MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN
KARAGANDY UNIVERSITY OF THE NAME OF ACADEMICIAN E.A. BUKETOV

«APPROVED»
By decision of the Board
NJSC «Karaganda University
named after academician E.A. Buketova»
Protocol № 2 от «21» 06 2024 г.
_____ prof. Dulatbekov N.O.

«APPROVED»
By decision of the Board of Directors
NJSC «Karaganda University
named after academician E.A. Buketova»
Protocol №5 от «21» 06 2024 г.

EDUCATIONAL PROGRAM

Level: Master

Degree: master of science in education program «7M07108 - Nanotechnologies and nanomaterials (by fields of application)»

Karaganda,
2024

APPROVAL SHEET

EDUCATIONAL PROGRAM «7M07108 - Nanotechnologies and nanomaterials (by fields of application)»

«AGREED»
Director of JSC «National Center
for Expertise and Certification»
_____ E.N.Zholumbetov
«17» 04 2024 y.

«AGREED»
Director of «NPO Defectoscopy» LLP
_____ T. Zh. Akylbekov
«17» 04 2024 y.

The educational program in the direction of training «7M071 Engineering and engineering» is developed on the basis of:

– Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education";
– Law of the Republic of Kazakhstan dated July 11, 1997 No. 151-I. "About languages in the Republic of Kazakhstan";
– State Mandatory Standards of Higher and Postgraduate Education No. 2 dated July 20, 2022.
– The National Qualifications Framework dated March 16, 2016 by the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations.
- Order of the Ministry of Education and Science of the Republic of Kazakhstan "On approval of the Rules for the organization of the educational process in credit technology" dated April 20, 2011 No. 152 (with amendments and additions dated 07/25/2023 No. 334).
– Classifier of areas of training with higher and postgraduate education dated October 13, 2018 No. 569.

Educational program «7M07108 - Nanotechnologies and nanomaterials (by fields of application)»

Content:

Passport of the educational program

1. Code and name of the educational program: 7M071 Engineering and engineering

2. Code and classification of the field of education, training areas: 7M07 Engineering, manufacturing and construction industries, 7M071 Engineering and Engineering work

3. Group of educational programs: 7M071 Engineering and engineering

4. Volume of credits: 120 ECTS.

5. Form of study: full-time

6. Language of instruction: Kazakh, Russian

7. Degree awarded Master of Technical Sciences in the educational program 7M071 Engineering and engineering

8. Type of EP: the current EP is an educational program, according to which training is carried out at the university.

9. ISCE level (International Standard Classification of Education) – level 7.

10. The level of the NQF (National Qualifications Framework) - level 7.

11. IQF level (Industry Qualifications Framework) – level 7.

12. Distinctive features of EP: - no

13. Number of the appendix to the license for the direction of personnel training: No. 016 KZ 83LAA00018495 dated 07/28/2020.

14. The name of the accreditation body and the validity period of the accreditation of the EP: Certificate of international accreditation of educational programs of NAOKO SA-A No. 0174/2 dated December 23, 2019-December 20, 2024.

15. The purpose of the EP: High-quality training of competitive and competent specialists with a high level of general and professional culture, developed professional language competencies, fundamental knowledge in the field of nanotechnology and nanomaterials, capable of effective professional activity at regional and industry enterprises.

a) Qualification characteristics of the graduate: The graduate the graduate is awarded the degree "Master of science in education program 7M07108 - Nanotechnology and nanomaterials".

b) List of graduate positions: The graduate the graduate is awarded the degree "Master of science in education program 7M07108 - Nanotechnology and nanomaterials".

c) The scope and objects of professional activity of graduates

The objects of professional activity of masters in the educational program 7M07110801 - Nanotechnology and nanomaterials are:

- theoretical and experimental research,
- mathematical and computer modeling,
- design, construction, production technology, materials, components, electronic devices, devices, installations of vacuum, plasma, solid-state, microwave, optical, micro-and nanoelectronics for various functional purposes.

