



SATBAYEV
UNIVERSITY

**THE MINISTRY OF EDUCATION AND SCIENCE OF
THE REPUBLIC OF KAZAKHSTAN**

**NON-PROFIT JOINT STOCK COMPANY
KAZAKH NATIONAL RESEARCH TECHNICAL
UNIVERSITY named after K.I. SATBAYEV**

Prior Document
QMS Level 3

Edition number 1
from "23" 04 2021

RS 029 -03.05-04-04.1.2 -
2021

MODEL SPECIALIST (MASTER)
**about the educational program 7M07111 - Digital engineering of machinery and
equipment**

RS 029-03.05-04-04.1.2 - 2021

Almaty 2021

FOREWORD

1 DEVELOPED by the Department of "Technological machines, transport and logistics" of the Institute of Metallurgy and Industrial Engineering of the NJSC "Kazakh National Research Technical University named after K.I.Satpayev"

Head of the Department of
TMT&L

"12" 04 2021

K. Yelemessov

2 AGREED

Vice-rector on academic issues

"21" 04 2021

B. Zhautikov

Director
Institute of Metallurgy and
industrial engineering

"16" 04 2021

K. Rysbekov

Head of department licensing,
certification and quality control of
education

"18" 04 2021

A. Sauranbaeva

Head of Legal Department

"14" 04 2021

D. Kuldzhanova

Translated by

" " 2021

U. Kakimov

3 DISCUSSED and approved by the Educational and Methodological Council of the Institute of Metallurgy and Industrial Engineering (Protocol No. 10 dated "30" 06 2021)

4 APPROVED by the decision of the Board of NJSC KazNITU named after K.I. Satpayev dated "23" 04 2021 No. 21

CONTENT

	Introduction	4
1	Objectives and tasks of the educational program 7M07111 - Digital Engineering of Machines and Equipment	5
2	List of qualifications and positions	6
3	Descriptors	6
4	Competencies for learning completion	7
4.1	Requirements to key competences of graduates of scientific and pedagogical magistracy should	7
4.2	Requirements for the research work of a master student in a scientific and pedagogical magistracy	10
4.3	Requirements for the organization of practices	10
5	Requirements for completion of training and obtaining a diploma	11
	Registration sheet for changes to	13

INTRODUCTION

The main idea of the educational program is to implement a continuous process of training scientific, pedagogical and professional personnel of a new generation, capable of working, aimed at transforming the new scientific potential of Kazakhstan from raw materials to innovative through the development and implementation of sustainable trends in the field of digital maintenance services.

The uniqueness of the EP "Digital Engineering of Machines and Equipment" is determined by the competencies possessed by the master who completed the education in this program.

The Master's program is designed to facilitate the effective training of future technical service professionals on a comprehensive and integrated foundation. It is aimed at a deep understanding of the role of digital monitoring in the operation of machinery and equipment in the mining, metallurgical and oil and gas industries and their timely service at a high level.

The program prepares masters for activities in areas such as Digital Engineering of Machines and Equipment, as well as in strategic planning, analytical and advisory activities.

At the master's level, training in the EP "Digital Engineering of Machines and Equipment" is carried out along trajectories involving the implementation of educational programs for the training of personnel in the oil, mining and metallurgical sectors with in-depth technical, analytical and predictive training.

The **specialist model** provides for:

- competencies due to the development of modern science and technology ;
- competencies dictated by the requirements of the profession, specialty ;
- competencies conditioned by the socio-political system of the country, its spiritual and moral system.

The specialist's model has historically been embodied in various forms: qualification characteristics and profессиograms.

To acquire a complex of professional, intercultural, communicative competencies, a graduate must master the knowledge of a set of basic (DB) and specialized (PD) disciplines, both their compulsory component and an optional component in accordance with the chosen educational trajectory in full, established by the state standard.

The ability to navigate the information flow is of great importance in the modern world: the ability to find and organize various sources of information according to a specific criterion; use rational methods of obtaining, transforming, systematizing and storing information, updating it in necessary situations of intellectual and cognitive activity, as well as computer literacy, possession of new information and multimedia technologies (e-mail, Internet), the ability to critically evaluate information.

1 Objectives and tasks of the educational program 7M07111 – Digital engineering of machines and equipment

Purpose: training comprehensively educated, intellectually developed specialists in the field of technological machines and equipment, innovative technologies in the field of operation and repair of mining, metallurgical and oil and gas machines, capable of realizing their professional knowledge, skills and abilities in public and private management, mining and metallurgical and oil and gas enterprises, public and research organizations of any form of ownership; to ensure the growth of research activities of the teaching staff of the department in order to integrate education, science and production; to provide fundamental training for undergraduates for the successful solution of scientific and engineering problems in the fields of automotive engineering, design of logistics systems and supply chain management; develop undergraduates' practical skills in engineering analysis and design, formulation and conduct of scientific research, including the formation of students' professional orientation as a personality trait of a future engineer; to improve a three-level model of training personnel with higher and postgraduate education: bachelor's - master's - doctoral studies that meet the requirements of consumers, on the basis of the introduction of modern educational technologies and continuous improvement of the educational and methodological activities of the teaching staff of the department.

