A. Burkitbayev Institute of Power and Mechanical Engineering

Department of «Mechanical engineering»

EDUCATIONAL PROGRAM

8D07209 Advanced technologies of materials processing

code and name of educational program

Code and classification of the field of education:
8D07-Engineering, manufacturing and construction industries
Code and classification of training directions:
8D072- Industrial and manufacturing branches
Group of educational programs:
D113- Technology for materials pressure processing
Level based on NQF: 8
Level based on IQF: 8
Study period: 3 years
Amount of credits: 180

Almaty 2025

Educational program **8D07209 – Advanced and technologies of materials processing**
code and name of educational program

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 2024.

Educational program **8D07209 – Advanced and technologies of**
code and name of educational program
developed by Academic committee in the direction of "8D072-Manufacturing and processing"

Full name	Academic degree/ academic title	Position	Workplace	Signature
Teaching staff:				
Nugman E.Z.	Doctor PhD, Associate Professor	Head of the Department of "Mechanical Engineering"	Institute of Energy and Mechanical Engineering named after A.Burkitbaev	
Kerimzhanova M.F.	Candidate of Technical Sciences, Docent	Professor	Department of Mechanical Engineering	
Uderbayeva A.E.	Doctor PhD	Assoc. Professor	Department of Mechanical Engineering	
Employers:				
Andreev V.I.		General Director	Kazecotech STE LLP	
Students				
Myrzakhan A.		1st year doctoral student	Department of "Mechanical Engineering"	

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List of abbreviations and designati

ECTS	European Credit Transfer and Accumulation System
BD	Basic disciplines
HEI	Higher education institution
SMSE	State mandatory standard of education
KazNRTU	K. I. Satpayev Kazakh National Research Technical University
MEP	Modular educational program
NJsC	Non-profit joint stock Company
RWDS	Research work of a doctoral student
EP	Educational program
PD	Profile disciplines
WC	Working curriculum
IWDS	Independent work of a doctoral student
EMC	Educational and Methodological Council
AC	Academic council
SDGs	Sustainable development goals

1 Description of educational program

A doctoral student in the field of training "Advanced technologies of materials processing" should be prepared to solve professional problems in accordance with the profile orientation of the doctoral program and types of professional activities:

design and engineering activities:

- analysis of the state of the scientific and technical problem and determination of the goals and objectives of the design of instrument systems based on the study of world experience;
- making decisions based on the results of calculations on projects and the results of technical and economic and functional cost analysis of the effectiveness of the designed engineering systems;

production and technological activities:

- development of methods for conducting theoretical and experimental research on the analysis, synthesis and optimization of the characteristics of materials used in mechanical engineering;
- solving economic and organizational problems of technological preparation of production of machine systems and the choice of systems to ensure environmental safety of production;

research activities:

- the construction of mathematical models for the analysis and optimization of research objects, the choice of a numerical method for their modeling or the development of a new algorithm for solving the problem;
- development and optimization of field experimental studies of machine systems, taking into account the criteria of their reliability;
- preparation of scientific and technical reports, reviews, publications based on the results of the research carried out;
- application of the results of research activities and the use of intellectual property rights;

organizational and managerial activities:

- finding optimal solutions when creating high-tech products, taking into account the requirements of quality, cost, deadlines, competitiveness, life safety, as well as environmental safety;
- support of a unified information space for enterprise planning and management at all stages of the life cycle of manufactured products;
- development of plans and programs for the organization of innovative activities at the enterprise.
- deep knowledge and understanding of fundamental phenomena in their field of science.

scientific and pedagogical activity:

- participation in the development of programs of academic disciplines and courses based on the study of pedagogical, scientific, technical and scientific-methodical literature, as well as the results of their own professional activities;
- participation in the formulation and modernization of individual laboratory

work and workshops in professional disciplines;

- conducting training sessions with students, participating in the organization and management of their practical and research work;

- application and development of new educational technologies, including computer and distance learning systems. Based on the theoretical and practical knowledge obtained, the doctoral student of technical sciences under the educational program 8D07209 – "Advanced technologies of materials processing" forms professional competencies.

2 Purpose and objectives of the educational program

Purpose of EP:

Training of highly qualified specialists in the field of advanced pressure treatment technologies with in-depth knowledge and competencies for the development and implementation of innovative technologies, work in the field of education, as well as contributing to the sustainable development of industry through modern engineering solutions.

Tasks of EP:

- training of scientific and pedagogical personnel with practical skills and the ability to perform professional functions in accordance with the market requirements for organizational, managerial, professional competencies;
- training of competitive specialists in the field of advanced technologies of materials processing, new materials used in procurement production;
- training of scientific and pedagogical personnel ready for continuous self-improvement and self-development, mastering new knowledge, skills and abilities in innovative areas in the field of processing technologies of machine-building materials;
- preparation of doctoral students for a successful career in the field of modern technological processes for processing new materials in mechanical engineering, in private, public and state organizations, educational institutions.