d) Types of professional activities

- analysis based on modern theoretical concepts
- application of physical phenomena in applied research;
- development of formal models and methods used in the creation of nanoobjects of professional activity;
- perfection of formal models and methods used in the creation of nanoobjects of professional activity;
- development of methods of analysis, synthesis of processes of functioning of nanoobjects of professional activity;
- development of methods for optimization of forecasting the quality of the processes of functioning of nanoobjects of professional activity;
- study of methods of analysis and synthesis of processes of functioning of nano-objects of professional activity;
- research of methods of optimization of forecasting of quality of processes of functioning of nanoobjects of professional activity;

- development of standards and technologies for the production of nanoobjects of professional activity;
- application of means of specification of methods of development of standards and technologies of production of nanoobjects of professional activity.

16. Functions of the graduate's professional activity

-analysis of the state and dynamics of engineering nanotechnology;

-planning, staging and conducting theoretical and experimental research in the field of engineering nanotechnology in order to find principles and ways to improve the objects of professional activity, substantiation of their technical characteristics, determining the conditions of use and operation;

-participation in the work on the complex solution of innovative problems - from the idea, fundamental and applied research to the creation of industrial products and the organization of mass production

-development of new technological processes of production of experimental and serial samples of products on the basis of complex use of nanomaterials, micro-nanomodules, nanotechnology;

-participation in the team of performers in the organization and management of the technological cycle of production of experimental and serial products; control over the parameters of nanotechnology processes and the quality of production of products; certification tests of products and nanotechnology equipment.

17. Formulation of learning outcomes based on competencies

Type of competencies	Learning outcome code	Learning outcome
1. Behavioral skills and personal qualities: ((Soft skills)	*ON 15*	To apply knowledge of traditional and modern problems of history and philosophy of science in scientific and pedagogical activity in the professional direction.
	ON 4	To analyze the modern paradigm of higher education and its content; to identify the features of modern didactic concepts in higher education; to demonstrate knowledge in the field of modern educational technologies; to choose the optimal and most effective modern educational technologies and forms of organization of the educational process in higher education.Has the skills to select and justify the methods necessary to solve specific problems in chemistry, chemical technology, medicine, chemical analysis using nanoobjects and nanotechnology. Independently conducts a natural science experiment and analysis of its results, using modern technologies to solve fundamental scientific and applied professional tasks. He knows the structure and properties of substances in the nanostructure, methods of obtaining and methods of studying nanostructures and nanomaterials, potential opportunities and risks of using nanostructured objects.
	ON 3	Apply the knowledge, techniques and methods of psychology to regulate conflicts in educational organizations, in professional activities.
	ON 14	Apply basic knowledge in the fields of commercialization of innovations and evaluation of the commercial potential of innovations in cognitive and professional activities.
	ON 10	Apply foreign languages at a level that allows effective interaction in a professional and scientific environment; carry out further training and development of a linguistic personality.
2. Digital competencies: (Digital skills):	*ON 12*	To develop schemes for the organization of scientific research using methods of scientific cognition in the field of innovation in natural science, technical and technological research.
	ON 2	To evaluate the main methods of processing and analysis of measurement information, the current level of development of information and measurement technologies and trends in their development; to experiment with lasers and the simplest laser devices; to develop software and

