«APPROVED»

Chairman of the board -

Rector _____

Doctor of historical sciences,

Academician, Kozhamzharova D.P.

«___»_____2022

EDUCATIONAL PROGRAM

7M06140- «Mathematical and computer modeling»

Registration number	7M06100009
Code and classification of the field of education	7M06 Information and Communication Technologies
Code and classification of areas of training	7M061 Information and Communication Technologies
Group of educational programs	M094 Information technologies
Type of EP	acting
ISCE level	7
NQF level	7
IQF level	7
Language of instruction	Kazakh, Russian, English
The complexity of the EP	120 credits
Distinctive features of the EP	-
Partner university (JEP)	-
Partner university (DDEP)	-

Shymkent, 2022 y.

Developers:

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12. Sarsenbi Abdizhakhan Manapovich	Director of the Scientific Center "Theoretical and Applied Mathematics"	Stamp

The EP was considered in the direction of training Information and Communication technology at a meeting of the academic committee, protocol № ___ «_____» _____ 2022 y.

Chairman of the Committee _____ Shertayev E. T.

The EP was considered and recommended for approval at Educational-methodical meeting of M. Auezov SKU
Protocol № « » 2022 y.

The EP was approved by the decision of the Academic Council of the University
Protocol № « » 2022 y.

CONTENT

1. CONCEPT OF THE EP

University Mission	Generation of new competencies, training of a leader who translates research and entrepreneurial thinking and culture
University Values	• Openness–open to change, innovation and cooperation. • Creativity – generates ideas, develops them and turns them into values. • Academic freedom – free to choose, develop and act. • Partnership – creates trust and support in a relationship where everyone wins. • Social responsibility – ready to fulfill obligations, make decisions and be responsible for their results.
Graduate Model	• Deep subject knowledge, their application and continuous expansion in professional activity. • Information and digital literacy and mobility in rapidly changing conditions. • Research skills, creativity and emotional intelligence. • Entrepreneurship, independence and responsibility for their activities and well-being. • Global and national citizenship, tolerance to cultures and languages.
The uniqueness of the educational program	• Orientation to the regional labor market and social order through the formation of professional competencies of the graduate, adjusted to the requirements of stakeholders • Practical orientation and emphasis on the development of critical thinking and entrepreneurship, the formation of a wide range of skills that will allow to be functionally literate and competitive in any life situation and be in demand in the labor market
Academic Integrity and Ethics Policy	The University has taken measures to maintain academic integrity and academic freedom, protection from any kind of intolerance and discrimination: • Rules of academic integrity (Minutes of the Academic Council No. 3 dated 30.10.2018); • Anti-Corruption Standard (Order No. 373 n/k dated 27.12.2019). • Code of Ethics (Protocol of the Academic Council No. 8 dated 31.01.2020).
Regulatory and legal framework for the development of EP	1. Law of the Republic of Kazakhstan "On Education"; 2. Standard rules of activity of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by Order of the Ministry of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595 with amendments and additions dated December 29, 2021 No. 614 3. State obligatory standards of higher and postgraduate education, approved by order of the Ministry of sciences and higher education of the republic of Kazakhstan dated July 20.2022 No. 2; 4. Rules for organizing the educational process on credit technology of education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152; 5. Qualification directory of positions of managers, specialists and other employees, approved by order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan dated December 30, 2020 No. 553. 6. Guidelines for the use of ECTS.

	7. Guidelines for the development of educational programs for higher and postgraduate education, Appendix 1 to the order of the Director of the Center for the Bologna Process and Academic Mobility No. 45 o / d dated June 30, 2021
Organization of the educational process	• Implementation of the principles of the Bologna Process • Student-centered learning • Availability • Inclusivity
Quality assurance of the Educational program	• Internal quality assurance system • Involvement of stakeholders in the development of the Educational Program and its evaluation • Systematic monitoring • Actualization of the content (updating)
Requirements for applicants	It is established according to the Model Rules for admission to training in educational organizations, implementing educational programs of higher and postgraduate education, Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 600 dated 31.10.2018