3 Requirements for evaluating educational program learning outcomes

As a result of mastering the EP modules, students develop the knowledge, skills and abilities necessary to carry out all types of professional activities in the field of mechanical engineering, develop training skills to carry out further training with a high degree of independence, that is, the formation of professional, communication and key competencies that meet the requirements of employers. Qualification awarded to the graduate Doctor of Philosophy PhD in EP 8D07209 – "Advanced technologies of materials processing"

4 Passport of the 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	8D072 - Industrial and manufacturing branches
3	Educational program group	D113 - Technology for materials pressure processing
4	Educational program name	8D07209- Advanced technologies of materials processing
5	Short description of the educational program	The professional activity of the doctoral student is directed in the field of design and development of advanced technological processes of materials processing by pressure, modeling of objects and processes using software packages of automated design, analysis of technical information, research in the field of engineering materials. Doctoral students will gain knowledge of effective methods of solving problems of technology, economics and management; they will acquire the skills and abilities of mathematical, physical and computer modeling of technological processes of materials processing by pressure, conducting research with the search for optimal solutions when creating competitive products.
6	Purpose of EP	Training of highly qualified specialists in the field of advanced pressure treatment technologies with in-depth knowledge and competencies for the development and implementation of innovative technologies, work in the field of education, as well as contributing to the sustainable development of industry through modern engineering solutions.
7	Type of EP	New EP
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	-
11	List of competencies of the educational program:	- Ability to use new research methods and areas of professional activity; - Willingness to use knowledge of modern problems of science and education in solving problems in the field of advanced materials processing technologies; - The ability to analyze the results of scientific research, apply them in solving specific research tasks in the field of science and education
12	Learning outcomes of educational program:	ON1 Master the methods of critical analysis and evaluation of scientific sources, as well as

		interpretation of the results of scientific research and scientific and educational works. Develop and prepare scientific and technical reports, analytical reviews and methodological materials on topical issues of scientific research and teaching activities. ON2 To participate in setting scientific and scientific-educational tasks, conducting theoretical and experimental research based on the principles of organizing scientific research and choosing research methods in conditions of sustainable production. ON3 Analyze the impact of intellectual property rights on innovation, assess the impact of scientific and technological developments on the economy, society and the environment. ON4 To apply systems thinking in scientific research, management of progressive production processes and development of innovative solutions in the field of materials processing by pressure, taking into account the principles of inclusiveness and accessibility for various user groups. ON5 To conduct research and develop innovative technological solutions, taking into account tribological factors that contribute to improving the efficiency and reliability of advanced materials processing technologies. ON6 To conduct advanced research and develop 3D nanoprinting technologies for use in digital engineering production. ON7 To develop, analyze and implement advanced digital technologies in industrial production, increasing its efficiency, flexibility and competitiveness. ON8 Apply modern management methods and technologies, develop control algorithms for real-world production tasks, ensuring accessibility and adaptability of solutions for various user groups, including the principles of inclusive engineering.
13	Education form	full-time
14	Period of training	3 years
15	Amount of credits	180
16	Languages of instruction	russian
17	Academic degree awarded	Doctor of Philosophy PhD
18	Developer(s) and authors:	The educational program was developed by the academic committee on direction «8D072- Industrial and manufacturing branches »

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

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)							
				ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8
Cycle of basic disciplines University component											
1	Academic writing	The course is aimed at developing academic writing skills and writing strategies for doctoral students in the field of engineering and natural sciences. The course focuses on the basics and general principles of academic writing for; writing effective sentences and paragraphs; using tenses in scientific literature, as well as styles and punctuation; writing abstracts, introductions, conclusions, discussions, conclusions, literature and resources used; quoting in the text; preventing plagiarism, and making presentations at a conference.	5	v							
2	Research methods	The course contributes to the formation of knowledge about scientific research, methods and methodology of scientific research, methods of collecting and processing scientific data, principles of organization of 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 modern science. The discipline examines the structure of technical sciences, the application of general scientific, philosophical and special methods of scientific research in theory and in practice.	5	v	v						
Cycle of basic disciplines Elective component											
3	Advanced Digital Factory	The purpose of the Advanced Digital Factory discipline is to provide students with in-depth knowledge and practical skills necessary for the development, implementation and operation of modern digital technologies and systems in manufacturing enterprises. Within the framework of this discipline, students study	5						v	v	