		hardware complexes for collecting, processing and presenting measurement information.
	ON 5	Apply the principles and methods of scientific research to conduct experiments, collect, process scientific information, select scientific journals and present research results in the form of an article or report.
	ON 11	To use and develop the theoretical foundations of traditional and new branches of physics and chemistry with the involvement of information databases, nanomaterial technologies in solving professional problems in the field of nanomaterials and nanotechnology.
	ON 13	To apply the classification of nanostructures and methods of their manufacture, the main patterns of interaction of optical radiation with nanostructures to study the patterns of formation of spectral characteristics of nanostructures.
3. Professional competencies: (Hard-skills)	*ON 7*	Explain the principles of operation of spintronics devices, apply control methods in various semiconductor nanostructures.
	ON 1	Apply the regularities of the methodology of science in the field of nanomaterials and nanotechnology to solve problems related to the development of new and improvement of existing processes for obtaining nanomaterials and nanosystems and forecasting the properties of nanomaterials.
	ON 9	Apply methods of modeling, analysis, evaluation of forecasting and optimization of technological processes and properties of micro- and nanosystems in scientific and pedagogical activities.
	ON 8	Has the skills to select and justify the methods necessary to solve specific problems in chemistry, chemical technology, medicine, chemical analysis using nanoobjects and nanotechnology. Independently conducts a natural science experiment and analysis of its results, using modern technologies to solve fundamental scientific and applied professional tasks. Independently measures the main parameters of laser radiation; develops new devices for solving problems of analysis and control of technological chains; maintains laser technology.
	ON 6	Analyze the operation of electronics installations and devices, formulate proposals for improving the devices of technological equipment.

18. Determination of modules of disciplines in accordance with the results of training

Learning outcome code	Module name	Name of discipline	Volume (ECTS)
LO 5	Philosophical and historical aspects of social and humanitarian knowledge	History and philosophy of science	4
LO 4		Higher School Pedagogy	4
LO 3		Psychology of management	4
LO 4		Teaching practice	4
LO 10	Professional language	Foreign language (professional)	4
LO 10		Professional foreign terminology of nanotechnology and nanoelectronics	5

LO 5, LO 10		Theory and methodology of preparation of a scientific publication in a foreign language	
LO 14	The innovation process the organization of scientific research	Commercialization of the results of scientific and technical activities	5
LO 7, LO 8		Advanced technologies in micro and nanoelectronics	
LO 12		Innovation in science, technology research	5
LO 6		Functional electronics	
LO 13	Fundamental principles of nanotechnology	Fundamentals basics of nanotechnology	4
LO 1		Nanophotonics (in English)	4
LO 7		Basics of spin electronics	4
LO 1	Scientific and experimental foundations of nanotechnology	Methods of contactless diagnostics of nanosystems and nanoobjects	4
LO 11		Research methods for nanomaterials	
LO 9		Modeling and design of micro and nano systems	4
LO 2		Computer methods for analyzing the properties of nanoobjects	
LO 9, LO 1		Research methods and diagnostics of nanoobjects and nanosystems	4
LO 8, LO 9		Methods of teaching nanotechnology in electronics	
LO 1, LO 6		Nanotechnologies and nanomaterials in electronics	5
LO 1		Nanomaterial technology	
LO 2		Measuring systems in nanotechnology	4
LO 6		Electronic measurements in nanotechnology and microelectronics	
LO 1		Laser technology in micro and nanosystem technology	4
LO 2		Laser physics and technology	4
LO 4, LO 6		Methods of teaching special disciplines in higher education	4
LO 4		Methods of teaching nanotechnology in electronics	

19. Matrix of achievability of learning outcomes

NN	Name of disciplines	Brief description of the discipline	Number of credits	Generated learning results (codes)														
				OH 1	OH 2	OH 3	OH 4	OH 5	OH 6	OH 7	OH 8	OH 9	OH 10	OH 11	OH 12	OH 13	OH 14	OH 15
Cycle of basic disciplines University component																		
D1	History and philosophy of science	The purpose of the discipline - deepening the knowledge of philosophy and methodology of science, systematization of knowledge about science as a cognitive activity, study of the features of scientific cognition. The course content includes familiarization with the functions of science in the life of society, the ways of correlation of rational and irrational, logic and intuition, discovery and justification in scientific knowledge, the genesis of institutional forms of scientific activity.	15															+
D2	Higher school pedagogy	The pedagogy of higher education is designed to put on a scientific basis both the solution of the problem of higher education for specific specialties, and the development by undergraduates in their future professional activities of managing the process of mastering this content. The pedagogy of higher education allows us to scientifically substantiate the requirements for the modern educational process and identify its regularities.	4				+											
D3	Psychology of management	The purpose of the discipline - formation of undergraduates' systemic ideas about the psychological patterns of managerial activity, theoretical positions and actual problems of management psychology, disclosure of the specifics of the use of socio-psychological knowledge in the structure of the manager's activities, personal characteristics of the head, mastering the skills of analyzing the socio-psychological principles underlying effective management.	3			+												

