Ministry of Science and Higher Education of the Republic of Kazakhstan
Karaganda University of the name of academician E.A. Buketov

«APPROVED BY»
The decision of the Administration of
NLC «Karaganda University of the name
of academician E.A. Buketov»

Protocol № 8 dated 24.05.2024

prof. N.O. Dulatbekov

«APPROVED BY»
The decision of the Directory Board of
NLC «Karaganda University of the name
of academician E.A. Buketov»

Protocol № 5 dated 21.06.2024

EDUCATIONAL PROGRAM

7M05302 – Physics

Level: Master's Degree

Karaganda,
2024

APPROVAL SHEET

EDUCATIONAL PROGRAM «7M05302 – Physics»

«AGREED»

Director of the Zh. Abishev Chemical-Metallurgical Institute

_____ S.O.Baysanov

«__18__» _____04_____ 2024

«AGREED»

Director of the Institute of Organic Synthesis and Coal Chemistry

_____ Z.M.Muldakhmetov

«__18__» _____04_____ 2024

The educational program 7M05302-«Physics» was developed on the basis of:

– Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III «On Education».

– State Compulsory Standard for Postgraduate Education dated August 31, 2018 No. 604.

– 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 organizing the educational process in credit technology» dated April 20, 2011 No. 152 (with amendments and additions dated August 11, 2023).

– Classifier of areas of training for personnel with higher and postgraduate education dated October 13, 2018. No. 569 (with amendments and additions as of 08/12/2023).

Content:

Passport of the educational program

Code and name of the educational program: 7M05302-«Physics»

Code and classification of the field of education, areas of training: 7M05 Natural Sciences, Mathematics and Statistics; 7M053 Physical and Chemical Sciences

Group of educational programs: M090 Physics

Volume of credits: 120 academic credits.

Form of study: full-time

Language of instruction: Kazakh, Russian, foreign languages.

Degree awarded: Master's degree in the educational program 7M05302-«Physics».

Type of OP: current OP.

ISCED level: Level 7.

Level according to the NRK: Level 7.

ORC level: Level 7.

Distinctive features of OP: none

Appendix number to the license for the direction of personnel training: State license of the Ministry of Education and Science of the Republic of Kazakhstan KZ83LAA00018495, date of issue: July 28, 2020.

The name of the accreditation body and the validity period of the OP accreditation: IQAA, SA-A No. 0242/3, date of issue: May 28, 2022 y., validity period: May 27, 2027 y.

The purpose of the OP: The purpose of education is to increase the efficiency of higher educational institutions and research organizations that train masters; to stimulate independent educational, research and pedagogical activities of undergraduates; to ensure the recognition of documents of the Republic of Kazakhstan on the award of the academic degree «master» in the international educational space and on the international labor market.

Qualification characteristics of the graduate

The list of graduate positions: A graduate of the Master's degree is awarded a Master of Science degree in the educational program 7M05302-«Physics». A graduate can hold the following positions: researcher, teaching assistant, curator, head of an organization, head of a structural unit, deputy head of a structural unit.

The sphere and objects of professional activity of the graduate: The master's degree program carries out his professional activities in the field of science and technology.

The objects of professional activity of masters are:

- for scientific and pedagogical training – research institutes, research centers, research laboratories, design and design bureaus, firms and companies, higher education institutions, state educational institutions and educational enterprises, as well as non-governmental educational organizations, ministries, public administration bodies of the relevant profile, organizations of the higher and secondary special education system education.

Types of professional activity of the graduate: experimental research; educational (pedagogical); organizational and managerial; teaching; educating; methodical; social and communicative.

Functions of the graduate's professional activity:

- research;
- educational;
- formulation of the task and plan of scientific research in the field of physics on the basis of bibliographic work with the use of modern information technologies;
- implementation of adjustment, adjustment and experimental verification of physical devices, systems and complexes;
- design and construction of various types of systems, blocks and nodes of justifications;
- educating;
- methodical;
- social and communicative.

