NJSC "Kazakh National Research Technical University named after K. I. Satpayev "
Institute of Industrial Engineering
Department of "Machine-tool building, materials science and technology of machine-building production"

Working curriculum
CURRICULUM PROGRAM

"ADDITIVE MANUFACTURING"
Master of Technical Sciences
in the field of mechanical engineering and additive manufacturing

on the basis of the following specialties of the invalidated Classifier of specialties: " 6M071200 - Mechanical engineering " , " 6M073800 - Technology of material processing by pressure "

1st edition
in accordance with the State Educational Standard of Higher Education 2018

Almaty 2019

The program was drawn up and signed by the parties:

от КазНИТУ имени К.И. Сатпаева:
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От работодателей - сопредседатель Консультативного совета ИПИ,
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Approved at a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K.I. Satpayev. Protocol No. 3 dated 19.12.2018

Qualification :
Level 7 of the National Qualifications Framework:
7M071 Engineering and Engineering (Master of Science):
7M0738107 - Additive manufacturing

Professional competencies: in the field of research methodology; in the field of scientific and scientific-pedagogical activity 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, expanding professional skills and abilities.

Brief description of the program:

1 Objectives of the educational program

The objectives of the EP **"Additive Manufacturing "** are:

Meeting the needs of students for intellectual, creative and professional development by acquiring knowledge and skills in the field of additive manufacturing ;

Organization of master's training, allowing all graduates to continue their education both with the aim of obtaining a PhD in additive manufacturing , and with the aim of further self-improvement in order to successfully build a career in additive manufacturing.

Meeting the needs of the Republic of Kazakhstan for qualified personnel through training on the use and maintenance of complex additive of plants and and specialists with skills of designing equipment with computer control because of industrialization and digital- to -ization industry.

To ensure high quality training and competitiveness of graduates, the department pays great attention to integration and cooperation with employers and strategic partners.

2 Types of work

The types of professional activities for which graduates who have mastered the master's program are preparing:

- research;
- design and engineering;
- organizational and managerial;
- installation and commissioning;
- service and operational ;
- scientific and pedagogical .

The master's degree in the direction of preparation " Additive manufacturing " should be prepared for solving professional problems in accordance with the profile direction of the master's program and types of professional activity:

research activities:

- implementation analysis and scientific and technical information, domestic and foreign experience in the field of research and development of additive manufacturing ; exploring new methods of management theory, techniques of artificial intelligence, and other scientific fields that make up the theoretical basis and dditivno of production and , compilation and publication of reviews and essays;

- carrying out theoretical and experimental research in the field of developing new samples and improving existing additive manufacturing , their modules and subsystems, searching for new additive technologies ;

- carrying out patent research accompanying the development of new additive manufacturing , in order to protect intellectual property objects, the results of research and development;

- carrying out developments and experimental samples of additive manufacturing , their modules and subsystems in order to verify and substantiate the main theoretical and technical solutions to be included in the terms of reference for the implementation of experimental design work;

- organizing and conducting experiments on existing additive manufacturing facilities , their subsystems and individual modules in order to determine their effectiveness and determine ways to improve, processing the results of experimental research using modern information technologies;

- preparation of reports, scientific publications and reports at scientific conferences and seminars, participation in the implementation of research and development results into practice;

design and engineering activities:

- preparation of a feasibility study for projects of new additive manufacturing , their individual subsystems and modules;

- calculation and research of additive manufacturing , control, information-sensor and executive subsystems using mathematical modeling methods, prototyping and testing of operating systems, processing of experimental data using modern information technologies;

- development of special software for solving problems of design of additive manufacturing , development of technical specifications and direct participation in the design of additive machines and equipment ;

organizational and management activities:

- development of organizational and technical documentation (work schedules, instructions, plans, estimates) and established reporting on approved forms;

- organization of the work of small groups of performers involved in research, design and construction work and in experimental research;

- control over the implementation of measures for the prevention of industrial injuries, occupational diseases, the prevention of environmental violations in the process of research and operation of additive manufacturing ;

installation and commissioning activities:

- participation in verification, commissioning, adjustment, assessment of the state of equipment and adjustment of additive manufacturing for various purposes, including both technical means and software control systems;

- participation in the pairing of software and hardware systems with technical objects as part of additive manufacturing , in testing and commissioning of prototypes of such systems;

service and operational activities:

- participation in verification, commissioning, adjustment and assessment of the state of additive equipment for various purposes, as well as their individual subsystems, in setting up control hardware and software complexes;

- preventive monitoring of the technical condition and functional diagnostics of additive equipment for various purposes, as well as their individual subsystems;

- preparation of operating instructions for additive equipment and their hardware and software, development of routine test programs;

- preparation of applications for equipment and components, preparation of technical documentation for equipment repair ;

scientific and pedagogical activity:

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

- participation in the organization and modernization of individual laboratory works and workshops in professional disciplines;

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

- application and development of new educational technologies, including computer and distance learning systems.