D4	Foreign language (professional)	The purpose of the course: improving the level of proficiency of undergraduates in a foreign language to solve social and communicative tasks. Course content: mastering the skills of expressing opinions, argumentation of decisions and actions, analysis of socially significant processes and problems; free use of three main components: the sphere of communication and topics, socio-cultural cognition, linguistics.	10										+						
	Professional foreign terminology of nanotechnology and nanoelectronics	The purpose of the course: the study of foreign terminology on nanotechnology and nanoelectronics, its specifics, mastering the skills of using foreign terminology on nanotechnology and nanoelectronics in the preparation of reports and publications on the subject of research. Course content: skills of formulating and substantiating a point of view in solving scientific problems, methods of preparing scientific publications using terminology on nanotechnology and nanoelectronics.	10										+						
	Theory and methodology of preparation of a scientific publication in a foreign language	The purpose of the course: familiarization with the theory, methodology of preparation and skills of writing a scientific publication in a foreign language, mastering the skills of analysis and selection of journals included in the Scopus, Thomson Reuters databases on the subject of research. Course content: methods of writing a scientific article on the profile for submission to journals in a foreign language, including journals included in the Scopus, Thomson Reuters databases. The specifics of the preparation of the article, the compilation of the glossary, the algorithm of writing the publication, the formulation of conclusions.	5,10					+					+						
Cycle of basic disciplines Component of choice																			
D5	Commercialization of the results of scientific and technical activities	The purpose of the discipline - studying the process of commercialization of the results of scientific and intellectual activity, attracting investments, introducing developments into production and their further	14															+	

		support. Content of the discipline: legal bases of commercialization of scientific achievements, technologies of commercialization of inventions and innovations, business plan and tender documentation of the commercialization project.																	
	Advanced technologies in micro and nanoelectronics	The purpose of the discipline: to study the theoretical foundations of various types of micro- and nanoelectronics devices, to develop skills in applying the principles of micro- and nanoelectronics to automate process control. Tasks: to use micro- and nanoelectronics methods that allow solving specific practical tasks; skills in interpreting physical ideas, their quantitative formulation and solving physical problems; knowledge of the theoretical foundations of micro- and nanoelectronics, analysis of various dependencies, principles of functioning of micro- and nanoelectronics devices.	7,8							+	+							
D6	Innovation in science, technology and technology research	The purpose of the discipline - mastering the methodology of substantiating technical solutions in innovation management, promoting innovative products to the market, determining the main directions of effective scientific, technical and production activities of the organization in the areas of development, implementation and commercialization of innovations. The content of the course is aimed at studying the role of innovations and innovative technology markets in the development of the world economy, studying the features of innovation activity in certain groups of countries.	12												+			
	Functional electronics	The purpose of the course: the formation of a new physical worldview among undergraduates, but not circuit-based methods of processing and storing information to understand the further development of microelectronics. In the course of studying the discipline, the basics of electronics are considered, including the device and the principle of operation of electronic components; non-circuitry methods of processing and storing information; methods and means of automated modeling and design of electronic circuits.	6						+									