Formulation of learning outcomes based on competencies

Type of competencies	Learning result code	Learning result (according to Bloom's taxonomy)
1. Behavioral skills and personal qualities: (Soft skills)	RC 1	Actualizes the acquired knowledge in the field of the history and philosophy of science, using the forms and methods of pre-scientific, scientific and extra-scientific knowledge, forming their own scientific ideas and hypotheses, defending them with arguments, choosing the optimal methodology for theoretical and applied research.
	RC 2	Establishes interpersonal contacts, convinces the colleagues of the expediency of the initiatives, organizes and unites the team, creates a favorable psychological climate.
	RC 3	Builds models of intercultural communication, organizational and public speaking, competently expresses his thoughts orally and in writing in the state, Russian and foreign languages in the process of professional interaction and training.
2. Digital competencies: (Digital skills):	RC 4	Effectively organizes educational activities using the norms, rules, methods and means of international cooperation, observing the pedagogical tact, rules of ethics, demonstrating leadership and leadership skills in the professional field.
	RC 5	Defines and describes phenomena, basic concepts, basic laws, and their experimental and theoretical basis from the main areas of physics.
3. Professional competencies: (Hard skills)	RC 6	Analyzes the results of research work in compliance with intellectual property rights, knowing the principles of working with databases, scientific publications, carrying out information-analytical and patent verification using modern media.
	RC 7	Synthesizes knowledge and skills for organizing work on the commercial use of research results and assessing commercial potential.
	RC 8	Selects mathematical and computer methods of data analysis, modeling and visualization for solving scientific and applied problems, taking into account the requirements of information security.
	RC 9	Describes the ways and methods of managing innovative activities in the field of physics, demonstrating knowledge of current trends, directions and patterns of development of domestic science in the context of globalization and internationalization.
	RC 10	Evaluates and interprets the results of optical studies of nanostructures and nanomaterials in accordance with their electronic and band structure, analyzing the methods of microscopic examination depending on their physical properties.
	RC 11	Develops experimental techniques by analyzing the principles of operation and characteristics of electronic devices, optoelectronic devices and lasers.
	RC 12	Applies modern methods and tools of physical and chemical analysis in research activities and in the performance of production tasks.
	RC 13	Selects the optimal research methods for solving various scientific and technical problems in the field of nanotechnology and condensed matter physics, presenting methods of scanning probe microscopy in metals and alloys; methods for analyzing the properties of hydrogen in metals and alloys, methods for structural analysis of surfaces, radiation defects in condensed media.

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

Learning result code	Name of the module	Name of disciplines	Volume (ECTS)
RC 1	Philosophical-historical aspects of social-humanitarian knowledge	History and philosophy of science	4
RC 7		Pedagogy of higher education	4
RC 2		Psychology of management	4
RC 3	Professional languages	Foreign language (professional)	4
RC 7		Physics teaching in foreign languages	5
RC 3		Professional foreign terminology in physics (in English)	
RC 5	Innovation organization process for scientific research	Fundamentals of inventive activity and patent science	5
RC 6		Commercialization of the results of scientific and scientific and technical activities	
RC 4. 6		Innovation in applied physics	5
RC 4. 13		Applied mathematics and physics	
RC 8. 10	Modern technologies in physics	Electronic processes in condensed matter	4
RC 8.10		Principles of nanotechnology (in English)	4
RC 9. 11		Laser technics and laser technology	4
RC 7		Innovation technologies for physics teaching in the high school	4
RC 8.9	Synergetics	Physics of systems of reduced dimension	4
RC 8.12		Technique of physical experiment in systems with reduced dimension	
RC 8.9.10		Scanning probe microscopy	4
RC 8.12.10		Scanning microscopy methods	
RC 8.9.13		Designing of electron devices for the analysis of corpuscular flows	5
RC 8.12.10		Methods of obtaining and studying nanostructures	
RC 8.12.10		Structural analysis of monocrystals	5
RC 8.9.10		Electronic excitations in homogeneous systems	
RC 8.9		Nuclear magnetic resonance spectroscopy (in English)	5
RC 8.12.13		Magnetic structure of low-dimensional systems	

