Mining and Metallurgical Institute named after O.A. Baikonurov

Department of "Materials Science, Nanotechnology and Engineering Physics"

EDUCATIONAL PROGRAM
8D07103 " Materials Science and Engineering "

Code and classification of the field of education:
8D07 "Engineering, manufacturing and construction industries"
Code and classification of training directions:
8D071 "Engineering and Engineering Trades"
Group of educational programs:
D101 "Materials Science and technology of new materials"

Level based on NQF: 8
Level based on IQF: **8**
Study period: 3 years
Amount of credits: **180**

Almaty 2025

Educational program 8D07103 " Materials Science and Engineering "was approved at the meeting of K.I. Satbayev KazNRTU Academic Council
Minutes # 10 dated «06» 03 2025.
was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council
Minutes # 3 dated «20» 12 2025 .
Educational program 8D07103 " Materials Science and Engineering "was developed by Academic committee based on direction «8D071 Engineering and Engineering Trades»

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Kakimov U.K.	PhD	Head of Department	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev"	
Teaching staff:				
Azat S.	PhD	Professor	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev"	
Kudaibergenov K.	PhD	Associate Professor	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev"	
Kemelbekova A.	PhD in material science	Senior Lecturer	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I.	

			Satpayev»	
Yetish T.	Master of technical science, PhD student	Lecturer	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev»	
Employers:				
Mutushev A.	PhD	General Director	Scientific Production and Technical Center "ZHALYN"	
Students				
Lihanov S.		2rd year student	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev»	
Altynov Y.		2nd year student	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev»	
Serikkyzy A.		2nd year student	Non-profit Joint Stock Company "Kazakh National Research Technical University named after K.I. Satpayev»	

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List of abbreviations and designations

Abbreviation		Full name
Ts	–	Teaching staff
EP	–	Educational program
OR	–	Registrar's Office
WC	–	Working Curriculum EP

1. Description of educational program

The educational programme 8D07 "Engineering, manufacturing and construction industries" is the third qualification level of the three-level higher education system, which is the final level in the three-level higher education system.

The educational programme of Doctor of Philosophy (PhD) has a scientific and pedagogical orientation and assumes fundamental educational, methodological and research training, and in-depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and scientific sphere. The content of the educational programme ‘Materials Science and Engineering’ is developed on the basis of studying the experience of foreign universities and scientific centres.

The main criterion for the completion of the educational process of Doctor of Philosophy (PhD) training (doctor on the profile) is the mastering by the doctoral student of at least 180 academic credits, including all types of educational and research activities.

The duration of doctoral studies is determined by the volume of academic credits mastered. Upon mastering the established volume of academic credits and achieving the expected learning outcomes for the degree of Doctor of Philosophy (PhD) or on the profile of the educational programme of doctoral studies is considered fully mastered.

Training of personnel in doctoral studies is carried out on the basis of Master's degree programmes.

2. Purpose and objectives of educational program

Purpose of EP: The purpose of the educational program is to provide scientific and engineering training for PhD students for successfully solving the tasks of various industries related to the production and use of various materials, developing the theoretical basis for obtaining new materials and developing technological processes for the production and processing of finished products from these materials

Tasks of EP:

In accordance with the professional competences of the Doctor of Philosophy (PhD) trained in the educational programme 'Materials Science and Engineering', the objectives of the programme are:in the field of experimental research activities:

- coverage of theoretical bases of formation of structure and properties of materials used in engineering, including powder, composite, ceramic, etc.;
- study of technological ways of improvement of traditional and creation of new materials;
-scientific analysis of the influence of alloying, thermal, thermomechanical and other types of treatment on the structure and properties of a wide class of technical materials.

3 Requirements for assessment of learning outcomes of the educational programme

Learning outcomes include knowledge, skills and competencies and are defined both for the educational programme as a whole and for its individual modules, disciplines or assignments.