SPECIALTY ORIENTED MODULES																			
D7	Fundamentals basics of nanotechnology	Purpose: to conduct technological research; to form a holistic view of the professional activity of creating innovations. Tasks: general characteristics of the technical blocks of the innovation process; fundamentals of scientific knowledge and creativity, collection and processing of scientific and technical information. The main concepts related to innovation management; the purpose of innovation activity and the main provisions of a systematic approach to innovation management; the role and tasks of an innovator specialist.	13													+		
D8	Nanophotonics (in English)	The purpose of the course is a deeper study of the physical principles of optics of nanoscale systems, familiarization with the development trends in the field of nanophotonics and their application in science and practice. In the course of studying the discipline, the fundamental foundations of the interaction of light with nanoobjects of different nature, experimental methods of nanophthonics, promising directions in this field are considered.	1	+														
D9	Basics of spin electronics	The purpose of the course is to formulate the concept of electron, multi–electron atom and photon spins, to master the methods of controlling them in various semiconductor nanostructures. In the course of studying the discipline, the issues of physics of low-dimensional systems with spin-orbit interaction, mathematical models for describing the properties of spin density and methods for controlling them in various semiconductor nanostructures, comparison of techniques for the orientation of charge carrier spins in semiconductors are considered.	7							+								
SPECIALTY ORIENTED ELECTIVE MODULES																			
D10	Methods for non-contact diagnostics of nanosystems and	The purpose of the discipline: obtaining theoretical skills and competencies in the field of existing and promising technologies	1	+														

	nanoobjects	for contactless diagnostics of nanosystems and nanoobjects. The course content includes the study of technologies of optical, atomic force and electron microscopy, X-ray spectroscopy and diffractometry.																	
	Research methods for nanomaterials	The purpose of the discipline: acquisition of skills in working with nanometer-sized objects and mastering modern physico-chemical research methods. The course discusses methods for studying nanoparticles and nanocomposites: scanning and transmission probe microscopy, optical methods for studying nanostructures.	11											+					
D11	Modeling and design of micro and nano systems	The purpose of the discipline: the formation of undergraduates' skills and abilities to apply modeling methods in order to effectively optimize the properties of materials and components of nano- and microsystem technology. This course discusses methods of formal description of micro- and nanosystems components; methods of calculation and modeling of basic components of micro- and nanosystems, methods of calculation and modeling of basic processes in the manufacture of components of micro- and nanosystems.	9									+							
	Computer methods for analyzing the properties of nanoobjects	The purpose of the discipline: the formation of undergraduates' knowledge of the theoretical foundations of modern computer methods of analysis, analytical techniques and techniques, statistical processing of analysis results. In the course of studying the discipline, the issues of developing skills of practical application of these methods for the analysis of specific technical objects in solving professional problems of nanotechnology and nanoindustry are considered.	2		+														
D 12	Modeling and design of micro and nano systems	The purpose of the discipline: the formation of undergraduates' skills and abilities to apply modeling methods in order to effectively optimize the properties of materials and components of nano- and microsystem technology. This course discusses methods of formal description of micro- and nanosystems components; methods of calculation and modeling of basic components of micro- and nanosystems, methods of calculation and modeling of basic processes in the manufacture of components of micro- and nanosystems.	9,1	+								+							

	Methods of teaching nanotechnology in electronics	The purpose is to give an idea about the features of the application of nanotechnology in electronics (including molecular), about the main directions of the development of nanoelectronics and the areas of its use.Tasks: to get acquainted with the historical stages of the origin of nanoelectronics, to determine the role of microelectronics at the present stage. To consider the achievements of nanotechnology in electronics, prospects and trends of its further development.	8,9								+	+						
D13	Nanotechnologies and nanomaterials in electronics	The purpose of the course is to study the main classes of nanotechnologies and nanomaterials used in the manufacture of electronics devices. The course covers the basics of nanotechnology and nanomaterials in electronics; the peculiarities of the influence of nanomaterials on the properties of metals, methods of studying nanomaterials and nanostructures, methods of forming nanomaterials.	1,6	+					+									
	Nanomaterial technology	The purpose of the course: mastering by undergraduates of the basic technologies for obtaining nanomaterials for experimental research. The course discusses the issues of electron microscopy, the principles of scanning tunneling, atomic force microscope, methods for obtaining thin films and heterostructures by molecular beam epitaxy and nanophotolithography, ion-track technology.	1	+														
D14	Measuring systems in nanotechnology	The purpose of the discipline: the formation of undergraduates' skills of verification and calibration of measuring instruments, skills of working with measuring systems in nanotechnology. The course content includes the study of methods of verification, calibration of measuring instruments, methods of measuring parameters and characteristics of objects and products of nanotechnology and nanoindustry.	2		+													