Matrix of achievability of learning outcomes

№	Name of disciplines	Brief description of the discipline (30-40 words)	Qty credits	Generated learning out comes (codes)												
				RC 1	RC 2	RC 3	RC 4	RC 5	RC 6	RC 7	RC 8	RC 9	RC 10	RC 11	RC 12	RC 13
Cycle of basic disciplines University component																
D1	History and philosophy of science	It is studied with the aim of forming knowledge about the significance of scientific knowledge in its tendency to development and sociocultural profile. Questions about the philosophy, methodology of science, science as a cognitive activity and tradition are considered.	4	+												
D2	Pedagogy of higher education	Studied to form ideas about the modern paradigm of higher education and the theory of scientific activity in higher education. The issues of pedagogy, education of professionals-specialists, professional skills of teaching in educational organizations, pedagogical control and evaluation of knowledge in higher education are considered.	4							+						
D3	Psychology of management	It is studied with the aim of forming knowledge about the psychological laws of managerial activity, skills in analysis of socio-psychological principles, the characteristics of the psychology of management, the personal characteristics of the leader.	4		+											
D4	Foreign language (professional)	It is studied with the aim of developing speaking, reading, writing and listening skills for effective communication in situations of professional communication, work with specialized literature in various fields, two-way interpreting in situations of professional communication.	4			+										
Cycle of basic disciplines Component of choice																
D5	Physics teaching in foreign	Purpose: to study the methods of teaching	5							+						

	languages	physics in higher and secondary schools in English. Teaching methods, modern pedagogical technologies and interactive teaching tools are considered. features of the formation of physical terms, basic laws and phenomena of the sections "Mechanics", "Molecular Physics", "Electricity and Magnetism", "Optics" and "Atomic Physics" in English. The course is aimed at developing the skills of conducting physics classes using innovative teaching technologies, selecting the most rational forms and didactic methods, interactive tools.															
	Professional foreign terminology in physics (in English)	Purpose: formation of language competencies for academic and professional interaction. The course studies professional scientific and technical terminology in physics; the main grammatical phenomena of scientific, professional and business style, taking into account their oral and written forms; aspects and features of the translation of technical literature in physics; general scientific and business vocabulary. Tasks: mastering English-language terms and describing processes in the field of natural sciences, technology, engineering and mathematics; correct translation of foreign literature; collecting information during a literary review of the research topic.				+											
D6	Fundamentals of inventive activity and patent science	Purpose: formation of ideas about human creative activity, legal protection of the results of creative work, which become intellectual property. Both the laws of the Republic of Kazakhstan on all objects of intellectual industrial property and international systems of intellectual property protection, including regional patent corporations, are considered. Upon completion of the course, undergraduates should be able to: determine the legal basis and mechanisms for the protection of intellectual property; to carry out information-analytical and patent verification using modern means of information.	5					+									
	Commercialization of the	It is studied in order to form skills to use the							+								

	results of scientific and scientific and technical activities	results of scientific and scientific and technical activities, including the results of intellectual activity in order to withdraw new or improved goods aimed at extracting income to the market.															
D7	Innovation in applied physics	Purpose: formation of a holistic approach to professional activity for the creation of innovations. The course examines the general characteristics of the technical blocks of the innovation process; the basics of scientific knowledge and creativity, collection and processing of scientific and technical information, the basic concepts of innovation management; the basic rules of innovation management and a systematic approach to the goal of innovation; the role and responsibilities of a specialist innovator. Upon completion of the discipline, undergraduates should be able to: describe the principles of applied research; choose an approach to the creation of innovations.	5				+		+								
	Applied mathematics and physics	Purpose: formation of in-depth knowledge and skills of conducting scientific research, methods of modeling physical processes. Contents: Study of physical phenomena in the context of interdisciplinary problems; application of mathematical methods, algorithms in other fields of science and technology; classification of mathematical models; basic forms of mathematical models used in solving applied problems. Upon completion of the course, undergraduates are able to: analyze, select and apply methods of mathematical description of physical phenomena and processes that determine the principles of operation of various technical devices.					+										+
Cycle of profile disciplines University component																	
D8	Electronic processes in condensed matter	Purpose: to study the fundamental foundations of the mechanisms of transformation of electronic energy and charge in molecular condensed media. Photophysical processes involving excited	4								+		+				

		electronic states of complex organic molecules are considered; a review of recent studies is given. The study of this course is aimed at the formation of research skills.															
D9	Principles of nanotechnology (in English)	Purpose: to familiarize with the main methods of obtaining nanostructured compounds, research methods used in this field and the study of the physico-chemical properties of nanoscale materials. The study of this course is aimed at the formation of research skills. The course covers: methods for obtaining nanostructures; the main stages of sample preparation for the study of their physical and chemical properties; basic principles of operation of devices used in nanotechnology; technological methods used to study nanotechnologies, including the design and construction of materials, devices and systems, including the control and management of the chemical composition and interaction of their components, individual elements of the nanorange.	4								+		+			
D10	Laser technics and laser technology	Purpose: to deepen theoretical knowledge about modern laser technology and technologies and to develop practical application skills. The course is aimed at studying laser radiation sources, the basics of modern laser physics and their application in various fields of science and technology. The course covers: Main types of lasers. Quantum frequency standards. Laser location of remote objects. Lasers in communication technology. Laser processing of materials. Application of lasers for metrology, control and machine vision in industry. Information retrieval systems with high data density. Application of lasers in parts prototyping systems.	4									+		+			
D11	Innovation technologies for physics teaching in the high school	The discipline is the basis of methodological and practical training of a high school teacher. The course is presented in the following sections: methods and means of interactive and information and communication technologies of training; development of educational and	4							+							

