IJSC «Kazakh National Research Technical University»
Named after K.I. Satpayev»

Institute of Metallurgy and Industrial Engineering
Department of Engineering Physics

Work Training Programme
CURRICULUM PROGRAM

Master

Educational program 7M7103 - "Material Science and Technology of New Materials".
Educational Program Group M101 - "Material Science and Technology of New Materials".

1st edition

in accordance with the SMSE of Higher Education 2018

Almaty 2020

The program was drawn up and signet by the parties:

From KazNRTU named K. Satpayev:

1. Head of EP Department _____ R.E. Beisenov
2. Director of Institute of IE _____ K.K. Elemesov
3. Chairman of Sc. Method. Council of EP Departmant _____ Kh.R. Maylina

From employers

1. Director of the Department of Space Materials Science and Instrumentation, JSC "National Center for Space Research and Technologies" _____ M.B. Ismailov
2. Director of LLP "Alakol Plant" _____ S.A. Sopolnik

Approved at a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K. Satpayev. Protocol №3 from 15.09.2020.
From employers

Professional competence:

- possession of information about the latest trends and trends in modern materials science, achievements and prospects of its development; concepts of phase and structure formation in materials under external influence; main problems of obtaining high-quality material products for various purposes;

- knowledge of basic principles of management of composition, structure and structure of materials to obtain the required level of technological and operational properties to ensure the reliability of structural and functional materials, the necessary requirements for the organization and conduct of tests, their methodological support to assess the quality of material products, the basis for maintaining regulatory and technical documentation in accordance with international standards series ISO 9000 and ISO 14000.

- ability to formulate goals, objectives and outline ways and measures for their achievement and solution; to plan and implement a set of activities for the organization of professional activity; to systematize, analyze and generalize a set of theoretical and practical achievements taking into account the resource of accumulated data; to formalize the results in the form of reports, scientific publications and recommendations, innovation projects;

- acquisition of skills of professional activity organization in material science institutions; evaluation of technical solutions for the efficiency of the production process, quality and reliability of material products, use of rational methods of collection, processing and analysis of scientific and technical information; development and implementation of software and methodological support for training, testing and research;

- competence in questions of an estimation of technical and economic efficiency of projected technical processes and innovative potential of let out production, its competitiveness in the internal and external markets; integration of professional activity in sphere of interbranch relations of machine-building branch.

Brief program description:

The main objectives of the educational program are:

- to provide scientific training for Master's students to successfully solve scientific and engineering problems of interdisciplinary nature;
- to develop skills in scientific analysis, formulation and conduct of scientific research, including as a team member;
- develop the skills of mastering and applying scientific methods of research, technologies for obtaining and processing materials for a specific purpose;
- to develop the concepts of professional and ethical responsibility, ability to study independently and to improve skills during the life cycle for successful careers in scientific, research and production organizations and educational institutions involved in solving scientific and technological problems.

The program is aimed at the following types of professional activities:
experimental research;
design and analytical;
industrial and technological;
scientific and pedagogical.

The objects of professional activity of Master of Technical Sciences are:

employees of national companies, research centers, business structures, public administration of industry and committees on science and technology; teachers in higher education institutions.

PASSPORT OF THE EDUCATIONAL PROGRAM

1.Program volume and content

The term of study in the magistracy is determined by the volume of academic credits. At mastering the established volume of the academic credits and achievement of expected results of training for a master's degree the educational program of a magistracy is considered completely mastered. In a scientific and pedagogical magistracy not less than 125 academic credits for the whole period of study, including all kinds of educational and scientific activities of the master.

Planning of the education content, a way of the organization and carrying out of educational process is carried out by the university and the scientific organization independently on the basis of credit technology of training.

Master's degree in scientific-pedagogical direction implements educational programs of postgraduate education for the training of scientific and scientific-pedagogical personnel for universities and research organizations with in-depth scientific-pedagogical and research training.

The content of the educational program of Master's degree consists of:

1) Theoretical education, including the study of cycles of basic and profiling disciplines;

2) practical training of master's students: different types of practices, scientific or professional internships;

3) research work, including the implementation of the master's thesis - for scientific and pedagogical master's degree.

4) final attestation.

The content of the educational program

The content of the program is oriented to the maximum satisfaction of domestic consumers' demands in the fields of industrial production, technological engineering, scientific and innovative activity, represented by large companies, operating enterprises and research institutions as potential employers. Proceeding from this, the program of Master of Technical Sciences training is carried out at the junction of material science, engineering and physical fields of knowledge, providing training in methods and principles of solving professionally oriented research tasks; technological methods of obtaining necessary materials and their processing to a given level of properties, as well as rational application on the basis of scientifically grounded choice and a set of received fundamental scientific and general professional knowledge.

The objectives of the educational program:

- The objectives of the educational program are consistent with the types of future professional activities and are as follows:
- in the field of experimental and research activities:
- - analysis of the research task in the given field on the basis of selection and study of literary and patent sources;
- - diagnostics of the state and dynamics of the objects of activity (materials, technological processes, equipment in various industries using the necessary means and methods of analysis);
- - study of structure and properties of technical materials, their improvement and creation of new materials and technological processes of their manufacturing;
- construction of mathematical models, computer modeling to solve the problem;
- carrying out measurements and research in the development of new materials and technologies according to the given method with the choice of modern technical means and computer processing of results;
- - in the field of calculation and design and analytical activities:

- - formulation of the task and objectives of the project (program) with the given criteria, target functions, constraints, building the structure of their interrelations, identification of priorities for problem solving;
- - development of generalized variants of problem solving, analysis of these variants, forecasting of consequences, finding of compromise solutions in conditions of multi-criteria, uncertainty, planning and project implementation;
- - development of production equipment projects taking into account mechanical, technological, design, operational, ergonomic, aesthetic and economic parameters;
- - use of information technologies for selection of necessary materials and equipment during manufacturing of finished products;
- - in the field of production and technological activity:
- Carrying out physical and experimental research using modern methods of measurement and processing of the results obtained;
- implementation of technological processes of production, quality control of elements and units for various purposes;
- calculation of production standards, technological standards for the consumption of materials, the choice of standard equipment, a preliminary assessment of the economic efficiency of the selected materials;
- effective use of materials and equipment, the choice and calculation of technological process parameters for the preparation of finished products;
- quality control of materials and technologies;
- - in the field of scientific and pedagogical activity:
- ensuring the qualitative transfer of skills and knowledge and the ability to work with staff in their training.