2. EP PASSPORT

Purpose of the EP	Training of specialists with conceptual, analytical and logical thinking, who are able to determine the organization's strategy, possessing a complex of new knowledge in the field of mathematical and computer modeling of processes.
Tasks of the EP	- the formation of socially responsible behavior in society, understanding the importance of professional ethical standards and adherence to these standards; - providing skills and abilities for lifelong learning that will allow them to successfully adapt to changing conditions in their careers; - providing conditions for acquiring a high general intellectual level of development, mastering a competent and developed speech, culture of thinking and skills of scientific organization of labor in the field of modeling technological and natural processes based on information technologies; - ensuring the implementation of the educational process based on the integration of education and science; - the formation of students in-depth and modern knowledge in the field of mathematical and computer modeling of processes, as well as the methodology of teaching them; - formation of skills to search for urgent and promising problems of world and domestic science, the use of modern mathematical modeling apparatus for solving a wide class of problems in science and technology; - the formation of a high scientific culture, pedagogical and research experience, the ability to plan, develop, implement and coordinate scientific research by industry.
Harmonization of EP	• 7th level of the National Qualifications Framework of the Republic of Kazakhstan; • Dublin descriptors of the 7th level of qualification; • 2 cycle of a Framework for Qualification of the European Higher Education Area); • 7th Level of European Qualification Framework for Life long Learning).
Connection of the EP with the professional sphere	The state mandatory standard of postgraduate education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 604; as amended by the Order of the Ministry of Education and Science of the Republic of Kazakhstan dated May 5, 2020 I 182. Rules for the organization of the educational process on credit technology of education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152 with amendments and additions dated October 12, 2018 No. 563; The industry Qualifications Framework "Information and Communication Technologies" (Approved by the minutes of the Meeting of the industry Commissions on Social Partnership and Regulation of Social and Labor Relations in the field of Information and communication technologies dated December 20, 2016, No. 1). Professional standard "Development of Geoinformation systems" (Appendix No. 29 to the order of the Deputy Chairman of the Board of

	the National Chamber entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 24, 2019 No. 259). Professional standard "Software maintenance" (Appendix No. 29 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 24, 2019 No. 259). Professional standard "Creation and management of information technologies" (Appendix No. 40 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 24, 2019 No. 259). Professional standard "Teacher" (Appendix to the order of the Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" No. 133 dated June 8, 2017).
Name of the degree awarded	After the successful completion of this EP, the graduate is awarded the degree of "Master of Engineering" in EP 7M06140 - "Mathematical and Computer Modeling".
List of qualifications and positions	Graduates can hold teaching positions in higher education institutions, engineers, designers and researchers in research institutes, in public and private companies, in education departments, in state and municipal structures, in the media, in industrial enterprises (analytical departments) using mathematical modeling of processes, computers and information and communication technologies, including a specialist in the field of geo information systems, interactive technologies in accordance with the qualification requirements of the National Classifier of the Republic of Kazakhstan (NKZ), approved by the order of the Committee technical regulation and metrology of the Ministry for Investment and Development of the Republic of Kazakhstan dated May 11, 2017 No. 130-od.
Field of professional activity	The sphere of professional activity is the fields of science and education, technologies of a different nature, branches of the real sector of the economy, management and business dealing with mathematical and computer modeling methods, processing statistical and experimental data, as well as with the search, storage, transmission, processing and protection of information.
Objects of professional activity	The objects of professional activity according to EP 7M06140- "Mathematical and Computer Modeling" are: -mathematical modeling of chemical-technological, ecological, physical and economic processes; - mathematical modeling of problems of mechanics, heat and mass transfer of external and internal flows; - mathematical and computer modeling of new technological processes; -system administration of operating systems, programming of production and scientific tasks; - development and management of databases for scientific, industrial and economic problems.
Subjects of professional activity	-development of mathematical and computer models of physical, natural, chemical-technological, environmental and economic processes; -development, use and management of databases;