		methodological documentation based on the regulatory framework for the organization of the educational process of higher education; modern physics equipment, software, electronic educational environment of the university; models of interaction between electronic and distance learning. The study of the course is focused on the formation of skills for conducting classes in physics using innovative teaching technologies, the selection of the most rational forms and didactic methods, interactive tools.														
Cycle of profile disciplines Component of choice																	
D12	Physics of systems of reduced dimension	Purpose: formation of knowledge and skills about the physical properties and behavior of charge carriers in low-dimensional structures. The course is aimed at studying the basics of using low-dimensional structures in electronic and optoelectronic devices, conducting a comparative review of the latest achievements and discoveries in this field. The course covers: Basic principles of dimensional quantization. Technologies for obtaining nanoscale structures: quantum wells, dots, one-dimensional conductors, superlattices, electrical and optical properties of nanostructures.	4								+	+				
	Technique of physical experiment in systems with reduced dimension	Purpose: formation of skills for setting up a physical experiment in systems with reduced dimensionality.The course is aimed at studying the methods of studying the spectral measurement of the luminescence parameters of quantum dots in the infrared range; measurement of the decay times of the luminescence of PbS quantum dots in the near IR range; measurement of the sizes of nanostructures by atomic force microscopy.									+				+	
D13	Scanning probe microscopy	Purpose: formation of skills of theoretical and practical application of experimental scanning probe microscopy techniques. The course is aimed at studying the principles of operation and application features of modern scanning tunneling, atomic, magnetic force	4								+	+	+			

		microscopes. The device, the schematic diagram of technologies, structures and equipment used in the study of nanostructures are considered.														
	Scanning microscopy methods	Purpose: formation of knowledge and skills of the physical foundations and methods of scanning probe microscopy. The course is aimed at studying the application of these methods in modern science, technology and technology. The following types of scanning probe microscopy are considered: scanning tunneling microscopy (STM), atomic force microscopy (AFM), electric force microscopy (EFM), magnetic force microscopy (MFM), near-field optical microscopy (NOM).								+		+		+	
D14	Designing of electron devices for the analysis of corpuscular flows	This course is designed to familiarize undergraduates with the methods of calculation and design of circuits of electronic devices designed for the analysis of corpuscular flows. The classification of electronic devices for the analysis of corpuscular flows, the basic elements of electronic devices will be considered, the methods and stages of design of designs of electronic devices, various methods of calculation of the electron-optical characteristics of electronic devices will be studied.	5							+	+				+
	Methods of obtaining and studying nanostructures	Purpose: formation of ideas about the methods of obtaining and studying nanostructures. The course is aimed at studying the structure and properties of nanoparticles, colloidal systems, disordered solid-state structures and ordered nanomaterials. The course is aimed at studying the structure and properties of nanoparticles, colloidal systems, disordered solid-state structures and ordered nanomaterials. Familiarity with the basic laws and achievements in the field of synthesis and research of nanoparticles, nanostructured systems and nanomaterials. Separate issues of methods for studying nanostructures.								+		+		+	