2 Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a standard diploma and confirm the level of knowledge of English with a certificate or diploma of a standard pattern.

The order of reception of citizens in a magistracy is established according to Standard rules of reception on training in the organizations of education realizing educational programs of postgraduate education»

Formation of a contingent of undergraduates, is carried out by placing the state educational order for training of scientific and pedagogical personnel, and also payment of training at the expense of own means of citizens and other sources. The state provides to citizens of the Republic of Kazakhstan the right to receive on a competitive basis according to the state educational order free postgraduate education if they receive education of this level for the first time.

At "entrance" a master should have all pre-requisites necessary for mastering of the corresponding educational program of a magistracy. The list of necessary pre-requisites is determined by the higher educational institution independently.

In the absence of necessary pre-requisites, the graduate is allowed to master them on a paid basis.

3 Requirements for completion of training and diploma

- **Degree/qualification awarded**: A graduate of the educational program "Material Science and Technology of New Materials" is awarded an academic degree "Master of Technical Sciences" in the direction of preparation "Material Science and Technology of New Materials".

- A graduate who has mastered the 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 activities, and develop their innovative abilities;
- the ability to independently formulate research goals and set a sequence of professional tasks;
- the ability to apply in practice the knowledge of fundamental and applied sections of disciplines that determine the orientation (profile) of the Master's program;
- the ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- mastering the skills of drafting and processing scientific and technical documentation, scientific reports, reviews, reports and articles;
- a willingness to lead a team in their professional sphere, tolerating social, ethnic, religious and cultural differences;
- readiness to communicate orally and in written form in a foreign language to solve professional tasks.
- A graduate who has completed a master's degree program must have professional competencies that correspond to the professional activities for which the master's program is oriented:
- research activity:
- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained during master's program master's studies;
- the ability to independently conduct scientific experiments and research in the professional field, to generalize and analyze experimental information, make conclusions, formulate conclusions and recommendations;
- the ability to create and research models of objects under study based on the use of in-depth theoretical and practical knowledge in the field of materials science, technologies for obtaining new materials and their processing;

Scientific and production activity:

- the ability to independently conduct production and scientific and production field, laboratory and interpretation work in solving practical problems;
- the ability to conduct professional operation of modern field and laboratory equipment and devices in the field of master's program;
- ability to use modern methods of processing and interpretation of complex information for solving production problems;
- design activity:
- Ability to independently prepare and present projects of research and production works;
- readiness to design complex research and scientific and production works for solving professional tasks;
- organizational and management activities:
- readiness to use practical skills of organization and management of scientific research and production works in solving professional tasks;
- readiness for practical use of normative documents in planning and organization of scientific and production works;
- scientific and pedagogical activity:
- ability to conduct seminar, laboratory and practical classes;
- ability to participate in management of scientific and educational work of students in the field of materials science, technologies of obtaining new materials and their processing.

At working out of the program of a magistracy all general cultural and general professional competences, and also the professional competences referred to those kinds of professional activity on which the program of a magistracy is focused, are included in a set of demanded results of master's program development.

4. The working curriculum of the educational program

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"
Satbayev University

SATBAYEV UNIVERSITY

Approved by:
Rector of the Non-profit Joint Stock Company "KazNRTU named after K.I.Satpayev"
Beysenbekov I.K.
28.04.20

WORKING CURRICULUM

Education program "Material science and technology of new materials - 7M07103"
Group of Educational Programs "Material science and technology of new materials - M103"
enrolment for 2020 - 2021 academic year

Academic degree: Magister
Term of study: 2 years

year of study	Code	Name of course	Component	Academic credits	lecture/ laboratory/ practice/MSIW	Prerequisites	Code	Name of course	Component	Academic credits	lecture/ laboratory/ practice/IWS	Prerequisites
1	1 semester						2 semester					
	LNG202	Foreign language (professional)	BD IC	6	0/0/3/3		AAP244	Pedagogical practice	BD IC	4	0/0/2/2	
	HUM201	History and philosophy of science	BD IC	4	1/0/1/2		PHY268	Technological quality assurance of materials	BD OC	6	1/0/2/3	
	HUM207	Higher school pedagogy	BD IC	4	1/0/1/2		PHY264	The modern theory of the atomic nucleus	BD OC	6	1/0/2/3	
	HUM204	Management psychology	BD IC	4	1/0/1/2		PHY265	Materials for 3D technology	PS IC	6	1/0/2/3	
	PHY262	Materials science and technology of new materials	BD OC	6	1/0/2/3		PHY266	Materials for energy storage and conversion	PS IC	6	1/0/2/3	
	PHY273	Numerical methods for solving physical problems	PS IC	6	1/0/2/3		AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6		
	AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6								
		In total		36				In total		34		
2	3 semester						4 semester					
	PHY269	Methodology for materials selection and technology	PS OC	6	1/0/2/3		AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6		
	PHY270	Multiphase structures and methods for calculating phase diagrams	PS OC	6	1/0/2/3		AAP236	Research scientific training	PS	7		
	PHY271	Destruction and reliability assessment of materials	PS OC	6	1/0/2/3		ECA205	Registration and defense of the master's thesis (RqDMT)	FA	12		
	PHY272	The Surface Structure Engineering	PS OC	6	1/0/2/3							
	AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6								
		In total		30				In total		25		
								In all		125		

Number of credits for the whole period of study

Cycles of disciplines	Credits
The cycle of general education	0
A cycle of basic disciplines (BD IC, BD OC)	40
A cycle of principal subjects (PS IC, PS OC)	49
All on the theoretical classes	89
MSSR	24
Registration and defense of the master's thesis (RoDMT)	12
In total	125

Decision of the Academic Board of Satbaev University. Protocol No.3 of "15" 09 2020

Decision of the Academic Council of the Institute of Metallurgy and Industrial engineering. Protocol No. 10 of "25" 05 2020

Vice-Rector for Research and Academic Affairs D.K. Nauryzbayeva

Chair of the APC K.B. Tulegenova

Director of Institute of Metallurgy and Industrial engineering K.K. Yelemessov

Head of "Engineering physics"department R.E.Beisenov

5 Descriptors of the level and scope of knowledge, skills and competencies

Requirements to the level of Master's degree are determined on the basis of the Dublin Descriptors of the second level of higher education (Master's degree) and reflect the mastered competencies, expressed in the achieved results of training.