	-programming in high-level object-oriented languages; -working with modern software packages for data analysis in the fields of science, engineering, economics and technology; - the use of computer, computing and network technologies for solving problems of an applied nature; - development of effective algorithms and programs for the implementation of mathematical models, the use of standard packages of computer mathematical systems; -computer graphics and animation for architectural and design tasks, three-dimensional modeling and visualization of objects
Types of professional activity	Master in EP 7M06140- "Mathematical and Computer Modeling" can perform the following types of professional activities: - research; - pedagogical; - design; - production and technological; - organizational and managerial; - analytical.
Learning outcomes	**LO1** Possess written and oral communication in native and foreign languages, use information management skills **LO2** Be able to independently develop efficient algorithms and programs for computer modeling of natural and man-made processes **LO3** To know the methods for developing efficient models and algorithms for their implementation in the study of the dynamics of gases and liquids in chemical technology devices, power plants, as well as in modeling problems of hydrodynamics, heat and mass transfer, and biotechnology. **LO4**To be able to analyze the stages of development of mathematical modeling of processes and analysis of the results of numerical experiments. **LO5** Be able to apply the latest achievements of mathematical and computer modeling in science, banking, insurance companies and financial structures, incl. foreign scientists **LO6** Understand the need to work in a team to solve modeling problems that require the coordination of efforts of several performers, with knowledge of the tasks of environmental physics. **LO7** Ability to plan and conduct numerical and full-scale experiments of research with the interpretation of the results obtained on the basis of modern modeling methods in the field of economics, engineering and technology. **LO8** Critically analyze existing methods for developing mathematical models in various subject areas using information technology. **LO9** Realize the need for and have the ability to independently learn and improve their qualifications throughout their lives.

3 COMPETENCES OF THE EP GRADUATE

SOFTSKILLS.Behavioral skills and personality qualities	
SS1. Competence in managing one's own literacy	SS1.1.The abilityofself-learn, self-develop and constantly update theirknowledgewithinthechosentrajectory and in an interdisciplinaryenvironment. SS1.2. The abilityto express thoughts, feelings, facts and opinions in the professional field. SS1.3. The abilityformobility in the modern world and criticalthinking.
SS 2. Language competence	SS2.1.The abilitytobuildcommunicationprograms in thestate, Russian and foreignlanguages. SS2.2. The abilityfor interpersonal social and professional communication in theconditionsofinterculturalcommunication.
SS 3. Mathematical Competence and Competenceinthe field of Science	SS3.1.The ability and willingnesstoapplytheeducational potential, experience and personal qualitiesacquiredduringthestudyofmathematical, naturalscience, technicaldisciplines at theuniversitytosolve professional problems.
SS 4. Digital competence, technologica lliteracy	SS4.1. The ability to demonstrate and develop information literacy through the mastery and use of modern information and communication technologies in all areas of their lives and professional activities. SS4.2. The ability to use various types of information and communication technologies: Internet resources, cloud and mobile services for searching, storing, protecting and disseminating information.
SS 5. Personal, social and academic competencies	SS5.1.The ability for physical self-improvement and focus on a healthy lifestyle to ensure full-fledged social and professional activities through the methods and means of physical culture. SS5.2. The aility to social and cultural development based on the manifestation of citizenship and morality. SS5.3 The ability to build a personal educational trajectory throughout life for self-development, career growth and professional success. SS5.4. The ability to successfully interact in a variety of socio-cultural contexts during study, work, home and leisure.
SS 6. Entrepreneurial competence	SS6.1. The abilitytobecreative and entrepreneurial in a varietyofenvironments. SS6.2. The ability to work in a mode of uncertainty and rapidly changing task conditions, mak decisions, allocate resources and manage your time. SS6.3. The ability to work with consumer requests.
SS 7. Cultural awareness and ability to express yourself	SS7.1. The ability to show world view, civil and moral positions. SS7.2. The ability to be tolerant of the traditions and culture of othe rpeoples of the world, to have high spiritual qualities.
HARDSKILLS.	
Theoretical knowledge and practical skills specific to this field	PC1 - knows how to reason, argue and express his opinion in a foreign language.
	PC2 - is able to analyze the stages of development of mathematical modeling of the process and ways to improve the efficiency of the created mathematical and computer models
	PC3 - is able to independently develop effective algorithms and programs for the implementation of mathematical models with verification of the

	adequacy of the results to the object of research
	PC4 - knows organizational forms, modern means, methods and technologies of teaching mathematics and methods of mathematical and computer modeling in educational and scientific institutions of various types
	PC5-is able to develop a design strategy, determine goals, performance criteria, limitations of applicability, new methods, tools and methods of mathematical modeling using information technologies and systems
	PC6-is able to develop mathematical and computer models of chemical-technological, hydrodynamic and environmental processes, heat and mass transfer
	PC7 - knows holistic ideas about the processes and phenomena of technology, technology, animate and inanimate nature, social life; understands and owns the methods of cognition at the level necessary for solving problems, while performing professional functions.