D15	Structural analysis of monocrystals	The discipline is studied in order to form theoretical ideas about the fundamentals of the structural study of single crystals. The course is aimed at mastering methods for determining the crystal structure of compounds, the metrics of molecules and the spatial arrangement of molecules in an elementary cell. Considered: The method of generating X-rays and their interaction with matter. Scattering of X-rays in matter. X-ray phase analysis. Diffraction of x-rays in a crystal. Physical basis of X-ray diffraction analysis Determination of lattice parameters and crystal symmetry. Determination of the coordinates of atoms in the elementary cell of the crystal.	5								+		+		+	
	Electronic excitations in homogeneous systems	The course is studied in order to familiarize with the physical foundations of the theory of non-radiative energy transfer. The kinetics of attenuation and the quantum yield of luminescence in the presence of energy transfer, singlet-singlet energy transfer, triplet-triplet energy transfer, spin-forbidden intermolecular energy transfer, triplet-triplet annihilation in molecular systems, triplet exciton migration and energy transfer in polymers are considered.									+	+	+			
D16	Nuclear magnetic resonance spectroscopy (in English)	Purpose: to study the theoretical foundations of NMR spectroscopy, the principles of the NMR spectrometer, the analysis of NMR studies. The course is aimed at developing practical skills in studying the structure of organic compounds by the express NMR.	5								+	+				
	Magnetic structure of low-dimensional systems	Purpose: to study the magnetic properties of low-dimensional systems, to acquire basic skills in the analysis of experimental data obtained for such systems. The course covers: The phenomenon of nuclear magnetic resonance. Proton magnetic resonance. Chemical shift. Empirical screening constants. Spin-spin interaction. Signal intensity. Spin-spin interaction constant.									+				+	+

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

Learning result code	Planned learning outcomes for the module	Teaching methods	Assessment methods
RC 1	Actualizes the acquired knowledge in the field of the history and philosophy of science, using the forms and methods of pre-scientific, scientific and extra-scientific knowledge, forming their own scientific ideas and hypotheses, defending them with arguments, choosing the optimal methodology for theoretical and applied research.	Interactive lecture, case-methods, round table, analysis of publications, demonstration of speech	Writing an essay
RC 2	Establishes interpersonal contacts, convinces the colleagues of the expediency of the initiatives, organizes and unites the team, creates a favorable psychological climate.	Interactive lecture, experimental works intended for scientific research	Colloquium, test
RC 3	Builds models of intercultural communication, organizational and public speaking, competently expresses his thoughts orally and in writing in the state, Russian and foreign languages in the process of professional interaction and training.	Project training, analysis of conducted experiments, interpretation of results	Colloquium, test
RC 4	Effectively organizes educational activities using the norms, rules, methods and means of international cooperation, observing the pedagogical tact, rules of ethics, demonstrating leadership and leadership skills in the professional field.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Colloquium, test
RC 5	Defines and describes phenomena, basic concepts, basic laws, and their experimental and theoretical basis from the main areas of physics.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Presentation
RC 6	Analyzes the results of research work in compliance with intellectual property rights, knowing the principles of working with databases, scientific publications, carrying out information-analytical and patent verification using modern media.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Colloquium, test
RC 7	Synthesizes knowledge and skills for organizing work on the commercial use of research results and assessing commercial potential.	Analysis of scientific literature, presentation of reports	Colloquium, test
RC 8	Selects mathematical and computer methods of data analysis, modeling and visualization for solving scientific and applied problems, taking into account the requirements of information security.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
RC 9	Describes the ways and methods of managing innovative activities in the field of physics, demonstrating knowledge of current trends, directions and patterns of development of domestic science in the context of globalization and internationalization.	Analysis of conducted experiments, analysis of scientific literature, presentation of reports	Project preparation
RC 10	Evaluates and interprets the results of optical studies of nanostructures and nanomaterials in accordance with their electronic and band structure, analyzing the methods of microscopic examination depending on their physical properties.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work
RC 11	Develops experimental techniques by analyzing the principles of operation and characteristics of electronic devices, optoelectronic devices and lasers.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Colloquium, test
RC 12	Applies modern methods and tools of physical and chemical analysis in research activities and in the performance of production tasks.	Analysis of conducted experiments, analysis of scientific literature, presentation of reports	Project preparation

RC 13	Selects the optimal research methods for solving various scientific and technical problems in the field of nanotechnology and condensed matter physics, presenting methods of scanning probe microscopy in metals and alloys; methods for analyzing the properties of hydrogen in metals and alloys, methods for structural analysis of surfaces, radiation defects in condensed media.	Interactive lecture, discussion, analysis of scientific literature, presentation of reports	Written work