The main task at this stage is to select methods and assessment tools for all types of control, with the help of which it is possible to assess the achievement of planned learning outcomes at the level of discipline in the most effective way.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	8D07 "Engineering, manufacturing and construction industries"
2	Code and classification of training directions	8D071 "Engineering and engineering trades"
3	Educational program group	8D071 "Material Science and Technology"
4	Educational program name	8D07103 "Engineering Physics and Materials Science".
5	Short description of educational program	The educational programme 8D07103 'Materials Science and Engineering' is the third level of qualification of the three-level system of higher education
6	Purpose of EP	The purpose of the educational program is to provide scientific and engineering training for PhD students for successfully solving the tasks of various industries related to the production and use of various materials, developing the theoretical basis for obtaining new materials and developing technological processes for the production and processing of finished products from these materials
7	Type of EP	New
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	No
11	List of competencies of educational program	KK1. Communicativeness KK2. Basic literacy in Natural science disciplines KK3. General engineering competences KK4.Professional competencies KK5. Engineering-computer competencies KK6.Engineering-working competencies KK7. Socio-economic competences KK8. Special-professional competences
12	Learning outcomes of educational program	1) To build a research process with the presentation of scientific results in publications of the rating journals of the international Scopus databases, as well as in national and international peer-reviewed publications; 2) To solve technological problems in new and unfamiliar contexts by methods of research, analysis, diagnostics and modeling of the properties of substances and materials; 3) Evaluate technological tasks and schemes of processes for obtaining modern materials;

		optimize existing technological production methods based on the assessment; 4) Systematize and generalize basic scientific information about objects, technologies and strategies for conducting scientific research based on deep general engineering knowledge in the field of materials science and technology of new materials; 5) To predict conditions and optimization of technological processes for obtaining products with desired properties by integrating interdisciplinary knowledge; 6) To formulate the main problems in the field of materials science and technology of new materials, to choose methods and means of their solution; 7) To plan and carry out comprehensive research and testing in the study of materials and products, their production processes, processing and modification; 8) To develop schemes of modern technological processes of production, processing of materials and products from them, control systems of technological processes;
13	Education form	Full - time
14	Period of training	3
15	Amount of credits	180
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	PhD
18	Developer(s) and authors	Mutushev Alibek Zhumabekovich Kakimov Ulan Kadyrkhanuly Azat Seythan Kudaibergenov Kenes Kakimovich Kemelbekova Ainagul Erzhanovna Yetish Talshyn Erbolkyzy

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amountof credits	Generated learning outcomes (codes)							
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
1	Academic writing	Purpose: to develop academic writing skills and writing strategies among doctoral students in the fields of engineering and natural sciences. Contents: fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, conclusion, references used; in-text citation; preventing plagiarism, as well as preparing a presentation at a conference.	5				+	+	+	+	
2	Methods of scientific research	Purpose: formation of knowledge about scientific research, methods and methodology of scientific research, methods of collecting, processing scientific data in modern science. Contents: structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of	5			+	+	+	+	+	

		scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.									
3	Sustainability Science	Purpose: to develop in doctoral students a deep understanding of the interactions between natural and social systems, as well as to develop skills in identifying and developing strategies for sustainable development that promote the long-term well-being of humanity and conservation of the environment. Content: The complex relationships between ecosystems and societies, and delve into the analysis of sustainability issues at local, national and international levels.	5			+	+		+	+	
4	Advanced structural technology hardening	The purpose of the course is to gain knowledge on modern technologies for hardening materials and surfaces and apply them in practice in the development of hardening technologies based on the structural theory of structural strength and the hierarchy of defect-structural levels of solids. The course content includes modern methods of materials	5	+	+	+					+

		research; classification of structural levels of solids, dimensional and morphological characteristics of granular, cellular and modulated and atomic and molecular structures. The features of real structures, stochasticity and the probability of evolution of complex systems are considered, the irreversibility, non-equilibrium, nonlinearity and unpredictability of processes in open systems, the autowave nature of material objects and processes, fractality and self-organization of structures of different levels under external influences are studied.									
5	Physics and technique of saving and renewable energy	The purpose of studying this discipline is to make a complete picture of non-traditional renewable energy sources, the possibilities of their use in solving problems of energy supply and energy saving, to study the possibilities of using non-traditional and renewable energy sources in the energy supply systems of industrial enterprises. The content of the course is devoted to the description and analysis of renewable energy sources, their use in the overall energy balance of the country and regions, the introduction of new developed renewable energy			+	+			+	+	+

		technologies into the production process. The issues of using secondary energy resources and improving environmental conditions are also considered; technical and economic indicators of the use of renewable energy sources in agriculture; application of resource-saving technologies using renewable energy sources.									
6	Applied tasks in material science	The purpose of studying this discipline is to consider and search for solutions to applied problems of modern materials science related to real problems of science, production and technology. The course content includes the scientific basis of the choice of material, taking into account its composition, structure, heat treatment and the operational and technological properties of power equipment products achieved at the same time, taking into account its operating conditions. The course examines the patterns that link the chemical composition, structure and properties of materials, methods for purposefully changing the properties of materials, chemical composition, properties and applications of various materials.		+	+					+	