3.1 Matrix for correlating EP learning outcomes as a whole with the resulting competencies of the modules

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9
SS1	+			+					+
SS2	+		+		+				
SS3		+				+			+
SS4			+		+		+		
SS5	+							+	
SS6		+		+				+	
SS7	+					+		+	
PC1			+		+				
PC2			+		+	+	+		
PC3	+			+	+	+	+		
PC4		+					+		+
PC5			+		+		+		
PC6					+			+	+
PC7		+				+		+	+

4.MATRIX OF THE INFLUENCE OF DISCIPLINES ON THE FORMATION OF LEARNING OUTCOMES AND INFORMATION ON LABOR INTENSITY

№	Module name	Cycle	UC/OC	Component name	Brief description of the discipline	Number of credits	Formed LO (codes)								
							LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9
1	Scientific and pedagogical training module	BD	UC	Psychology of management	Knowledge of psychological and pedagogical assistance in the organization of the pedagogical process in various educational institutions. To acquaint with the basic laws of the age anatomical and physiological development of children of preschool and school age. Ability to study the psychological characteristics of students and classrooms to solve professional problems; take into account the individual psychological characteristics of the individual when designing the educational process	4						v			
		BD	UC	History and philosophy of science	The basics of the emergence of philosophy are considered, the features of the emergence of the culture of thinking are revealed, the concepts of "philosophy", "worldview", the essence and content of the concepts of "being", "consciousness" are revealed. The relationship between the concepts of "cognition" and "creativity" is considered, the essence and content of the category of philosophy of freedom are revealed, the skills of highlighting the essence of a philosophical problem, critical thinking, skills of researching philosophical aspects, problems of practice and cognition are developed.	4	v								
		BD	UC	Higher education pedagogy	The issues of modern paradigms of higher education, the system of higher professional education in Kazakhstan are considered. Know the methodology of pedagogical science. Professional competence of a higher school teacher. Organization of the educational process based on the credit system of education in higher education. Methods and forms of training in the training of future specialists. New educational technologies in higher education.	4	v		v						
		BD	UC	Foreign language	The issues of the main types of reading of foreign language original sources with varying degrees of content coverage	4	v								

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№	Module			Discipline	Description	Credits										
		(professional)			are considered. Development of skills in the preparation of written communications on scientific topics in the specialty: scientific report, articles, abstracting sources in a foreign language, annotating the text, resume. Development of oral communication skills in the specialty: presentation of a report, presentation of scientific research, scientific discussion and debate											
2	Mathematical modeling of technological and natural processes	BD	EC	Numerical Methods for Flow Models	Knowledge and understanding of the features of the implementation of numerical methods for models of liquid and gas flows; methods of constructing two systems of equations for describing the flows of a viscous compressible gas - quasi-gas-dynamic and quasi-hydrodynamic (QHD) systems of equations; finite-difference numerical algorithms based on equations of mathematical physics and examples of numerical calculations ensuring stability and convergence	5				**v**				**v**	
		PD	EC	Mathematical modeling in scientific research	Knowledge and understanding of the basic principles of building mathematical models; basic methods for the numerical solution of modern computational physical and chemical problems; Ability to apply the acquired knowledge in theoretical analysis, computer modeling and experimental research of physical and chemical processes, independently acquire new knowledge and skills necessary for practical activities; master other applied programs designed to solve computational problems; Possess algorithmic thinking skills; skills in choosing the optimal numerical method for solving the problem, based on the available base of modern algorithms.	6			**v**	**v**					
		PD	EC	Mathematical and computer modeling of economic processes	Knowledge and understanding of mathematical modeling methods and their applications for the systematic increase in the economic efficiency of management decisions; creation of modeling methods in the field of mathematical economics and computer modeling for government organizations, private companies, international corporations through the development of modern methods of mathematical modeling of economic processes and	6			**v**		**v**					