Tasks:

- practical implementation in the educational process of the requirements of educational programs in the system of continuing education of the Republic of Kazakhstan;
- introduction into the educational process of innovative technologies, promising teaching methods that contribute to the development of independence and creative thinking of undergraduates ;
- increasing the level of responsibility of the teaching staff for the quality of teaching and mastering the necessary knowledge by undergraduates in accordance with the qualification requirements for the training of graduates of KazNRTU named after K.I.Satbayev;
- development and improvement of creative thinking and independence in solving scientific problems among undergraduates , deepening and consolidating the knowledge gained during training;
- the formation in study groups of a healthy moral and ethical atmosphere, friendship and cooperation;
- participation in international activities in the field of education and training;
- training of highly qualified competent specialists for the transport and logistics sector of the economy of the Republic of Kazakhstan, capable of quickly adapting to rapidly changing socio-economic conditions;
- to form in a master's student a certain set of personal qualities, general cultural and professional competencies, sufficient for the formation of a modern transport industry in the country (region) and an advanced organization of activities;

2 List of qualifications and positions

A graduate of a master's degree student in the specialty 7M07111 - "Digital Engineering of Machines and Equipment" is awarded the academic degree of Master of Technical Sciences.

Qualifications and positions are determined in accordance with the "Typical qualification characteristics of the positions of teaching staff and persons equated to them" approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated July 13, 2009 No. 338 (with amendments and additions dated June 9, 2011).

In ypuskniki specialty 7M07111 - "Digital Engineering machinery and equipment", regardless of the educational program can work in the following positions:

- constructors;
- technologist;
- mechanics of technological machines and equipment in the field of underground mining, ore preparation, smelting and rolling production, drilling and mining;
- engineer (in categories I, II, III, leading and chief);
- the head of the production site (base, workshop, department);
- head of the workshop (laboratory).

Professional activities

A feature of this master's program is the preparation of graduates capable of conducting the following types of professional activities:

- pedagogical;
- research;
- organizational and managerial;
- production and technological.

Objects of professional activity

The objects of professional activity of a graduate are:

- secondary specialized and higher educational institutions;
- mechanical engineering enterprises;
- design and engineering and research organizations;
- research institutes specializing in the design of technological equipment;
- organizations and companies specializing in the production of technological equipment.

3 Descriptors

Master's degree in specialty 7M07111 - "Digital Engineering of Machines and Equipment"

Requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's

degree) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) demonstrate developing knowledge and understanding in the studied area of digital technologies for diagnostics of equipment for mining, metallurgical and oil and gas production, based on advanced knowledge of this area, in the development and (or) application of ideas in the context of research;

2) apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a broader interdisciplinary context;

3) collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;

5) learning skills necessary for independent continuation of further education in the studied area of digital technologies for diagnostics of equipment for mining, metallurgical and oil and gas production.

4 Competencies for learning completion

4.1 Requirements to key competences of graduates of scientific and pedagogical magistracy should

1) have an idea:

- about the role of science and education in public life;
- about current trends in the development of scientific knowledge;
- on topical methodological and philosophical problems of natural (social, humanitarian, economic) sciences;
- about the professional competence of a higher school teacher;
- on the contradictions and socio-economic consequences of globalization processes;

2) know:

- methodology of scientific knowledge;
- principles and structure of the organization of scientific activity;
- psychology of students' cognitive activity in the learning process;
- psychological methods and means of increasing the efficiency and quality of education;

3) be able to:

- use the knowledge gained for the original development and application of ideas in the context of scientific research;

- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;
- to apply the knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- think creatively and be creative in solving new problems and situations;
- be fluent in a foreign language at a professional level, allowing for research and teaching of special disciplines in universities;
- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;

4) have skills:

- research activities, solving standard scientific problems;
- implementation of educational and pedagogical activities on credit technology of education;
- methods of teaching professional disciplines;
- the use of modern information technologies in the educational process;
- professional communication and intercultural communication;
- oratory, correct and logical formulation of your thoughts in oral and written form;
- expanding and deepening knowledge necessary for daily professional activities and continuing education in doctoral studies.

5) be competent:

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activities in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.
- B1 - knowledge of basic methods, methods of digital diagnostics, basic operational characteristics of technological equipment for mining, metallurgical and oil and gas production;
- B2 - understanding the essence and significance of the interconnection of production processes and their impact on the operational efficiency of the trouble-free use of technological equipment for mining, metallurgical and oil and gas production,

allowing the rational use of natural resources, waste-free technology and reduce the negative impact on the environment;

- B3 - the ability to solve non-standard problems of choosing a rational method for restoring parts of mining, metallurgical and oil and gas production using innovative repair technologies.

- P - Professional competence, including in accordance with the requirements of industry professional standards, providing deep theoretical knowledge and practical skills in the field of technology for the development of solid minerals and hydrocarbons.

- P1 - A wide range of theoretical and practical knowledge in the professional field, digital technical diagnostics of equipment for the production complex of mining metallurgical and oil and gas machinery and equipment, taking into account industrial and environmental safety .