The learning outcomes are formulated both at the level of the entire Master's degree program and at the level of individual modules or academic discipline.

The descriptors reflect learning outcomes that characterize a learner's abilities:

1) Demonstrate evolving knowledge and understanding in materials science and engineering, based on advanced knowledge in materials science, new materials production and processing technologies, when developing and/or applying ideas in the context of research;

2) professionally apply their knowledge, understanding and abilities to solve problems in a new environment, in a broader interdisciplinary context;

3) to 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 to both professionals and non-professionals;

5) training skills necessary for independent continuation of further training in the field of industrial production, technological engineering, scientific and innovation activities.

6 Competencies for completion of training

6.1 Requirements to the key competencies of graduates of scientific and pedagogical masters, shall:

1) have an idea:

about the role of science and education in public life;

modern trends in the development of scientific knowledge;

actual methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

the professional competence of a higher school teacher;

on contradictions and socio-economic consequences of globalization processes;

2) to know:

2) know: methodology of scientific cognition;

principles and structure of scientific activity organization;

psychology of cognitive activity of students in the process of education;

psychological methods and means to increase efficiency and quality of education;

3) be able to:

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 process and phenomenon analysis;

integrate knowledge gained from different disciplines to solve research problems in new unfamiliar conditions;

by integrating knowledge to make judgments and decisions based on incomplete or limited information;

apply the knowledge of pedagogy and psychology of the higher school in their pedagogical activities;

apply interactive teaching methods;

carry out informational, analytical and bibliographic work involving modern information technologies;

think creatively and approach creatively to solving new problems and situations;

be fluent in a foreign language at a professional level that allows to conduct scientific research and teach special subjects in higher education institutions;

summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;

4) have skills:

4) have skills in: research activities, solving standard scientific problems;

realization of educational and pedagogical activity on credit technology of training;

methods of teaching professional disciplines;

use of modern information technologies in the educational process;

professional communication and intercultural communication;

Oratorical art, correct and logical design of their thoughts in oral and written form; expansion and deepening of knowledge necessary for everyday professional activity and further education in doctoral studies.

5) be competent:

in the field of research methodology;

in the field of scientific and scientific-pedagogical activities in higher education institutions;

in the issues of modern educational technologies;

in the implementation of scientific projects and research in the professional field;

in the ways to ensure constant updating of knowledge, expanding professional skills and abilities.

B - Basic knowledge, skills and abilities

B1 - physical theories and concepts for explanation of structural regularities in materials; complexes of physical and mechanical properties of materials and technological methods of their change by influence on structural parameters; technological route maps of technological processes; principles of rational choice of materials to ensure their optimal application in constructions and products; information sources, databases for solving professional tasks; methods of conducting, analysis and evaluation of experimental results investigated

B2 - analysis of structure and properties of a certain class of materials using modern methods of research and scientific instruments (electro-physical, optical, electron-microscopic, X-ray); modeling the structure and properties of materials based on mathematical processing of scientific research results and the use of software products of material science in solving real problems and problems of science and production; selection and use of materials in technological processes of mechanical engineering, energy,

B3 - the basic technical and economic requirements to the equipment, modern technical means, methods and modes of preparation of initial material, processing for the purpose of reception of demanded properties and quality of production; questions of labour protection and safety precautions, a basis of the law and the nature protection legislation, a basis of patenting and scientific organization of work; independent working out and teamwork at the decision of professional problems with application of theoretical and practical knowledge.

P - Professional competencies:

P1 - to carry out competent, scientifically grounded choice of materials on the basis of extensive theoretical and practical knowledge in the professional field and development of research culture as a result of expansion of ideas about the specialty and formation of the integral view on science of materials;

P2 - to carry out industrial and technological types of professional activity; to solve engineering tasks in the field of obtaining and processing of materials and products from them; to conduct the necessary research and measurements, using modern scientific equipment; to analyze and interpret the data obtained, to draw conclusions;

P3 - to use the rules of safety and labor protection in conditions of industrial activity.

O - Human, social and ethical competencies

O1 - Ability to be guided by ethical and legal standards;

O2 - Ability to work in an international context;

O3 - Willingness to be aware of the social significance of their future profession, self-development, advanced training;

O4 - Ability to analyze socially significant processes and phenomena, to participate responsibly in social and political life.

C - Special and managerial competences:

C1-competence in production and management, design and development, organizational, technological and scientific-pedagogical fields on the basis of modern training means of information technologies and information resources.

C2-competence to carry out professional functions within one or more types of activities on the basis of the final results of training, taking into account the specifics of these activities, market requirements to organizational, management and professional competencies.

6.2 Requirements for research work of a master's degree student in scientific and pedagogical master's degree:

1) Corresponds to the profile of the Master's degree program on 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, methodical and technological achievements of science and practice;

4) is performed using modern methods of scientific research;

5) contains research (methodical, practical) sections on the main protected provisions;

6) is based on the best international experience in the relevant field of knowledge.

6.3 Requirements for organization of practices:

The educational program of scientific and pedagogical master's degree includes two types of practices that are conducted in parallel with theoretical training or in a separate period:

1) Pedagogical in the DB cycle - in the university;

2) research in the DB cycle - at the place of the dissertation.

Pedagogical practice is carried out for the purpose of forming practical skills of teaching and learning methods. In this case, the master's degree students are involved in conducting classes at the undergraduate level at the discretion of the university.