№	Module name			Discipline name	Learning outcomes	Credits										
					phenomena; computer tools for the practical implementation of mathematical models.											
		BD	EC	Modeling the consequences of man-made disasters	Knowledge and understanding of methods: assessment of technogenic risk and mathematical modeling of the spread of gas emissions into the atmosphere; methods of mathematical and computer modeling of the formation of temperature and concentration zones during combustion of substances; the laws of continuum mechanics and the phenomenological approach to mathematical modeling of forest and steppe fires.	5								v		
				Research Practice	Use theoretical knowledge: defining a problem, formulating a hypothesis and a task; developing a research plan, choosing the best research methods; process the results obtained, analyze them taking into account the level of knowledge of the problem; conduct bibliographic work; present the results of scientific research in the form of reports, abstracts, scientific articles, determine the degree of scientific elaboration of the selected research topic; substantiate the relevance, theoretical and practical significance of the work	7								v		
3	Mathematical modeling in natural science	BD	EC	Modeling and calculation of fluid dynamics in channels	Knowledge and understanding: the peculiarities of modeling the movement of liquids and gases in the contact devices of technological devices; algorithms for engineering calculation of heat and mass transfer in devices with different shapes; algorithms for constructing finite difference and finite-element grids for calculating hydrodynamic and heat and mass transfer characteristics in contact devices of technological devices.	5								v		
		BD	EC	Workshop on solving experimental problems in the MathCAD Prime	Demonstrate knowledge of the basic principles of working in the Mathcad Prime environment, the ability to use operators, built-in functions for solving problems, as well as conduct numerical experiments in the Mathcad environment. Apply knowledge on using the graphic capabilities of the package, as well as for solving a wide	5								v		

				environment	class of mathematical and engineering problems. Have the skills to solve a wide class of mathematical problems and obtain high-precision results, as well as compare their results with the results obtained using other computer applications.										
		PD	EC	Mathematical models of dispersed systems	Know and understand: Definitions of dispersed systems, their classification. Monodisperse and polydisperse systems. Mathematical modeling of the distribution of dispersed systems. Analysis of the stability properties of dispersed systems (dispersion, uniform distribution in a dispersed medium, interphase interactions). The ability of dispersed systems to withstand the phenomena of expansion and subsidence. Theoretical and practical significance of the stability of a dispersed system. Simple models of dispersed systems: suspension, aerosol, gas suspension, bubble media. Simulation of movement s in dispersed media.	4						v		v	
		PD	EC	Applied models of multiphase media	Knowledge and understanding of general and individual equations that reflect the laws of mechanics of multiphase media; modeling the motion of multiphase impurities taking into account phase transitions and momentum, energy transitions; solving some applied problems of chemical technology using models of the mechanics of multiphase media; Three-temperature scheme of the heat transfer process in multiphase media; Stress tensor in multiphase media; Determination of strain tensor and strain rate tensor; Equations of joint phase deformation. Simple models of multiphase media; Flotation model in dispersed systems.	5								v	
		PD	EC	Simulation of deposition processes in chemical technology	Knowledge and understanding of precipitation processes. Implementation of deposition processes according to various technological schemes; problems of research and calculation of various sedimentation processes and devices of chemical technologies and their systems; Suspended sedimentation processes, their mathematical modeling and analysis. Analysis of the influence of sediment formation	5		v							