		the concepts of digital factories, including the principles of automation, robotization, and the use of the Internet of Things in order to increase the efficiency, flexibility, and sustainability of production processes.									
4	Sustainability Science	Objective: to develop a deep understanding among doctoral students of the interactions between natural and social systems, as well as to develop skills for identifying and developing strategies for sustainable development that promote long-term human well-being and environmental preservation. Content: complex interconnections between ecosystems and societies, as well as an in-depth analysis of sustainability issues at local, national, and international levels.	5		v	v					
5	Intellectual property and the global market	Purpose: the goal is to train specialists in the field of intellectual property law who can analyze and predict trends in its development in the global market, develop strategies for the protection and commercialization of intellectual property. Contents: global aspects of intellectual property and its role in international trade and economics, analysis of international agreements and conventions, IP management strategies, cases of protection and violation of intellectual property rights in various jurisdictions.	5			v					
Cycle of profile disciplines Component of choice											
6	Tribotechnical processes in the processing of materials	The purpose of the discipline is to develop skills in the theory and practice of tribotechnical processes and their application to friction units of equipment. The discipline introduces tribotechnical processes in ensuring the required operational characteristics and reliability of equipment, with the main types and patterns of friction and wear, including in relation to specific products. The influence of tribotechnical processes on the characteristics of equipment, methods for determining the power, speed and other operating conditions of friction units and the choice of materials are considered.	5					v			
7	Advanced Systems	The purpose of the discipline is to develop an understanding of the principles and methods of systems thinking necessary for the analysis, modeling and	5				v				

	Thinking Theory and Practice	management of complex systems in scientific and practical fields. The formation of a systemic worldview, the study of methods and tools of advanced systems analysis, the theory of disasters and synergetics, artificial intelligence. Inclusive engineering technologies: designing accessible and adaptive technical solutions tailored to the needs of different user groups. Social and economic systems: forecasting and modeling based on the principles of inclusivity. The application of systems thinking to an actual scientific or educational program.									
8	Advanced 3D Nanoprinting Technology	The course is aimed at the formation of knowledge of nanotechnology and nanomaterials, nanoindustry. The discipline examines the history of the development of nanotechnology, the properties and structure of nanomaterials, the classification of dispersed systems, methods for obtaining nanoscale materials. The structure and properties of carbon nanotubes, nanocomposite materials, and methods for producing nanopowders are considered. 3D printing technologies, analysis of the application of 3D printing in the field of industrial industry, 3D nanoprinting technologies are studied.	5						v		
9	Advanced Management Systems Engineering	The course is aimed at the formation of theoretical and practical knowledge of modern industrial production management systems. The discipline deals with the organization of high-tech machine-building production, strategic and operational planning, methods of production management and information support, methods of development and management decision-making. The management systems of the organization, its main elements are considered: goals, business processes, personnel, information systems, infrastructure. The problems of building an effective management system of an industrial enterprise or organization are considered.	5								v

5 Curriculum of the educational program

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: D113 - "Technology for materials pressure processing"
Educational program: 8D07209 - "Advanced technologies of materials processing"
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)															
M1 Technical training module															
MET322	Methods of scientific research		BD, UC	5	150	30/0/15	105	E	5						
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
MSM306	Advanced Digital Factory	1	BD, CCH	5	150	30/0/15	105	E	5						
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
MNG349	Intellectual property and the global market	1	BD, CCH	5	150	30/0/15	105	E	5						
M4 Experimental research module															
AAP350	Pedagogical practice		BD, UC	10				R		10					
CYCLE OF PROFILE DISCIPLINES (PD)															
M2 Module of scientific and industrial training															
MSM312	Tribotechnical processes in the processing of materials	1	PD, CCH	5	150	30/0/15	105	E	5						
IND315	Advanced Systems Thinking Theory and Practice	1	PD, CCH	5	150	30/0/15	105	E	5						
MSM303	Advanced 3D Nanoprinting Technology	2	PD, CCH	5	150	30/0/15	105	E	5						
IND313	Advanced Management Systems Engineering	2	PD, CCH	5	150	30/0/15	105	E	5						
M3 Practice-oriented module															
AAP355	Research practice		PD, UC	10				R			10				
M4 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	
M5 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 № 3 dated 19.12.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs — Uskenbayeva R. K.

Approved:

Vice Provost on academic development — Kalpeyeva Z. B.

Head of Department - Department of Educational Program Management and Academic-Methodological Work — Zhumagaliyeva A. S.

Director of the Institute - A.Burkitbaev Institute of Energy and Mechanical Engineering — Yelemessov K. .

Department Chair - Mechanical Engineering — Nugman E. .

Representative of the Academic Committee from Employers ___Acknowledged___ — Andreev V. I.