The research practice of the master's degree is carried out for the purpose of acquaintance with the newest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific researches, processing and interpretation of experimental data.

7 ECTS Diploma Supplement

The application is developed according to the standards of the European Commission, Council of Europe and UNESCO/CEPES. This document serves only for academic recognition and is not an official confirmation of a document of education. It is not valid without a higher education diploma. The purpose of the European Appendix is to provide sufficient data on the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information on the national education system. The model of the Appendix, on which the transfer of grades will be carried out, uses the European Transfer or Credit Transfer System (ECTS).

The European Diploma Supplement gives the opportunity to continue education in foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition you will need additional legalization of the diploma of education. The European supplement to the diploma is filled in English upon individual request and is issued free of charge.

FOREIGN LANGUAGE (PROFESSIONAL)

Professional English for Project Managers

CODE - LNG202

ACADEMIC CREDITS - 6 (0/0/3/3)

COURSE OBJECTIVE AND GOALS

The course aims to develop students' English for their current academic research and to improve their performance in project management.

COURSE SUMMARY

The course aims to develop vocabulary and grammar for effective communication in project management and to improve reading, writing, listening and speaking skills at Intermediate level. Students are expected to improve their business English vocabulary and learn grammatical structures that are often used in management contexts. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, while the 6th module is accompanied by a test at the end of the course. The course concludes with a final exam. Masters also need to study independently (MIS). MIS is the independent work of graduate students under the supervision of a teacher.

KNOWLEDGE, SKILLS, AND ABILITIES AT THE END OF THE COURSE

Upon successful completion of the course, students are expected to be able to recognize the main idea and main message, as well as specific details when listening to monologues, dialogues and group discussions in the context of business and management; to understand written and spoken English on topics related to management; write management texts (reports, letters, e-mails, minutes of meetings), following a generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases to speak about different business situations, using the appropriate business vocabulary and grammatical structures - in pairs and group discussions, meetings and negotiations.

THE PURPOSE OF THE COURSE

The purpose of the course is to develop students' English language competence for their current academic studies and efficient professional performance in the field of Project Management.

COURSE DESCRIPTION

The course aims at building up vocabulary and grammar for effective communication in the field of Project Management and is focused on improving reading, writing, listening, and speaking skills within the Intermediate level. Students are expected to acquire knowledge of Business English vocabulary and learn grammatical structures that are frequently used in the management context. The course comprises 6 modules. The 3rd module of the course is concluded with a midterm test and the 6th module is followed by an end-to-course test. The course finishes with the final examination. It is also mandatory for the master students to do their individual study (MIS). MIS is masters' independent work supervised by the instructor.

LEARNING OUTCOMES UPON SUCCESSFUL COMPLETION OF THE COURSE

Upon successful completion of the course, the student will be able to figure out the main idea and overall message, as well as specific details while listening to monologues, dialogues and group discussions within the business and management context; understand written and spoken English speech on the management-related topics; read, analyze and interpret authentic business English texts for perspectives, opinions and styles; write managerial texts (reports, letters, e-mails, meeting minutes) following the generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, speaking about different business situations using appropriate business vocabulary and grammatical structures - in pair and group discussions, at meetings and negotiations.

HISTORY AND PHILOSOPHY OF SCIENCE

CODE - HUM201

ACADEMIC CREDITS - 4 (1/0/1/2)

OBJECTIVES AND OBJECTIVES OF CURSE - to reveal the connection between philosophy and science, to highlight philosophical problems of science and scientific cognition, the main stages of the history of science, leading concepts of philosophy of science, modern problems of development of scientific and technical reality.

Brief description of the course - the subject of philosophy of science, dynamics of science, specifics of science, science and science, antiquity and formation of theoretical science, the main stages of historical development of science, features of classical science, non-classical and post-classical science, philosophy of mathematics, physics, technology and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of the scientist and engineer.

KNOWLEDGES, ASSESSMENTS, CURSE PURPOSE - to know and understand philosophical questions of science, the basic historical stages of development of science, leading concepts of philosophy of science, to be able to critically assess and analyze scientific and philosophical problems, to understand the specifics of engineering science, to possess the skills of analytical thinking and philosophical reflection, to be able to justify and defend their position, to possess the techniques of discussion and dialogue, to be able to be communicative and creative in their professional activities.

HIGHER SCHOOL PEDAGOGY

CODE - HUM207

ACADEMIC CREDITS - 4 (1/0/1/2)

Aims and ACTIVITIES of the course is directed on studying of psychological and pedagogical essence of educational process of the higher school; formation of representations about the basic tendencies of development of the higher school at the present stage, consideration of methodical bases of process of training at the higher school, and also psychological mechanisms influencing success of training, interaction, management of subjects of educational process. Development of psychological and pedagogical thinking of graduate students.

Brief description of the course in the course of study the master's students get acquainted with the didactics of the higher school, forms and methods of organization of education in the higher school, psychological factors of successful learning, features of psychological influence, mechanisms of educational influence, pedagogical technologies, characteristics of pedagogical communication, mechanisms of management of the learning process. Analyze organizational conflicts and methods of their resolution, psychological destructions and deformations of the teacher's personality.

KNOWLES, ASSESSMENTS, CURSE DEVELOPMENTS - at the end of the course the master should know features of the modern system of higher professional education, organization of pedagogical research, characteristics of subjects of educational process, didactic bases of the organization of the process of study in higher school, pedagogical technologies, regularities of pedagogical communication, features of educational influences on students, and also problems of pedagogical activity.

MANAGEMENT PSYCHOLOGY

CODE - HUM204

ACADEMIC CREDITS - 4 (1/0/1/2)

PREREQUISIT Discipline Management Psychology" is based on the knowledge gained from the Bachelor's degree courses.

COURSE OBJECTIVE AND GOALS

Study of the basic principles of organization management and educational activity management

COURSE SUMMARY

The content of the course is aimed at learning the basics of education management,

Management of global educational processes, analysis and selection of strategic initiatives, the project as a development management strategy of the educational institution/organization. Also Master's students will study education marketing, human resources management in educational organizations, information and communication technologies in education and educational process management (on the example of higher school).

