activities fundamental concepts and categories of state formation to substantiate their own views and political beliefs with understanding of Ukraine social and political history, legal principles and ethical norms.
PLO 24	Be able to communicate with specialists and non-specialists about ideas, problems, solutions and personal experience in the field of biotechnology and bioengineering in state (official) or one of the main European languages.

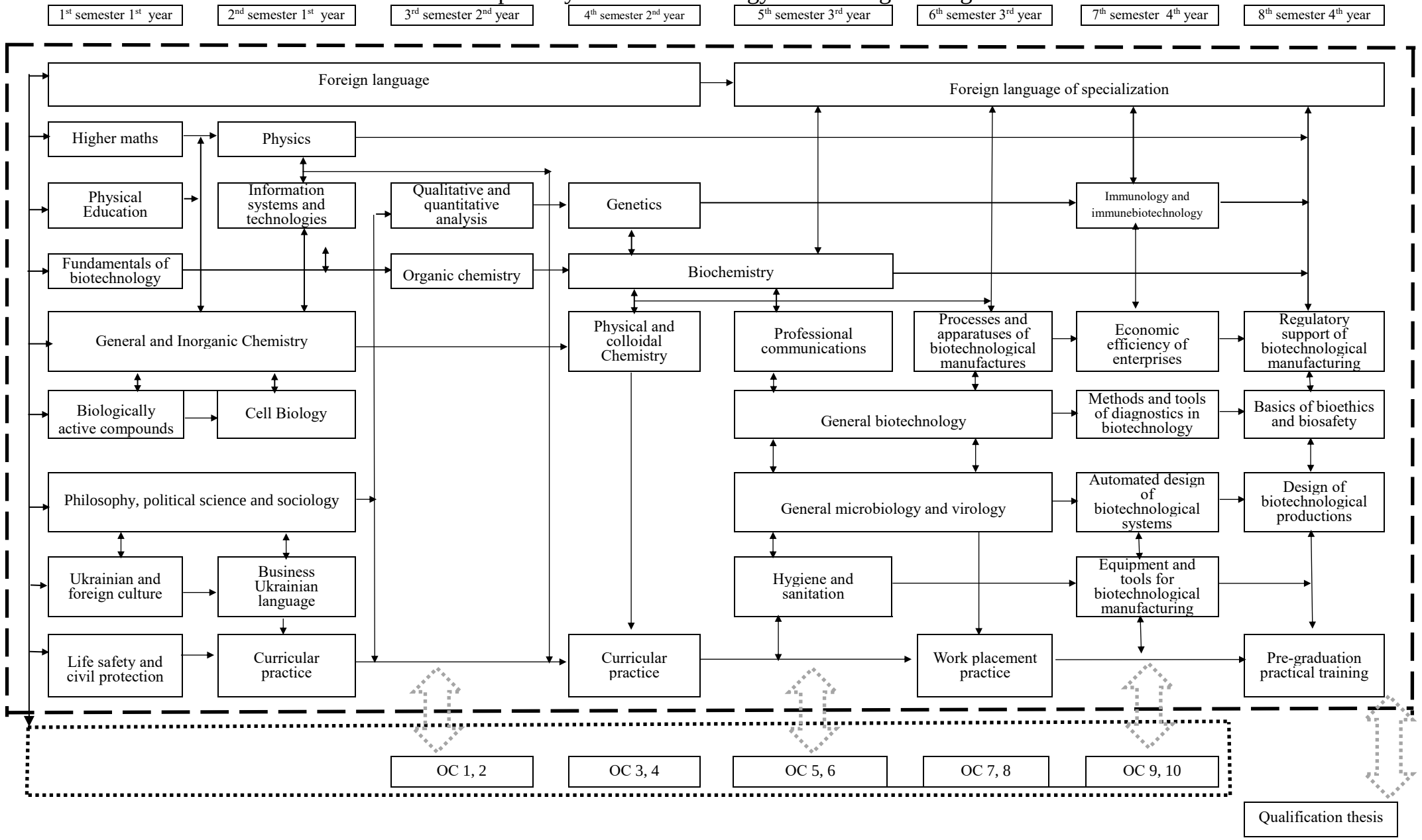
1.8 – Resource support for program implementation	
Staffing	All scientific and pedagogical workers who carry out the educational and professional program correspond to the profile and direction of the disciplines taught by qualification; they have the necessary experience of pedagogical and practical work. Specialists with experience in scientific, managerial, innovative, creative and professional work, foreign teachers are involved in the organization of the educational process.
Material and technical support	Logistics fully allows ensuring the educational process throughout the cycle of training in the specialty. Laboratory equipment includes: complex equipment for the development, production, and characterization of biotechnological products of various origins in structure and function; orbital thermal shaker incubator, natural convection microbiological incubator, electrophoresis chamber, PCR analyzer and PCR box, enzyme-linked immunosorbent assay equipment, microscopes with video cameras for photo and video studies of microbiological objects, spectrophotometers for quantitative and qualitative analysis, microdispensers, centrifuges, including necessary technical support, complete with computer and multimedia equipment. The condition of the premises is certified by sanitary passports that comply with applicable regulations.
Information and methodological support	The program is fully equipped with an educational and methodological complex of all components of the educational program, the availability of which is presented in the modular environment of the educational process of the University.
1.9 – Academic mobility	
Internal academic mobility	Provides for the possibility of academic mobility in some components of the educational program, providing the acquisition of general and / or professional competencies.
International credit mobility	The program opens up prospects for participation and internships in research projects and academic mobility programs abroad (Belgium, Lithuania); conducted in an active research environment.
Education for foreign higher education applicants	Training of foreign applicants for higher education is carried out according to accredited educational programs.