№	Discipline			Course	Description	Credits										
					on sedimentation processes in suspension. Demonstration of methods of analysis and mathematical modeling of deposition processes in chemical technological systems..											
		PD	EC	Mathematical modeling in physics	Knowledge and understanding: creation of mathematical models of physical and technical objects and processes required for modeling; methods for determining the adequacy of the mathematical model of a physical process; numerical methods, as well as methods of computer modeling using standard and specially developed software; methods for modeling air flows and ocean currents.	4					v					
4	Mathematical modeling of mechanical processes	BD	EC	Mathematical and computer modeling in the scientific study of complex systems	Knowledge and understanding of methods of mathematical modeling as a method of scientific research of complex processes. Planning and conducting numerical experiments with mathematical models. Methods for the development of mathematical models, information technologies and methods for processing simulation results. Establishing the adequacy of mathematical models of deterministic and stochastic processes, in a general setting and in solving scientific and practical problems.	5			v	v						
		BD	EC	Modern methods of mathematical modeling	Knowledge and understanding of different forms of differential and nonlinear equations, variants of initial and boundary conditions, various types of finitedifference schemes used in mathematical and computer modeling; scientific concepts, computational technologies, methods of physical, mathematical and numerical modeling of flows of viscous heat-conducting media in systems using modern advances in computational mechanics and mathematical optimization. Modern methods for the implementation of mathematical models and visualization of numerical results	5			v	v						
		PD	EC	Applied boundary value problems	Acquaintance with the application of applied boundary value problems; Using numerical methods. Methods for developing algorithms for numerical methods and their application to applied boundary value problems. Definition and formulation of boundary value problems. Methods for solving problems and their definition. The concept of numerical integration of the Cauchy problem. Reduction of	4			v					v		

#	Module			Subject	Description	Cr.									
					a linear boundary value problem to the Cauchy problem. Steps for solving a boundary value problem by the superposition method. Transformation of problems for differential equations of the third order to the Cauchy problem. Three point boundary value problems. Algorithm of the method of conjugate operators. Algorithms for solving applied boundary value problems by the finite difference method.										
		PD	EC	Boundary problems of mechanics	Knowledge and understanding: Basic concepts defining relationships and thermodynamic principles of mechanics; applied formalism and technique of direct tensor notation. Description of the required mathematical apparatus, including methods of mathematical modeling of boundary value problems in mechanics; Examples of algorithms for solving boundary value problems in mechanics and procedures for creating the corresponding boundary value problems. Models of boundary value problems in mechanics and algorithms for their application.	4			v		v				
5	Mathematical modeling of applied problems	PD	EC	Mathematical Modeling of the Extraction Process in the System "Solid - State"	Know and understand: the principles of mathematical modeling of the extraction process of poly-disperse materials; experimental and theoretical methods for finding the concentration distribution of the target component depending on the size fractions of the extracted substance; features of the implementation of numerical methods designed to simulate viscous fluid flows in the pores of a poly-disperse material.	4				v					
		PD	EC	Hydrodynamics of flows in technological devices	Know the concept of environmental and technological safety; methods of analysis and assessment of technogenic risk and the basis for the development of recommendations for the application and use of the basic provisions of the safety of technical systems; understand the methodology for assessing chemical hazards based on probabilistic and statistical methods and constructing the presentation of the results of experimental and computational studies on electronic maps of cities.	4						v			
		PD	EC	Applied	Fundamentals of Continuum Mechanics. Concepts about	5						v			

No	Module	PD	EC	Discipline	Description	Cr									
				Models of Continuum Mechanics	different ways of describing the motion of a continuous medium. The system of equations describing the motion of continuous media. Modeling potential and vortex motions. Perfect and viscous movements. Creeping flow models. Simulation of fluid movement in a pipe. Simple models of the Earth's atmosphere. Models of viscous fluid flow around a body. The characteristics of each real environment, their equations of state and rheological equations that determine the relationship between stress and strain and strain rates for a given environment. Dependence of the properties of the entire environment on temperature and other physicochemical parameters. Formulation of initial and boundary conditions for each specific case.										
		PD	EC	Theory of Boundary Layer	The concept of a thin layer of liquid (gas) that forms on the surface of a solid moving in a viscous liquid (gas), or at the boundary of two liquids with different temperatures, chemical composition and velocity. Boundary layer (dynamic boundary layer) due to the change in speed in the horizontal direction. Boundary layer (thermal or temperature) associated with a change in temperature. Boundary layer (diffusion or concentration), characterized by a sharp change in the concentration of individual chemical components. Investigation of the influence of viscosity, thermal conductivity, diffusion properties of a liquid (gas) on the formation of a flow in the boundary layer.	5							v		
6	Mathematical and modeling of biotechnological processes and	PD	EC	Computer modeling and visualization in graphics packages	Know and understand: technology for working with AutoCAD commands; creation of AutoCAD objects; means of ensuring accuracy; creation of basic graphic primitives and the basis of three dimensional modeling in the Autodesk AutoCAD environment; 3D modeling capabilities for visualizing the results of numerical modeling of objects; work with coordinate systems in three-dimensional models	5									v
		PD	EC	Mathematical	Knowledge and understanding: current trends in the	4			v						