KNOWLEDGE, ABILITIES, SKILLS UPON COMPLETION OF THE COURSE

As a result of this course, the graduate student should know:

- modern ideas about the role of pedagogical management in ensuring the competitiveness of the educational institution/organization;
- the maintenance of concept "education management"; the basic stages of the organization of educational process;
- the main features of the marketing policy of the educational institution/organization;
- the main approaches used in the practice of human resources management of an educational institution/organization;
- role of information and communication technologies in education
- be able to:
- be guided by the main trends of modern scientific and technological development;

various resources and tools to manage the educational process;

- choose the most appropriate strategy for the innovative development of an educational institution/organization;
- work with scientific, technical and economic literature on organization, management and marketing of education.

MATERIALS SIENCE AND TECHNOLOGY OF NEW MATERIALS

CODE -PHY262

ACADEMIC CREDITS - 6 (1/0/2/3)

COURSE OBJECTIVE AND GOALS

Purpose of the discipline:

- To acquire professional knowledge in the field of practical and theoretical material science in an amount sufficient to understand the processes occurring in solids under the influence of external factors, and to develop technologies for obtaining promising materials by creating a given structural-phase state and properties.

Objectives of the discipline:

- study of basic provisions and principles of formation of the given level of structure and properties of materials of various purposes;

- mastering the principles of management of structural-phase state of materials and the influence of technological factors of external influence on it.

SHORT COURSE DESCRIPTION

Material science as a basic component of machine and instrument engineering. Aims and objectives of modern and advanced material science. The concept of an ideal structural and functional material, its characteristics and production capabilities. Classification of promising materials and technologies. Principles of creation of the given structural-phase condition from the point of view of interaction of internal characteristics of materials and technological factors of external influence. Ultrafast melt hardening and obtaining amorphous materials. Ion-plasma technologies for modification of structural and functional materials. A new class of powder materials obtained by electron-pulse compacting methods. Mechanically activated materials with high reactivity of interaction with improved characteristics of structure and properties. Functional hybrid materials representing metal-ceramic polymer compositions. Highly entropic alloys with unique structure characteristics and properties.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

KNOWLEDGE

- basics of the theory and practice of creating a given structural-phase state of materials for different purposes;

- regularities of influence of external technological factors on change of grain and subgrain structure of materials, their phase composition, state, type and concentration of defects;

- principles of interaction of internal characteristics of materials with external factors of technological influence.

ASSESSMENTS

- to apply the received knowledge at an estimation of possibilities of reception of the set level of structure and properties of materials at influence of external technological factors;

- to determine by standard methods the operational and technological properties of structural and functional materials;

the set task and choose the optimal ways of its solution for obtaining the necessary structural-phase state.

SKILLS

- making an independent decision when choosing the best way to produce materials for various purposes and properties;

- possession of quantitative and qualitative methods of processing and analysis of test results of plastic and strength properties of materials;

- analysis of information about the main trends in the development of advanced material science in the field of development of a fundamentally new class of structural and functional materials.

NUMERICAL METHODS FOR SOLVING PHYSICAL PROBLEMS

CODE –PHY273

ACADEMIC CREDITS - 6 (1/0/2/3)

OBJECTIVE OF EDUCATION: to teach the construction of mathematical models of various physical phenomena, to study the basic methods of solving mathematical problems arising in this case, to clarify the physical meaning of the obtained solutions.

CONTENTS: To build a mathematical model (compilation of equations describing the phenomenon under study). Selection of numerical calculation methods (construction of a discrete model approximating an initial mathematical problem, construction of a difference scheme, development of a computational algorithm, etc.). Creation of a program that implements a computational algorithm. Performing calculations and processing the obtained information. Analysis of calculation results, comparison (if possible) with a field experiment.

KNOWLEDGES, MANUFACTURES, CURSE LEVELS: demonstrate the ability to apply the obtained knowledge in mathematics and physics to set, formulate and solve applied scientific technical problems using recognized methods of computational physics.

TECHNOLOGICAL QUALITY ASSURANCE OF MATERIALS

CODE - PHY 268

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

The objectives of the discipline are:

- study of quality indicators of materials, determining its performance in products of a particular purpose;

The objectives of the discipline are as follows:

- study of the main quality indicators of materials from the standpoint of their performance in products and structures;
- quality management of materials used in engineering based on compliance with the principles and criteria for quality assessment, as reflected in industry documents and regulations, as well as national and international standards.

COURSE SUMMARY

The course of discipline "Technological quality assurance of materials" is based on the knowledge of quality indicators of materials and products made of it. In this regard, to study the concept of quality of material, different indicators (manufacturability, ergonomics, standardization and unification, economic indicators, safety), characterizing the properties and determining the functions of products for which the material is intended, as well as determining the field of application of this material. To study the possibilities of technological quality assurance of materials for manufacturing of technical products, the discipline course also includes the issues of analysis of reasons for quality reduction at different stages of design of the technological process; methods of control (diagnostics) of the material state, its defects associated with the violation of technological processes; methods to improve the quality of materials in the technological process of production of parts and structures. The experimental approach of technological quality assurance of materials based on theoretical knowledge and measurement tests, as well as mathematical simulation of processes on the basis of experimental data is considered separately.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

Magistrate

Must have an idea of:

- scientifically grounded approaches, procedures and algorithms to solve complex multifactorial problems on technological quality assurance of materials intended for a particular application.

Must know:

- the main indicators of quality of materials, which are built the technological process of manufacturing products and structures, and, accordingly, the application of the material;
- in-depth information on the main groups of materials (metals and alloys, ceramics, polymers, composites, nanomaterials), together with the study of technological processes of production and processing of

Should be able to:

- perform statistical analysis of experimental test data for statistical quality control to avoid defects;
- evaluate the quality of materials according to normative documents.

THE MODERN THEORY OF THE ATOMIC NUCLEUS

CODE - PHY 264

ACADEMIC CREDITS - 6 (1/0/2/3)

OBJECTIVE: to study modern models of the atomic nucleus, basic concepts, ideas and methods of modern theory of elementary particles.