	Electronic measurements in nanotechnology and microelectronics	The purpose of the discipline: the formation of undergraduates' skills in using technical means to measure and control the main parameters of technological processes, properties of materials and products. The course content includes consideration of modern electronic and measuring devices used in scientific research, methods of testing and testing of devices and systems of microelectronics and nanotechnology.	6						+										
D15	Laser technology in micro and nanosystem technology	The content of the course includes consideration of modern electronic and measuring instruments used in scientific research, methods of testing and testing devices and systems of microelectronics and nanotechnologies. The content of the course includes consideration of modern electronic and measuring instruments used in scientific research, methods of testing and testing devices and systems of microelectronics and nanotechnologies.	1	+															
	Laser physics and technology	The purpose of the course: the formation of undergraduates' ideas about the physics of laser operation, the properties of laser radiation, the skills of using lasers in science, technology, and production. The course discusses ideas about the principles of operation, the design of lasers, the properties of laser radiation, types of lasers, pulsed modes of their operation, introduces the most common laser systems, issues of interaction of laser radiation with matter and areas of application of lasers.	2		+														
D16	Methods of teaching nanotechnology in electronics	It is studied in order to form knowledge about the totality of means, methods and forms of teaching special disciplines and the acquisition by undergraduates of the necessary practical skills in organizing the educational process for the study of disciplines of a special cycle, preparing methodological support for the educational process of training specialists..	4,6				+		+										
	Methods of teaching special disciplines in higher education	It is studied in order to form knowledge about the totality of means, methods and forms of teaching special disciplines and the acquisition by undergraduates of the necessary practical skills in organizing the educational process for the study of disciplines of a special cycle, preparing methodological support for the educational process of training specialists.	4				+												

20. Coordination of the planned learning outcomes with the methods of teaching and evaluation within the module

Learning result code	The result of the training (according to Bloom's taxonomy)	Teaching methods	Assessment methods
ON15	To apply knowledge of traditional and modern problems of the history and philosophy of science in scientific and pedagogical activities in the professional field. Interactive lecture, case methods, round table, analysis of publications, demonstration of speech, Colloquium, testing.	Interactive lecture, case-methods, round table, analysis of publications, demonstration of speech	Colloquium, testing
ON4	To analyze the modern paradigm of higher education and its content; to identify the features of modern didactic concepts in higher education; to demonstrate knowledge in the field of modern educational technologies; to choose the optimal and most effective modern educational technologies and forms of organization of the educational process in higher education.	Interactive lecture, experimental works intended for scientific research	Project preparation
ON3	Apply knowledge, techniques and methods of psychology to conflict management in educational organizations and in professional activities.	Interactive lecture, experimental works intended for scientific research	Written work
ON14	Apply basic knowledge in the fields of commercialization of innovations and assessment of the commercial potential of innovations in cognitive and professional activities.	The round table	Portfolio
ON10	To apply foreign languages at a level that allows effective interaction in a professional and scientific environment; to carry out further education and development of a linguistic personality.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
ON12	To develop schemes for the organization of scientific research using methods of scientific cognition in the field of innovation in natural science, technical and technological research.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Testing
ON2	To evaluate the main methods of processing and analyzing measurement information, the current level of development of information and measurement technologies and trends in their development; to experiment with lasers and the simplest laser devices; to develop software and hardware complexes for collecting, processing and presenting measurement information.	Analysis of the conducted experiments, analysis of scientific literature, presentation of reports	Report, presentation
ON5	Apply the principles and methods of scientific research to conduct experiments, collect and process	Monitoring the implementation of an individual research plan by doctoral	Report, presentation