3 Objects of professional activity

The objects of professional activity of a graduate are:

- Additive machines and 3 D printers , including information-sensory, executive and control modules, their mathematical, algorithmic and software, methods and tools for their design, modeling, experimental research and design;

- theoretical and experimental studies of additive manufacturing for various purposes.

PASSPORT OF THE EDUCATIONAL PROGRAM

1 Scope and content of the program

The term of study in the master's program is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. In the scientific and pedagogical magistracy, at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master student.

The planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of credit technology of education.

Master's scientific and pedagogical direction is realized in an educational program of postgraduate education in the training of scientific and scientific-pedagogical personnel for universities and research organizations with in-depth research and teaching and research training.

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

1) theoretical training, including the study of cycles of basic and major disciplines;

2) practical training of undergraduates: various types of practices, scientific or professional internships;

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

4) final certification.

OP content of the " additive manufacturing " in the framework of special s 6 M 071 200 - Machinery, 6 M 073 800 material handling -Technology pressure is implemented in accordance with the credit technology training and implemented at the state and Russian languages.

The EP allows you to successfully implement the principles of the Bologna Process. Based on the choice and independent planning of the sequence of study disciplines by undergraduates, they independently form their individual curriculum (IEP) for each semester according to the Working curriculum of the specialty and the Catalog of elective disciplines.

Objectives of the educational program:

- development of students through research activities, critical thinking, development of professionally oriented skills and abilities;

- the use of highly professional training of undergraduates in a different educational environment;
- training a new competitive generation of technical specialists for the labor market;
- developing an environment that supports people of different cultures, and creating an atmosphere of pursuit of knowledge, academic integration and intellectual motivation;
- Carrying out research work, educational activities based on the best world experience, the development of its own methods and style of training specialists;
- development of cooperation "university-industry" to meet the requirements of the labor market for technical specialists, to improve the quality of educational programs for training specialists;
- development of additional educational and training programs in the use of multimedia ynyh , new teaching technologies for training on the principle of learning throughout life;
- establishing partnerships with other universities, organizations in order to improve the quality of education, to support technical and cultural ties.

2 Requirements for applicants

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

The procedure for admitting citizens to the magistracy is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education.

Formation of a contingent master's degree, is carried out by district azmescheniya state educational order for training of scientific and pedagogical staff, as well as tuition fees at their own expense of citizens and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

3 Requirements for completing studies and obtaining a diploma

Awarded degree / qualifications : A graduate of this educational program is awarded an academic degree " Master of Engineering " 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, to develop their innovative abilities;
- the ability to independently formulate research goals, 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 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 compiling 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 for communication 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 activity that the master's program is focused on:

research activities:

- the ability to draw up mathematical models of additive manufacturing , their subsystems, including executive, information-sensory and control modules, using the methods of formal logic;
- the ability to use existing software packages and, if necessary, develop new software required for information processing and control in additive manufacturing , as well as for their design;
- the ability to develop experimental models of control, information and executive modules of additive manufacturing and conduct their research using modern information technologies;
- the ability to analyze scientific and technical information, generalize domestic and foreign experience in the field of additive manufacturing , automation and control, conduct a patent search;
- the ability to develop methods for conducting experiments and conduct experiments on existing models and samples of additive manufacturing and their subsystems, to process the results using modern information technologies and technical means;

- readiness to draw up analytical reviews and scientific and technical reports on the results of the work performed, in the preparation of publications based on the results of research and development;

- the ability to put into practice the results of research and development carried out individually and as part of a group of performers, to ensure the protection of intellectual property rights;

design and engineering activities:

- willingness to lead and participate in the preparation of a feasibility study for projects to create additive manufacturing , their subsystems and individual modules;

- the ability to prepare technical specifications for the design of additive manufacturing of their subsystems and individual devices using standard executive and control devices, automation equipment, measuring and computing equipment, as well as new devices and subsystems;