Brief Content: An overview of the current stage of development of the theory of the atomic nucleus and elementary particles is presented. Such sections as basic characteristics of stable nuclei, radioactive transformations of nuclei, models of nuclei, nuclear reactions, types of nuclear reactors, characteristics and systematics of interaction particles, quark particle model, physics of elementary particles and the Universe are considered. The major part of the course is devoted to general issues of physics of nuclei, elementary particles and interactions, possibilities of combining interactions, nuclear power are also considered.

KNOWLEDGES, MANUFACTURES, CURSE LEVELS: the ability to apply the acquired knowledge in practical and research work, the ability to use nuclear physics instruments and methods of nuclear technologies.

MATERIALS FOR 3D TECHNOLOGY

CODE - PHY 265
ACADEMIC CREDITS - 6 (1/0/2/3)
DISCIPLINE OBJECTIVE AND GOALS
The purpose of this discipline is to study:
-Formation of ideas about mechanisms and regularities of composite and powder materials creation, obtaining a complex of knowledge about the relationship of technological parameters with the structure and properties of materials for 3D modeling.
-Consultation of engineering skills for building technological processes of using composite and powder materials, modern methods of control over the technological process and quality of products for 3D technology.
The objectives of the discipline are as follows:
- To acquaint master's students with various metal and non-metal materials, their chemical, physical, technological properties and methods of their evaluation, as well as with the basics of 3D technologies, their advantages, disadvantages and main areas of application.
SHORT COURSE DESCRIPTION
The discipline "Materials for 3D technology" is a study of methods of obtaining and using composite and powder materials, as well as the representation of the mechanism and patterns of materials for 3d modeling, their advantages, disadvantages and main areas of application.
KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE
Magistrate
Must have an idea of:
- the current state of the materials used for 3D modeling.
Must know:
processes in the theory and practice of the use of composite, powder materials, modern scientific concepts in mechanics and physics of forming and sintering processes to create a material for 3D technology with a set of properties.
Must be able to:
choose the method and modes of powders production depending on their purpose and required characteristics as well as on economic considerations. Ability and skills in determining the particle size distribution by different methods, particle shape, microhardness, bulk density, fluidity and other physical and technological characteristics of powders. Knowledge of issues of classification and marking of materials for 3D technology.
acquire practical skills:
Building technological processes of using composite and powder materials, modern methods of control over the technological process and quality of products for 3D technology.

MATERIALS FOR ENERGY STORAGE AND CONVERSION

CODE - PHY 266

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

COURSE OBJECTIVE AND GOALS

Purpose of the discipline:

- To acquire the necessary knowledge on the principles and technology of manufacturing of a special class of materials for the accumulation and conversion of energy of chemical and physical processes into energy of power plants and units

Objectives of the discipline:

- Studying the physical basis for the implementation of the phenomena of the photo effect, thermoelectronic emission and the Zeebeck-Peltier-Thompson effect;

- understanding the principles of functioning of photovoltaic, thermoelectric emission and thermoelectric energy converters.

SHORT COURSE DESCRIPTION

General characteristics of the processes leading to the generation and transformation of thermal energy. Physical basics of functioning of energy converters of different types. Zone diagrams and energy zone structures of semiconductor materials. Methods and technical means of measurement of functional characteristics of photoelectric converters. Thermal emission energy converters, their classification, principle and energy efficiency. The phenomena occurring in thermal emission generators, operating modes and electrical characteristics. Materials for emitter and collector units of thermal emission converters. Thermoelectric converters, circuits and operating principle. Theory and practice of operation of thermoelectric converters. Problems and prospects of development of new power engineering.

KNOWLEDGE, SKILLS, SKILLS ON COMPLETION OF THE COURSE.

KNOWLEDGE

- status of the issue of renewable energy sources on the global clean energy market;

- main regularities of physical processes development accompanied by thermal energy emission;

- principles of operation of energy converters of different types, their advantages and disadvantages.

ASSESSMENTS

- to apply the obtained knowledge when assessing the energy efficiency of conversion of energy of physical processes into electric energy of power plants;

- to use standard measuring instruments and methods of calculation of functional characteristics of converters;

- to analyze design features of transducers of different types and understand the principle of increasing the efficiency of their work.

SKILLS

- organization of a self-education system to understand the essence of physical processes that occur in materials that accumulate and transform thermal energy;

- work on test facilities and research equipment to assess their performance and efficiency of energy converters of different types;

- analysis and generalization of scientific and technical information on fundamental and applied problems of developing a special class of functional energy converters materials.

METHODOLOGY FOR MATERIALS SELECTION AND TECHNOLOGY

CODE - PHY 269

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

The purpose of this discipline is to study:

-knowledge of the basics of structural crystallography, crystallochemistry and theory of metal crystal structure defects, necessary for understanding the structure of metals and alloys, control and prediction of properties.

The tasks of the discipline are as follows:

- study the basic concepts and laws of structural crystallography, crystallochemistry and theory of defects.

SHORT COURSE DESCRIPTION

The role of the discipline "Methodology of choice of materials and technologies" in the preparation of qualified specialists is determined by the fact that the choice of materials and technologies for obtaining and processing this material is one of the most important stages of engineering, construction and other types of production. It is the right choice of material, to a large extent, determines the quality of detail, reliability and efficiency of its work, as the quality of products and, in particular, specific parts and structures, significantly depends on both the technology of manufacture and the quality of materials, their structure and properties.

Selection of optimal materials for technical products and their rational use in production are possible only on the basis of knowledge of the structure and properties of materials, methods of assessing their quality. Therefore, this course of discipline summarizes the totality of theoretical knowledge and practical techniques used in specific technologies... As a result of studying this discipline, the methodological culture of the bachelor's degree in engineering and technology in the material science area of training increases. The content of the course is oriented not only to the study of the basics of science, but also to the science itself in development to bring together the research and training work of students.

KNOWLEDGE, SKILLS, AND ABILITIES UPON COMPLETION OF THE COURSE

The magistrate should have an idea of:

- scientifically grounded approaches, procedures and algorithms to solving complex multifactorial problems on the optimal choice of materials and technologies based on the use of methodological methods and techniques.