Criteria for assessing the achievability of learning outcomes

Learning result code	Criteria
RC 1	**Knows:** to use knowledge of traditional and modern problems of the history and philosophy of science in research activities in a professional direction
	Can: navigate the system of philosophical knowledge as a holistic view of the foundations of the universe and the prospects for the development of nature, society and thinking; understand the characteristic features of the modern stage of the development of philosophy; apply philosophical principles and laws, forms and methods of cognition in professional activity; find, analyze and contextually process information obtained from various sources
	Owns: the skills of philosophical analysis of various types of worldview, the use of various philosophical methods to analyze trends in the development of modern society, scientific-philosophical and practical-philosophical analysis; the skills to evaluate their actions and the actions of others from the point of view of ethics and morality; the skills of behavior in a team and communication with citizens in accordance with the norms of etiquette; the culture of thinking, the ability to perceive, analyze, generalize information, set goals and ways to achieve it
RC 2	**Knows:** how to use the level of training to solve psychological and pedagogical problems in the educational process of higher education
	Can: demonstrates the level of training for solving psychological and pedagogical tasks in the educational process of higher education
	Owns: professionally has the skills to guide the main provisions of regulatory documents in planning, forecasting, analysis of the main components of the learning and education process in higher education
RC 3	**Knows:** the basic psychological methods and techniques of conflict management in the organization.
	Can: is able to use the basic provisions and methods of the psychological science of management in professional activity
	Owns: has the skills to use the knowledge gained in the process of mastering the psychology of management in professional activities
RC 4	**Knows:** the basic theoretical provisions, principles, terms, concepts, processes, methods, technologies, tools, operations of scientific activity; knows the procedures for setting and solving scientific problems
	Can: is able to use methods of scientific cognition in the field of innovation in natural science, physical research understands methods of planning and organization of scientific research
	Owns: owns the mechanism of scientific search, analysis, conducting experiments, organizing surveys, compiling questionnaires, etc.; has the skills to choose a scientific research topic and select the necessary bibliographic publications and information materials on the research topic
RC 5	**Knows:** basic knowledge in the fields of commercialization of innovations and evaluation of the commercial potential of innovations
	Can: able to use basic knowledge in the fields of commercialization of innovations and evaluation of the commercial potential of innovations in cognitive and professional activities
	Owns: has basic theoretical knowledge about the organization of innovation activities, basic theoretical knowledge about the use of information technology in innovation risk management
RC 6	**Knows:** the ability to correctly express physical ideas in a foreign language
	Can: translate visually- written and visually-oral texts of technical content from English
	Owns: skills of written and oral academic speech, skills of using terminology in the specialty
RC 7	**Knows:** the design of lasers, independently measures the main parameters of laser radiation; develops new devices for solving specific tasks of analysis and control of technological chains; maintains laser equipment used in industry
	Can: able to apply knowledge in practice; analyzes ways to solve the task, finding the most effective.
	Owns: has the skills to work on laser devices and use laser technology to solve scientific and applied problems. Uses laser technologies in various tasks of science and technology. Has experience working with lasers and the simplest laser devices
RC 8	**Knows:** knows the basic theories of the general course of physics for successful application to solve practical problems
	Can: use the acquired knowledge in solving both theoretical and practical problems
	Owns: analyze the ways to solve the task, finding the most effective
RC 9	**Knows:** the fundamental foundations of the properties of nanomaterials to create a variety of devices
	Can: the ability to determine methods for obtaining and researching nanostructured materials based on the analysis of modern achievements in the field of

	nanotechnology under study
	Owns: to develop methods for the synthesis of nanostructured materials
RC 10	**Knows:** current methodologies of scientific and pedagogical research that contribute to the implementation of the main directions of educational policy
	Can: take part in the development of new methods and methodological approaches in scientific and innovative research and engineering and technological activities
	Owns: skills of analysis and development of new methods and methodological approaches in scientific and innovative research and engineering and technological activities
RC 11	**Knows:** the current trends in physics for the successful application of knowledge in solving practical problems
	Can: able to consolidate and improve the practical experience acquired in the course of training in the field of the profession being studied
	Owns: adapts to the specific conditions of the activities of organizations of various organizational and legal forms Forms, strengthens and develops teaching skills in institutions of higher education
RC 12	**Knows:** the methodological foundations, principles and methods of scientific research
	Can: is able to conduct independent research in accordance with the developed program; substantiates the relevance, theoretical and practical significance of scientific research; presents its results in the form of an article or report; identifies problems in the analysis of specific economic situations and scientific and technical trends, suggests ways to solve them and evaluates the expected results; formulates strategies for the development of research on theoretical topics and improving financial planning in the organization
	Owns: has the skills to work with information sources, scientific and reference literature on physics
RC 13	**Knows:** methods of optical and microscopic studies of nanostructures and nanomaterials
	Can: compare and interpret the results of optical studies of nanostructures and nanomaterials in accordance with their electronic and band structure. Selects methods of microscopic examination of nanostructures and nanomaterials depending on their physical properties
	Owns: skills in analyzing the properties of hydrogen in metals and alloys, isotopic chemical structural analysis of the surface, radiation defects in condensed media