- P2 - Determine the main organizational issues for carrying out repair and restoration work.

- P3 - Skills in the development of technological maps of restoration processes and increasing the wear resistance of parts, practical skills in drawing up design and technical documentation; practical skills in checking the compliance of the developed technological process with the requirements of standards, specifications and other regulatory documents.

- P4 - Digital systems for the design of technological machines and equipment, modern digital developments and the main directions of development of digital design and construction of technological machines, as well as with the technological preparation of their production.

- P5 - Digital methods for predicting the technical state and reliability of objects, studying the foundations of the theory of diagnostics, studying the basic concepts, techniques and innovative methods for diagnosing the technical state of parts, mechanisms and products.

- P6 - Formation of knowledge, skills and abilities on energy efficiency and energy saving in the mining, metallurgical and oil and gas industries based on equipment and technologies of automation and control, mastering knowledge in the field of energy saving, mastering the principles and methods of energy saving as a set of measures or actions taken to ensure efficient use of energy resources and technological equipment during their operation.

- P7 - Skills of installation work using innovative methods and monitoring the technical condition (welding, rolling, basic locksmith work, commissioning and fitting work), drawing up report forms and regime maps, digital calculation of optimal parameters, operating modes of equipment.

- O - Human, socio-ethical competences:

- O1 - Understanding and disclosing the connection between philosophy and science, highlighting the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of the philosophy of science, modern problems of the development of scientific and technical reality ;

- O2 - Possess knowledge of English for their ongoing academic research and improve their performance in the field of project management;
- O3 - Studying the basics of education management, management of global educational processes, analysis and selection of strategic initiatives, a project as a strategy for managing the development of an educational institution / organization. ...
- C - Special and managerial competencies:
 - C1 - Independent management and control of work processes within the framework of the strategy, policy and goals of the organization, discussion of the problem, reasoning of conclusions and competent handling of information;
 - C2 - Know and own the main management functions (decision-making, organization, motivation, control) and methods of their implementation;
 - C3 - To have organizational skills, to be able to create mobile working groups to fulfill the set goals and to be able to manage such a group, to be able to protect their rights and demand from them to fulfill their duties.

4.2 Requirements for the research work of a master student in a scientific and pedagogical magistracy

- 1) corresponds to the profile of the master's educational program, according to which the master's thesis is performed and defended;
- 2) is relevant and contains scientific novelty and practical significance;
- 3) is based on modern theoretical, methodological and technological achievements of science and practice;
- 4) is carried out using modern methods of scientific research;
- 5) contains research (methodological, practical) sections on the main protected provisions;
- 6) is based on advanced international experience in the relevant field of knowledge.

4.3 Requirements for the organization of practices

The educational program of the scientific and pedagogical magistracy includes two types of practices, which are carried out in parallel with theoretical training or in a separate period:

- 1) pedagogical in the DB cycle - at the university;
- 2) research in the PD cycle - at the place of the dissertation.

Pedagogical practice is carried out with the aim of developing practical skills in teaching and learning methods. At the same time, undergraduates are involved in conducting classes in a bachelor's degree at the discretion of the university.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

5 Requirements for completion of training and obtaining a diploma

The main criterion of completion of the educational process for the preparation of Master of Engineering, is the development of undergraduates at least 120 credits, of which at least 73 theoretical education loans, at least 12 credits of pedagogical and research practice and not less than 24 credit and research magist weł.

As part of the research work of the master's degree, in order to get acquainted with innovative technologies and new types of production, it is envisaged to undergo a scientific internship in scientific organizations and / or organizations of relevant industries or fields of activity, including abroad.

The final certification of the master's degree is carried out within the timeframes stipulated by the academic calendar in the form of passing a comprehensive exam and defending a master's thesis in the manner prescribed by law.

Awarded degree / qualifications: The graduate of this educational program is awarded the academic degree "Master of Science" in the direction.

A graduate who has mastered master's programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activity, develop their innovative abilities;
- the ability to independently formulate research goals, to establish a sequence for solving professional problems;
- the ability to apply in practice the knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern scientific and technical equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- possession of the skills of drawing up and preparing scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness to communicate in oral and written forms in a foreign language to solve problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activities that the master's program is focused on:

research activities:

- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained during mastering the master's program;
- the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;

- the ability to create and research models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of digital technologies for diagnosing the state of equipment in mining, metallurgical and oil and gas production ;

- research and production activities:
- the ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;
- the ability to professionally operate modern field and laboratory equipment and instruments in the field of the mastered master's program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;
- project activities:
- the ability to independently compose and submit projects of research and development work;
- readiness to design complex research and development work in solving professional problems;
- organizational and management activities:
- the readiness to use the practical skills of organizing and managing research and development work in solving professional problems;
- readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;
- scientific and pedagogical activity:
- the ability to conduct seminars, laboratory and practical classes;
- the ability to participate in the management of scientific and educational work of students in the field of digital technologies for diagnosing the state of equipment in mining, metallurgical and oil and gas production .

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

document designation

Approved by the Decision of the Board of NAO KazNITU named after K.I. Sattpayev "23" 07 2021 No.