She should know:

- the basic concepts and stages of scientific knowledge on which any research is based, and, accordingly, the choice of a particular material, part, product, construction is a research process based on knowledge of the methodology of scientific search.

- In-depth information on the main groups of materials (metals and alloys, ceramics, polymers, composites, nanomaterials), together with the study of technological processes of obtaining and processing.

Should be able to:

- organize the search for optimal material and technology in solving material science problems;

- find an appropriate application of the material for a particular purpose, taking into account the technology of its production and processing.

MULTIPHASE STRUCTURES AND CALCULATION METHODS FOR PHASE DIAGRAMS

CODE - PHY 270

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

Aims of studying the discipline.

The purpose of studying the discipline "Multiphase structures and methods for calculating phase diagrams" is to familiarize students: with the basics of theory of alloys of phase transformations occurring in materials; with the regularities of formation of phase composition and structure of alloys depending on their chemical composition, temperature, pressure and processing modes; with theoretical methods of calculation of phase equilibriums and prediction of diagrams of multi-component metal systems.

Objectives of the discipline.

The main objectives of studying the discipline "Multiphase structures and methods of calculation of phase diagrams" are: mastering the scientific foundations of theoretical methods of calculation of metal systems phase diagrams, the ability to make block diagrams and computer programs for the calculation of phase diagrams, the construction of calculation by isothermal and polythermal sections of phase diagrams of multicomponent systems.

SHORT COURSE DESCRIPTION

Further theoretical and experimental studies of all kinds of phase transitions in liquid, solid metals and alloys are needed to find ways of scientifically grounded control of phase composition, structure and properties of alloys. Theoretical studies of phase equilibriums in multi-component metal systems, calculation and prediction of condition diagrams have now acquired a large scope. Calculation methods make it possible to involve the achievements of theoretical physics, computer technology and success in the study of thermodynamic and physical properties of alloys in the construction of condition diagrams.

The special scientific discipline "Multiphase Structures and Methods of Calculation of Phase Diagrams" allows to form a scientific worldview in the field of development and creation of new materials with the required level of properties, as well as to navigate in promising directions and trends in material science, to analyze the basic components of the relationship between internal and external parameters of structure management.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

The master should have an idea of the current state of the theory of phase transitions, trends of further development; know the laws and concepts of physical chemistry; be able to analyze phase changes occurring in pure metals and multicomponent systems; be able to construct and calculate phase diagrams of multicomponent metal systems.

DESTRUCTION AND RELIABILITY ASSESSMENT OF MATERIALS

CODE - PHY 271

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

The objectives of the discipline are:

- in-depth study of mechanical properties and behavior of materials under the influence of various factors, taking into account the presence of cracks in them;

The objectives of the discipline are as follows:

- study of the fracture process of materials by linear fracture mechanics criteria;
- assessment of reliability of materials operating under different operating conditions.

SHORT COURSE DESCRIPTION

The course of discipline "Destruction and estimation of reliability of materials" is based on the modern approach to an estimation of durability and destruction of materials taking into account positions of linear mechanics of destruction and synergetic principles of destruction, establishing the general laws by definition of points of bifurcation which are responsible for non-equilibrium phase transitions at change of micromechanism of destruction. The sections for study include crystals of fracture materials associated with the formation of conditions of crack propagation (type of stressed and deformed state of the original material, structural heterogeneity in the fracture zone, the dislocation mechanism of crack initiation and propagation). To assess the reliability of materials are included to study the criteria of linear fracture mechanics, allowing to assess the local behavior of materials in the implementation of flat deformation (CI, GIC) and flat-stressed state (C, GC), as well as the criteria of local fracture half-halfunction, allowing to analyze the fracture process taking into account the geometric, mechanical and physical similarity. Methods of Brittle Fracture Resistance Assessment by Criteria of Crack Resistance are to be studied.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

Magistrate

Must have an idea of:

- modern approaches to the investigation of fracture mechanisms from the position of linear fracture mechanics and synergistic views.

Must know:

- new criteria of crack nucleation and propagation, characterizing the performance of the material under specific operating conditions;
- the physical nature of the fracture mechanism associated with the creation of a certain dislocation structure in the crack propagation zone;
- methods for determination of mechanical characteristics and fracture resistance parameters taking into account similarity of local fracture of materials.

Should be able to:

- to estimate by experimental methods fracture resistance on criteria of linear fracture mechanics;
- analyze the influence of various factors on fracture fracture parameters of materials

THE SURFACE STRUCTURE ENGINEERING

CODE - PHY 272

ACADEMIC CREDITS - 6 (1/0/2/3)

DISCIPLINE OBJECTIVE AND GOALS

The purpose of this discipline is to study:

- obtaining knowledge about the parameters of the state of the surface layer of materials affecting the performance characteristics of the product, as well as on technological methods of obtaining surface layers with specified properties.

The objectives of the discipline are as follows:

- to study the composition and structure of surface layers of materials, as well as physical and mechanical properties of surface layers and coatings (microhardness, wear characteristics, adhesion, corrosion, etc.);

- study methods of surface topography, distribution of residual stresses, etc., as well as technological methods to influence the structure of the surface layer.

SHORT COURSE DESCRIPTION

The course of discipline "Engineering of surface structures" develops the basis of one of the promising directions of modern material science, which appeared in connection with the new needs of production industries. Proceeding from a number of the latest developments in the field of friction and wear theory, plasma technologies of surface treatment, ion technology, laser treatment, the course of discipline includes the relevant sections. The promising areas of surface structure engineering are new methods of surface analysis, in particular, the development of nanostructured functional gradient coatings on steel surfaces to create new functional properties, technology of surface oxidation of titanium and titanium alloys samples. Another area of surface structure engineering is related to the creation of anti-corrosion coatings based on epoxy-polyester powder coatings, some coating properties obtained by high-speed gas-flame spraying of composite powders containing nanoparticles, as well as nanocomposite carbon coatings modified by copper nanoclusters.