2. List of components of the educational-professional program "Biotechnology" and their logical sequence

2.1 List of components of the educational-professional program

Code of the course	Components of the educational program (educational subjects, course papers, practical training, qualification work)	Number of credits	Form of final control
Compulsory components CC			
CC 1	Ukrainian and foreign culture	2	Credit
CC 2	Foreign Language (English, Latin)	12	Exam
CC 3	Business Ukrainian language	2	Credit
CC 4	Philosophy, political science and sociology	4	Exam
CC 5	Foreign language for specific purposes	8	Exam
CC 6	Life safety and civil protection	2	Exam
CC 7	General and inorganic chemistry	10	Exam
CC 8	Higher mathematics	6	Exam
CC 9	Physics	3	Exam
CC 10	Physical Education	2	Credit
CC 11	Fundamentals of biotechnology	3	Credit
CC 12	Information systems and technologies	2	Exam
CC 13	Qualitative and quantitative analysis	7	Exam
CC 14	Organic chemistry	4	Exam
CC 15	Physical and colloidal chemistry	4	Exam
CC 16	Biologically active compounds	4	Credit
CC 17	Cell Biology	8	Exam
CC 18	Biological chemistry	9	Exam
CC 19	Genetics	4	Credit
CC 20	Professional communications	2	Credit
CC 21	General Microbiology and Virology	9	Exam
CC 22	Immunology and immunobiotechnology	4	Exam
CC 23	Hygiene and sanitation	1	Credit
CC 24	Processes and equipments of biotechnological industries	2	Exam
CC 25	General biotechnology	7	Exam
		1	Coursework
CC 26	Automated design of biotechnological systems	3	Exam
CC 27	Economic efficiency of enterprises	2	Credit
CC 28	Equipment and tools for biotechnological manufacturing	4	Exam
CC 29	Methods and tools of diagnostics in biotechnology	3	Exam
CC 30	Design of biotechnological productions	6	Exam
CC 31	Basics of bioethics and biosafety	2	Credit
CC 32	Regulatory support of biotechnological industries	2	Credit
CC 33	Curricular practice	12	Credit
CC 34	Work placement practice	6	Credit
CC 35	Pre-graduation practice	6	Credit
CC 36	Preparation and defense of qualification work	12	Attestation
The total amount of compulsory components		**180**	
Selective components			
SC	Disciplines of free choice for higher education students	60	Credit
The total amount of sample components		**60**	
TOTAL CRDITS		**240**	

2.2 Structural-logical scheme of the educational-professional program for Bachelor's study in specialty 162 Biotechnology and Bioengineering



3. Form of certification of students for higher education

Form of certification of students for higher education	Certification is carried out in the form of defense of qualification work
Requirements for qualifying work and/or requirements for the qualifying examination in the speciality	During the preparation and defense of the qualification work, the graduate must demonstrate the ability to solve complex specialized tasks or practical problems characterized by the complexity and uncertainty of conditions in biotechnology and bioengineering using theories and methods of biotechnology and bioengineering. The qualification work must be checked for plagiarism. The qualification work must be published in the KNUTD repository.

4. Correspondence matrix of program competencies to the components of the educational program

	IC	GC 1	GC 2	GC 3	GC 4	GC 5	GC 6	GC 7	GC 8	GC 9	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10	PC 11	PC 12	PC 13	PC 14	PC 15
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CC 35	+	+			+	+	+	+				+	+	+		+				+					
CC 36	+	+		+	+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

5. Correspondence matrix of the program learning outcomes to the corresponding components of the educational program

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PLO 13	PLO 14	PLO 15	PLO 16	PLO 17	PLO 18	PLO 19	PLO 20	PLO 21	PLO 22	PLO 23	PLO 24
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