Graduate model of an educational program:
Attributes of a graduate of a Master's degree

- 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)	The ability to use knowledge of traditional and modern problems of the history and philosophy of science in research activities in a professional direction. Demonstrates the level of training for solving psychological and pedagogical tasks in the educational process of higher education. Professionally has the skills to guide the main provisions of regulatory documents in planning, forecasting, analysis of the main components of the process of education and upbringing in higher education. Has the skills to use the knowledge gained in the process of mastering the psychology of management in professional activities. He is able to use the basic provisions and methods of the psychological science of management in his professional activity. Knows the basic psychological methods and techniques of conflict management in the organization.
2. Digital competencies (Digital skills):	Knows the basic theoretical provisions, principles, terms, concepts, processes, methods, technologies, tools, operations of scientific activity; understands the methods of planning and organizing scientific research; has the methodology of scientific design, creativity, the general scheme of the organization of scientific research, the practice of using methods of scientific knowledge in the field of innovation in natural science, physical research; owns the mechanism of scientific research, analysis, conducting experiments, organizing surveys, compiling questionnaires, etc.; has the skills of choosing a scientific research topic and selecting the necessary bibliographic publications and information materials on the research topic; knows the procedures for setting and solving scientific problems He is able to use basic knowledge in the fields of commercialization of innovations and evaluation of the commercial potential of innovations in cognitive and professional activities. Has basic theoretical knowledge about the organization of innovation activities, basic theoretical knowledge about the use of information technology in innovation risk management.
3. Professional competencies (Hard skills)	Ability to correctly express physical ideas in a foreign language Owns the theoretical foundations of laser technologies; applies knowledge in practice; analyzes ways to solve the problem, finding the most effective. He knows the design of lasers, independently measures the main parameters of laser radiation; develops new devices for solving specific problems of analysis and control of technological chains; maintains laser equipment used in industry. He has the skills to work on laser devices and use laser technology to solve scientific and applied problems. Uses laser technologies in various tasks of science and technology. Has experience working with lasers and the simplest laser devices. The ability to analyze ways to solve the task, finding the most effective. Willingness to use the acquired knowledge in solving both theoretical and practical problems. The ability to determine methods for obtaining and researching nanostructured materials based on the analysis of modern achievements in the field of nanotechnology under study.

	The ability to participate in the development of new methods and methodological approaches in scientific and innovative research and engineering and technological activities. Knows current trends in physics for the successful application of knowledge in solving practical problems. He is able to consolidate and improve the practical experience acquired in the course of training in the field of the profession being studied. Adapts to the specific conditions of the activities of organizations of various organizational and legal forms. Forms, strengthens and develops teaching skills in institutions of higher education. Knows the methodological foundations, principles and methods of scientific research; is able to conduct independent research in accordance with the developed program; substantiates the relevance, theoretical and practical significance of scientific research; presents its results in the form of an article or report; identifies problems in the analysis of specific economic situations and scientific and technical trends, suggests ways to solve them and evaluates the expected results; formulates strategies for developing research on theoretical topics and improving financial planning in the organization; has the skills to work with information sources, scientific and reference literature on physics. He has the methods of scanning probe microscopy in metals and alloys; the skills of analyzing the properties of hydrogen in metals and alloys, isotopic chemical structural analysis of the surface, radiation defects in condensed media.

Developers:
Members of the working group:

Head of the Department of physics and Nanotechnology — G.S.Omarova

Associate Professor of the Department of Physics and Nanotechnology, PhD — T.M.Serikov

Master's student — A.A.Aimagambetova

The educational program was reviewed by the Faculty Council from 25.04.2024 Protocol No. 9
The educational program was reviewed at the meeting of the Academic Council from 29.04.2024 Protocol No. 5
The educational program was reviewed and approved at the meeting of the University Board from 24.05.2024 Protocol No. 8

Member of the Board – Vice-rector for academic affairs — **M.M.Umurkulova**

Director of the Department for Academic Work — **T.M.Khassenova**

Dean of the faculty of physics and technology — **A.K. Zeinidenov**