No	Module name			Discipline	Description	Credits											
	graphic visualization			modeling of biotechnological processes	development of mathematical modeling of microbiological kinetics; mathematical models of enzymatic catalysis processes; mathematical description of the course of biological processes in time using molecular concepts and principles of physical and chemical kinetics; computer models of modern concepts of fermentation processes..												
		PD	EC	Additional sections of mathematical modeling of modern technological processes	Know and understand: the principles of creating mathematical models of thermos-catalytic synthesis of nanoparticles in periodic and continuous modes; setting the boundary and initial conditions for the concentration of radicals; Laplace transform methods for the implementation of a mathematical model in simple cases (two-dimensional and homogeneous cases); classification of new technological processes and the applied mathematical apparatus.	4			v			v					
		PD	EC	Development of software packages for calculating internal flows	Knowledge and understanding of: the UniHUB technological platform for numerical modeling and calculations of fluid flows using free applied computational packages OpenFOAM and ParaView; setting complex boundary conditions using the built-in and advanced utilities of the OpenFOAM package; a method for calculating turbulence parameters in problems of flow around nozzles in channels using software packages.	5											
7	Methodical Fundamentals of Teaching	PD	UK	Teaching Methods of Special Disciplines	Methodology for teaching specialized disciplines Knowledge and understanding of modern methods and technologies of teaching mathematics and diagnostics of its results; methods of teaching sections of mathematics, often used in mathematical modeling of technical, technological and other systems (differential equations, other systems of equations); ways to develop methods, technologies and techniques for teaching mathematics; methods for establishing the adequacy of mathematical models in a general setting when solving practical problems	5				v							
				Pedagogical practice	To develop a professional research culture in the field of ICT, as a condition of pedagogical skill and pedagogical creativity, to form professional and pedagogical skills, a culture of	4		v									

№	Module			Topic	Content	Credits									
					scientific and pedagogical thinking. Develop educational and methodological documents for the major discipline. Attend lectures by leading teachers; prepare and conduct all types of classes in special disciplines; apply new active forms of conducting classes										
8	Module research work and final certification			Research work of a master's student, including an internship and a master's thesis	The importance of the research part of the dissertation for solving the set task for this level of education is substantiated. The essence of this activity, forms of organization, peculiarities of research activities of undergraduates are considered. The analysis of the state of the chosen direction and subject of research is carried out.	24	v								
				Registration and defense of a master's thesis	Unleash scientific potential, show the ability to organize and conduct independent research in the field of ICT; argue and develop sound recommendations; reveal the level of scientific qualifications; demonstrate the internal unity of work and display the progress and results of the development of the selected topic; apply the rules of registration and defense of a master's thesis; find out the readiness for work in an educational or research institution according to the profile.	12							v		

5.SUMMARY TABLE SHOWING THE VOLUME OF LOANS DISBURSED BY MODULES EDUCATIONAL PROGRAMS

Course of study	Semester	Number of modules to be mastered	Number of subjects studied			Number of credits KZ					Total in hours	Total credits KZ	Количество	
			OK	BK	KB	Theoretical training	Pedagogical practice	Research practice	SRWM	Registration and defense of a master's thesis			exam	diff.test
1	1	3		4	3	29			1		900	30	6	2
	2	4		-	5	23	4		3		900	30	4	2
2	3	3		-	4	21		7	2		900	30	4	2
	4								18	12	900	30		1
итого		10	-	1	12	73	4	7	24	12	3600	120	14	7