7	Software for structuring materials	The purpose of studying this discipline is to form doctoral students' ideas about the structure formation of materials using software, as well as the use of analytical equipment and instruments. The course covers the basic concepts of structuring materials using software, as well as the use of analytical equipment and instruments. The discipline is a complex for the study of modern research methods and the use of materials. An overview of the current state of the software for the structure formation of materials is given. The course examines the processes in the field of theory and practice using modern software.	5	+	+			+			
8	Physics of low-dimensional structures and systems	The purpose of studying this discipline is to consider and study the physical properties of low-dimensional solid structures and develop skills in calculating electronic, photon and phonon states in semiconductor nanostructures and analyzing their physical properties. The discipline is aimed at acquiring students' knowledge in the field of physics of low-dimensional systems: structures with quantum wells, quantum wires, quantum dots and superlattices. Considerable attention	5		+		+	+	+		

		is paid to the development of skills in calculating electronic, photonic and phonon states in semiconductor nanostructures and analyzing their physical properties. Also covered are the main questions about physical properties in electronic systems of various dimensions, the issues of reducing the dimension to physical phenomena.									
9	Physicochemical methods of materials research	The purpose of this discipline is to study the fundamentals of the theory and practice of physical and chemical analysis of substances, the main experimental regularities underlying the physicochemical methods research, their connection with modern technologies. When studying the discipline, doctoral students will study the following aspects: the principles of studying the chemical composition and structure of matter through the use of physical methods of analysis, including atomic spectroscopy, optical spectroscopy, magnetic resonance spectroscopy, mass spectroscopy, IR spectroscopy.	5	+	+			+			

5 Curriculum of educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**D101 - "Materials science and technology of new materials"**
Educational program	**8D07103 - "Materials Science and Engineering"**
The awarded academic degree	**Doctor of Philosophy PhD**
Form and duration of study	**full time (scientific and pedagogical track) - 3 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters						Prerequisites
									1 course		2 course		3 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
CYCLE OF BASIC DISCIPLINES (BD)															
M-1. Module of basic training															
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
MET322	Methods of scientific research		BD, UC	5	150	30/0/15	105	E	5						
PHY316	Advanced structural technology hardening	1	BD, CCH	5	150	30/0/15	105	E	5						
PHY306	Physics and technique of saving and renewable energy	1	BD, CCH	5	150	15/15/15	105	E	5						
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP350	Pedagogical practice		BD, UC	10				R		10					
CYCLE OF PROFILE DISCIPLINES (PD)															
M-2. Module of professional activity															
PHY317	Applied tasks in material science	1	PD, CCH	5	150	30/0/15	105	E	5						
PHY303	Physics of low-dimensional structures and systems	1	PD, CCH	5	150	30/0/15	105	E	5						
PHY318	Software for structuring materials	2	PD, CCH	5	150	30/0/15	105	E	5						
PHY302	Physicochemical methods of materials research	2	PD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP355	Research practice		PD, UC	10				R			10				
M-4. Experimental research module															
AAP336	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	5				R	5						
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R		20					
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R			20				
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R				30			
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R					30		
AAP348	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	18				R						18	
M-5. Module of final attestation															
ECA325	Final examination (writing and defending a doctoral dissertation)		FA	12										12	
Total based on UNIVERSITY:									30	30	30	30	30	30	

		60	**60**	**60**	

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	**University component (UC)**	**Component of choice (CCH)**	**Total**
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	20	5	25
PD	Cycle of profile disciplines	0	10	10	20
Total for theoretical training:		**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				123
ERWDS	Experimental Research Work of Doctoral Student				0
FA	Final attestation				12
TOTAL:					**180**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 4 dated 12.12.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. Б.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
Director - Mining and Metallurgical Institute named after O.A. Baikonurov	Rysbekov K. .
Department Chair - Materials Science, Nanotechnology and Engineering Physics	Kakimpv U. K.
Representative of the Academic Committee from Employers ____Acknowledged____	Mutushev A. Z.