	scientific information, select scientific journals and present research results in the form of an article or report.	students (publication of scientific results, preparation of a dissertation).	
ON11	To use and develop the theoretical foundations of traditional and new branches of physics and chemistry with the involvement of information databases, nanomaterial technologies in solving professional problems in the field of nanomaterials and nanotechnology.	Analysis of the results of the intermediate and final certification of the research work of PhD students. Organization and monitoring of the defense of doctoral dissertations.	Testing
ON13	To apply the classification of nanostructures and methods of their manufacture, the basic patterns of interaction of optical radiation with nanostructures to study the patterns of formation of spectral characteristics of nanostructures.	Interactive lecture, case-methods, round table, analysis of publications, demonstration of speech	Colloquium, testing
ON7	To explain the principles of operation of spintronics devices, to apply control methods in various semiconductor nanostructures.	Interactive lecture, experimental works intended for scientific research	Project preparation
ON1	Apply the regularities of the methodology of science in the field of nanomaterials and nanotechnology to solve problems related to the development of new and improvement of existing processes for obtaining nanomaterials and nanosystems and forecasting the properties of nanomaterials.	Interactive lecture, experimental works intended for scientific research	Written work
ON9	Apply methods of modeling, analysis, evaluation of forecasting and optimization of technological processes and properties of micro- and nanosystems in scientific and pedagogical activities.	The round table	Portfolio
ON8	To choose methods for solving specific problems in chemical technology, medicine, chemical analysis using nanoobjects and nanotechnology, to assess the potential opportunities and risks of using nanoobjects.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
ON6	Analyze the operation of electronic installations and devices, formulate proposals for improving the devices of technological equipment.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Protection

22. The graduate model of the educational program

Attributes:

- deep professional knowledge in their field of study;
- interest in mastering trends in education and science;
- ability to collaborate in the professional community;
- independence in the search for opportunities for professional and personal development;
- sociability;
- tolerance and good manners;
- academic integrity;
- willingness to participate in solving state tasks and strategies of Kazakhstan.

Types of competencies	Description of competencies
1. Behavioral skills and personal qualities (Soft skills)	To apply knowledge of traditional and modern problems of history and philosophy of science in scientific and pedagogical activity in the professional direction.To analyze the modern paradigm of higher education and its content; to identify the features of modern didactic concepts in higher education; to demonstrate knowledge in the field of modern educational technologies; to choose the optimal and most effective modern educational technologies and forms of organization of the educational process in higher education.Apply the knowledge, techniques and methods of psychology to regulate conflicts in educational organizations, in professional activities.Apply basic knowledge in the fields of commercialization of innovations and evaluation of the commercial potential of innovations in cognitive and professional activities.Apply foreign languages at a level that allows effective interaction in a professional and scientific environment; carry out further training and development of a linguistic personality.
2. Digital competencies (Digital skills):	To develop schemes for the organization of scientific research using methods of scientific cognition in the field of innovation in natural science, technical and technological research.To evaluate the main methods of processing and analysis of measurement information, the current level of development of information and measurement technologies and trends in their development; to experiment with lasers and the simplest laser devices; to develop software and hardware complexes for collecting, processing and presenting measurement information.Apply the principles and methods of scientific research to conduct experiments, collect, process scientific information, select scientific journals and present research results in the form of an article or report.To use and develop the theoretical foundations of traditional and new branches of physics and chemistry with the involvement of information databases, nanomaterial technologies in solving professional problems in the field of nanomaterials and nanotechnology.To apply the classification of nanostructures and methods of their manufacture, the main patterns of interaction of optical radiation with nanostructures to study the patterns of formation of spectral characteristics of nanostructures.