- the ability to participate in the development of design and design documentation for additive manufacturing in accordance with existing standards and specifications;

- willingness to develop a methodology for experimental research and testing of additive manufacturing , the ability to participate in such tests and the processing of their results;

organizational and management activities:

- the ability to organize the work of small groups of performers;

- willingness to develop technical documentation (work schedules, instructions, plans, estimates) according to approved forms;

- willingness to apply methods of prevention of industrial injuries, occupational diseases, prevention of environmental violations;

installation and commissioning activities:

- the ability to carry out commissioning, adjustment and tuning of additive manufacturing for various purposes;

- willingness to debug hardware and software systems and their interface with technical objects as part of additive manufacturing ;

- willingness to participate in testing and putting into operation prototypes of additive manufacturing ;

service and operational activities:

- willingness to participate in the development of routine test programs, verification and assessment of the state of additive manufacturing for various purposes, as well as their individual subsystems;

- the ability to carry out preventive monitoring of the technical condition and functional diagnostics of additive manufacturing for various purposes, as well as their individual subsystems;

- the ability to draw up instructions for the operation of additive manufacturing and their hardware and software;

- readiness to draw up applications for equipment and components, to participate in the preparation of technical documentation for equipment repair.

scientific and pedagogical activity:

- willingness to take a direct part in educational and educational-methodical work on the profile of the direction of training, to participate in the development of programs of academic disciplines and courses;

- the ability to conduct training sessions, laboratory work, to ensure practical and research work of students;

- the ability to apply new educational technologies.

When developing an educational program for a master's program , all general cultural and general professional competencies, as well as professional competencies related to the types of professional activities of additive manufacturing specialists , are included .

4 Working curriculum of the educational program

4 .1. The term of study is 2 years

Year of study	The code	Name of the discipline	Component	Loans		Lk / lb / pr	Prerequisites	The code	Name of the discipline	Component	Loans		Lk / lb / pr	Prerequisites
				ECTS	RK						ECTS	RK		
one	**1 semester**							**2 semester**						
		Foreign language (professional)	DB VK	5	3	0/0/3		MCH	3D scanning and digitization	DB KV	5	3	2/0/1	
		History and philosophy of science	DB VK	4	2	1/0/1		MCH	Photonics and advanced laser systems and technologies	DB KV	5	3	2/0/1	
		Higher education pedagogy	DB VK	4	2	1/0/1		MCH	Modern and prospectively materials processing technology	PD KV	4	2	1/0/1	
		Management psychology	DB VK	4	2	1/0/1		ISO	Qualimetry in mechanical engineering	PD KV	4	2	1/0/1	
	ISO	Optimal machine design	DB OK	5	3	2/0/1		SIT	Implementation of additive technologies in production	PD KV	5	3	2/0/1	
	ISO	Digital Manufacturing Design	PD KV	5	3	2/0/1			Research work of a master student	NIRM	7	2		
		Teaching practice	DB KV	3	3									
		Total:		**thirty**					**Total:**		**thirty**			
2	3 semester							4 semester						
		Research work of a master student	NIRM	8	2				Research work of a master student	NIRM	nine	2		
	MCH	Design and operation of machines and	PD KV	5	3	2/0/1			Research practice	PD KV	nine	2		

		equipment for gas and plasma at omization												
	MCH	Operation of plants for additive manufacturing	PD KV	5	3	1/0/1			Registration and defense of a master's thesis (OiZMD).	IA	12	3		
	MCH	Organization and implementation of maintenance and repair of additive plants	PD KV	4	2	2/0/1								
	MCH	Reverse engineering and reverse engineering	PD KV	4	2	2/0/1								
	MCH	Organization and management of technological processes of 3D printing of additive manufacturing	PD KV	4	2	1/0/1								
		Total:		**thirty**					**Total:**		**thirty**			
									Total:		**120**			

5 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The 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 evolving knowledge and understanding in the field of additive manufacturing under study , based on advanced knowledge of this area of additive manufacturing in the development and application of ideas used in research x ;

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

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

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

5) learning skills necessary for self-continued further education in the studied area of additive manufacturing .