6. STRATEGIES AND METHODS OF TRAINING, MONITORING AND EVALUATION

Learning Strategies	**Student-centered learning: the learner is the center of teaching/learning and an active participant in the learning and decision-making process.** **Practice-oriented learning: focus on the development of practical skills.**
Teaching methods	Conducting lectures, seminars, practical and laboratory work with: • application of innovative technologies: • problem learning; • case study; • work in a group; • discussions and dialogues, intellectual games, competitions, quizzes; • software development; • presentations; • rational and creative use of information sources: • multimedia educational programs; • electronic textbooks; • virtual laboratory work; • digital resources. Organization of independent work of students, individual consultations.
Monitoring and assessing the achievability of learning outcomes	Current control on each topic of the discipline, control of knowledge in classroom and extracurricular activities (according to the syllabus). Assessment Forms: • survey in the classroom; • testing on the topics of the academic discipline; • test papers; • protection of independent works; • discussions; • trainings; • colloquia; • essays, etc. Midterm control at least two times during one academic period within the same academic discipline. Intermediate certification is carried out in accordance with the working curriculum, academic calendar. Conduct forms: • exam in the form of testing; • oral exam; • a written exam; • combined exam; • defense of term papers; • protection of practice reports. Final examination.

7. TRAINING AND RESOURCE SUPPORT OF THE EP

Information Resource Center	The structure of the EIC includes 6 subscriptions, 16 reading rooms, 2 electronic resource centers (ERC). The basis of the network infrastructure of the JRC is 180 computers with Internet access, 110 workstations, 6 interactive whiteboards, 2 video doubles, 1 video conferencing system, 3 scanners of A-4 format, 3. The software of the JRC is AIBS "IRBIS-64" under MS Windows (basic set of 6 modules), stand-alone server for uninterrupted operation in the IRBIS system. The library fund is reflected in the electronic catalog available to users on the site http://lib.ukgu.kz on-line 24 hours 7 days a week. Thematic databases of their own generation have been created: "Almamater", "Proceedings of SKSU scientists", "Electronic archive". Online access from any device in 24/7 mode via an external link http://articles.ukgu.kz/ru/pps. Working with catalogs in electronic form. EC consists of 9 databases: "Books", "Articles", "Periodicals", "Proceedings of the teaching staff of SKSU", "Rare Books", "Electronic Fund", "SKSU in Print", "Readers" "SKU". The JIC provides its users with 3 options for accessing its own electronic information resources: from the "Electronic Catalog" terminals in the catalog hall and in the JIC subdivisions; through the information network of the university for faculties and departments; remotely on the library website http://lib.ukgu.kz/. Open access to international and republican resources: "SpringerLink", "Polpred", "Web of Science", "EBSCO", "Epigraph", to electronic versions of scientific journals in the public domain, "Zan", "RMEB", "Adebiet" , Digital library "Aknurpress", "Smart-kitar", "Kitar.кz", etc. For people with special needs and disabilities, the library website has been adapted to the work of visually impaired users
Material and technical base	Specialized Audiences: Computer classes and lecture halls equipped with modern functional and presentation equipment. Modern hardware and licensed software are installed in computer classes. All laboratory rooms are equipped with new generation computers that are in working order, allow for scientific and laboratory work, and are used in full. Computers are united in a local network and connected to the high-speed network of the university. Lecture halls are equipped with computers, multimedia projectors, which allow teaching at a high level. Laboratory instruments and installations Standard kit - "Molecular Physics" (Processing the results of multiple direct measurements, Maxwell's Pendulum) - Installation "Electricity and magnetism" (Modeling, Determination of the specific charge of the Electron by the magnetron method, Hall effect) Standard kit - "Optics" (Dispersion, Diffraction, Polarization, Interference) - Installation for studying the electric hole transition - Installation for studying the external photoelectric effect - Installation for determining the resonant potential of an atom of an inert gas (mercury) with an oscilloscope - Installation for determining the width of the sealing layer of the P-n junction and the concentration of impurities in the region of avalanche breakdown - Devices and equipment

AGREEMENT SHEET
on the Educational program
"6B06140-"Mathematical and computer modeling"

Director of PGE_____Konarbayeva Z. K.

Director of DASc_____Nazarbek U. B.

Director of DE&C_____Bazhirov T. S.