3. Professional competencies (Hard skills)	Explain the principles of operation of spintronics devices, apply control methods in various semiconductor nanostructures.Apply the regularities of the methodology of science in the field of nanomaterials and nanotechnology to solve problems related to the development of new and improvement of existing processes for obtaining nanomaterials and nanosystems and forecasting the properties of nanomaterials.Apply methods of modeling, analysis, evaluation of forecasting and optimization of technological processes and properties of micro- and nanosystems in scientific and pedagogical activities.Has the skills to select and justify the methods necessary to solve specific problems in chemistry, chemical technology, medicine, chemical analysis using nanoobjects and nanotechnology. Independently conducts a natural science experiment and analysis of its results, using modern technologies to solve fundamental scientific and applied professional tasks. Independently measures the main parameters of laser radiation; develops new devices for solving problems of analysis and control of technological chains; maintains laser technology.Analyze the operation of electronics installations and devices, formulate proposals for improving the devices of technological equipment.

Developers:

Head of the Department of Radiophysics and Electronics,PhD — G.K. Alpysova
Professor, Candidate of Physical and Mathematical Sciences — A.K.Aimukhanov
Associate Professor, PhD — A.K. Zeinidenov

Notes.

The educational program was reviewed by the faculty council from 25.04.24 Protocol no. 9
The educational program was reviewed at the meeting of the Academic Council from 29.04.24 Protocol no. 5
The educational program was reviewed and approved at the meeting of the University Board from 24.05.24 Protocol no. 8

Board Member-Vice-Rector for Academic Affairs — **M.M.Umurkulova**

Director of the Academic Work Department — **T.M. Khasenova**

Dean of the Faculty of Physics and Technology — **A.K. Zeinidenov**

EDUCATIONAL PROGRAM DEVELOPMENT PLAN
7M07108 - Nanotechnology and nanomaterials (by field of application)

The purpose of the Plan - is to contribute to improving the quality of the conditions for the implementation of the educational program, taking into account the current requirements of the labor market and the achievements of modern science.

Target indicators

№	Indicators	Unit of measurement	2024-2025 (plan)	2025-2026 (plan)	2026-2027 (plan)	2027-2028 (plan)
1	**Human resources development**					
1.1	The increase in the number of teachers with academic degrees	Number of people	1	1	1	1
1.2	Advanced training in the field of teaching	Number of people	1	1	1	1
1.3	Involvement of practitioners in teaching	Number of people	1	1	1	1
1.4	Other	Number of people				
2	Promotion of Educational Programs in the ratings					
2.1	IQAA	Position	50	70	80	100
2.2	IAAR	Position	500	600	800	1000
2.3	Atameken	Position	-	-	-	-
3.	**Development of educational and scientific-methodical literature, electronic resources**					
3.1	Textbooks	Quantity	1			
3.2	Tutorials	Quantity	1	1	1	1
3.3	Methodological recommendations/instructions	Quantity	1	1	1	1
3.4	Electronic book	Quantity	1	1	1	1
3.5	Video/audio lectures	Quantity	1	1	1	1
3.6	Other	Quantity				
4.	**Development of educational and laboratory base**					
4.1	Purchase of software products	Quantity		1	1	1
4.2	Purchase of equipment	Quantity	1	2	2	1
4.3	Other	Quantity				

5.	**Actualization the content of Educational Programs**					
5.1	Updating the results of training and the list of disciplines, taking into account the requirements of the labor market, scientific achievements, professional standards	Year	5%	5%	5%	5%
5.2	Introduction to Educational Programs of academic disciplines in foreign languages*	Year	-	1	1	1
5.3	Introduction of new teaching methods	Year	1	1	1	1
5.4	Opening of a joint/double degree program based on Educational Programs	Year	-	-	1	1
5.5	Other	Year				

Head of the Department of Radiophysics and Electronics **Alpyssova G.K.**