KNOWLEDGE, SKILLS, COMPLETION SKILLS

Magistrate

Must have an idea of:

- processes occurring in the surface layer of the material and determining the behavior of this material under the influence of various factors.

Must know:

- the nature of changes in a number of parameters of the state of surface layers (composition, structure) and the most important factors that determine the resistance of high-strength materials to cracking;

- possible structural changes and phase transformation of the layer depth under the influence of external factors.

Must be able to:

- apply methods of measuring element composition of the surface layer, distribution of residual stresses, etc;

- use technological methods to influence the structure of the surface layer to obtain the specified properties of the product.

MASTER'S STUDENT SCIENTIFIC RESEARCH, INCLUDING AN INTERNSHIP AND A MASTER'S THESIS

CODE - AAP 242

CREDIT -6

In accordance with the SESR, the research work of a master's degree student is an obligatory section of the Master's degree program and is aimed at forming general cultural and professional competencies.

The research work of the master's degree includes scientific and research work in a semester (NIRM) as a separate type of activity for which 6 academic credits in each semester are allocated in the curriculum of the master's degree.

The research work in a semester is carried out by a master's degree student under the direction of a scientific supervisor. The direction of the research work of the master's degree is determined in accordance with the master's program and the topic of the master's thesis.

The list of forms of research work in a semester for master's students of the 1st and 2nd years of study is determined by the curriculum of the master's program and the individual plan of the master's degree agreed with the head. The plan of scientific and research work of NIRM is developed by the scientific head of the master's degree program, approved at the department meeting.

The purpose of research work in the semester is to prepare the master's degree student for independent research work, the main result of which is the writing and successful defense of the master's thesis, and the conduct of scientific research in the creative team.

The objectives of the research work in the semester:

Development of work plans and programs for scientific research and technical developments, preparation of individual tasks for the performers;

collection, processing and systematization of scientific and technical information on the subject of planned research, selection of methods and means for solving the formulated tasks;

development of experimental research programs, its implementation, including selection of technical means and processing of results;

preparation of scientific and technical reports in accordance with the requirements of regulatory documents, development of reviews and preparation of publications;

development of recommendations on the practical use of the results obtained;

development of patent documents for samples of new technology.

is aimed at studying research and design activities, solution of standard professional tasks in innovative conditions, ability to plan and organize technological processes of production.

The research work of a master's degree student in a scientific and pedagogical direction should:

- correspond to the main problems of the educational program on which the master's thesis is defended, be relevant, contain scientific novelty and practical importance;
- be based on modern theoretical, methodological and technological achievements in science and practice;
- to be carried out using modern methods of scientific research.

PEDAGOGICAL PRACTICE

CODE - AAP 244

ACADEMIC CREDITS - 4 (0/0/2/2)

Pedagogical practice of the master's degree in the scientific and pedagogical direction in the DB cycle is carried out for the purpose of forming practical skills of teaching and learning methods. In this case, master's students are involved in conducting classes in the bachelor's degree at the discretion of the department under the supervision of a scientific supervisor, head of the department, highly qualified specialists.

In accordance with the pedagogical practice is a compulsory form of practice of master's students of the second year of study is intended for further orientation of future master's students on scientific and pedagogical activities as a teacher of technical disciplines.

The place of the scientific and pedagogical practice is the department. The methodological management of the practice is carried out by the person responsible for the practice of master's students.

The main objectives of the pedagogical practice are:

acquaintance of master's students with the specifics of the activity of a discipline teacher and formation of skills to perform pedagogical functions;

consolidation of psychological and pedagogical knowledge in the field of engineering pedagogy and acquisition of skills of creative approach to solving scientific and pedagogical problems.

The content of the pedagogical practice of master's students is not limited to the direct pedagogical activity (independent laboratory and practical classes, seminars, course design, reading pilot lectures on the proposed topic, etc.).

It is assumed that the trainee will work together with the faculty of the Department to address current educational and methodological issues, get acquainted with innovative educational technologies and introduce them into the educational process.

RESEARCH SCIENTIFIC TRAINING

CODE - AAP 236

CREDIT - 7

The research practice is part of the Master's research work, which also includes semester research and preparation of the Master's thesis.

The purpose of the research practice is to prepare the student to carry out professional activities in the field of research processes: to develop the skills of independent research work, to consolidate the knowledge obtained in the framework of theoretical training, to acquire the required research professional competencies, to gain experience in research of the actual scientific problem, which is the subject of the master's thesis.

In accordance with these tasks, the specific objectives of the research practice are as follows:

- consolidation of knowledge, skills and abilities acquired by the master's students in the process of studying the master's program disciplines;
- forming a list of required competencies;
- mastering of the modern methodology of scientific research by master students;
- mastering modern methods of collection, analysis and processing of scientific information;
- forming a comprehensive view of the specifics of research activities in the field of materials science
- forming the ability to determine the purpose, objectives and plan of research; - collecting materials on the topic of the master's thesis;
- involving master's students in the practice of research work carried out at the department,
- management design skills development;
- mastering the skills of presenting the results obtained in the form of reports, publications, and reports;
- assistance in activation of research activity of Master's students.

REGISTRATION AND DEFENSE OF THE MASTER'S THESIS (RADMT)

COD - ECA205

CREDIT -12

The purpose of the master's thesis is:

Demonstration of the level of scientific/research qualification of the master's degree, ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most common methods and techniques to solve them.

BRIEF DESCRIPTION

Master's thesis is a final qualifying scientific work, which is a generalization of the results of independent research by the master of one of the actual problems of a particular specialty of the corresponding branch of science, which has an internal unity and reflects the course and results of the development of the chosen topic.

Master's thesis - the result of research /experimental research work of the master's degree student, conducted during the whole period of the master's education.

Defending the master's thesis is the final stage of master's training. The master's thesis should meet the following requirements:

- the work should conduct research or solve actual problems in the field of industrial production, technological engineering, scientific and innovative activity;
- the work should be based on identifying important scientific problems and their solution;
- the decisions should be scientifically grounded and reliable, have internal unity;
- the dissertation work should be written in person.

Contents