6 Competencies on completion of training

6.1 Requirements for the key competencies of graduates of the *scientific and pedagogical magistracy* , the undergraduate must:

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;
- about the contradictions and social and economic consequences of globalization processes;

2) know:

- methodology of scientific knowledge;
- principles and structure of the organization of scientific activity;
- the 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;
- to integrate the 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;
- free to speak a foreign language at a professional level allowing e m to carry out research and to implement the teaching of special disciplines in the 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 design of your thoughts in oral and written form;
- expanding and deepening the knowledge required 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.

B - Basic knowledge, abilities and skills

- B1 - know:
- English at a professional level;
- history and philosophy;
- methods of pedagogy and psychology;
- information devices and systems;
- Modern and advanced materials processing technologies
- Qualimetry in mechanical engineering

B2 - 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;
- to integrate the 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 that allows you to conduct scientific research and teach 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 .;
- B3 - 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 design of your thoughts in oral and written form;
- expanding and deepening the knowledge required for daily professional activities and continuing education in doctoral studies.

P - Professional competencies:

P1 - the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary areas;

P2 - the ability to design and carry out complex research, including interdisciplinary, based on a holistic systemic scientific worldview using knowledge in the field of history and philosophy of science;

P3 - readiness to participate in the work of Kazakhstani and international research teams to solve scientific and scientific and educational problems;

P4 - readiness to use modern methods and technologies of scientific communication in the state and foreign languages;

P5 - the ability to follow ethical standards in professional activities;

P6 - the ability to plan and solve problems of their own professional and personal development.

O - Human, socio-ethical competences

O1 - Assess the surrounding reality on the basis of ideological positions formed by knowledge of the foundations of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge;

O2 - Developing an environment that welcomes and supports people from different cultures, and creating an atmosphere of pursuit of knowledge, academic integration and intellectual motivation;

A3 - Have skills in social design and methods of forming and maintaining the socio-psychological climate in the organization.

C - Special and managerial competences

C1 - Independent management and control of the processes of labor and educational activities 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 - Organization of the activities of the production team, making organizational and managerial decisions in the context of different opinions and assessing the consequences of decisions made;

C3 - Organization in the division of work on improvement, modernization, unification of additive manufacturing .

6 .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 scientific research methods;

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

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

6 .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.

7 ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Supplement is to provide sufficient information about 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 about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma is required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

Foreign language (professional)

Professional English for Project Managers
CODE - LNG205
CREDIT - 3 (0/0/3)
PREREQUISIT –Academic English, Business English, IELTS 5.0-5.5

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to develop students' knowledge of the English language for their ongoing academic research and to improve their performance in the field of project management.
SHORT DESCRIPTION OF THE COURSE
The course is aimed at building vocabulary and grammar for effective communication in project management and improving reading, writing, listening and speaking skills at the "Intermediate" level. Students are expected to develop their Business English

vocabulary and learn grammatical structures that are often used in a management context. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, and the 6th module is followed by a test at the end of the course. The course ends with a final exam. Master students also need to study independently (MIS). MIS is an independent work of undergraduates under the guidance of a teacher.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Upon successful completion of the course, students are expected to be able to recognize the main message and message as well as specific details while listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English in topics related to management; write management texts (reports, letters, emails, minutes of meetings) following a generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, speak about various business situations using appropriate business vocabulary and grammatical structures - in pairs and groups discussions, meetings and negotiations.

History and philosophy of science

CODE - HUM201
CREDIT - 3 (1/0/1)
PREREQUISIT - HUM124

GOALS AND OBJECTIVES OF THE COURSE - to reveal the connection between philosophy and science, to highlight 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
BRIEF DESCRIPTION OF THE COURSE - the subject of philosophy of science, the dynamics of science, the specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science,

philosophy of mathematics, physics, technology and technology, the specificity of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer

KNOWLEDGE, ABILITY, SKILLS FOR COMPLETION OF THE COURSE - to know and understand the philosophical issues of science, the main historical stages of the development of science, the leading concepts of the philosophy of science, to be able to critically assess and analyze scientific and philosophical problems, to understand the specifics of engineering science, to have the skills of analytical thinking and philosophical reflection, be able to substantiate and defend their position, master the techniques of conducting discussion and dialogue, possess the skills of communication and creativity in their professional activities .

Higher education pedagogy

THE CODE

CREDIT 2

PRE - REQUISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

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

SHORT DESCRIPTION OF THE COURSE

The content of the course is aimed at 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. Also, undergraduates will study marketing of education,

human resource management in educational organizations, information and communication technologies in the field of education and management of the educational process (for example, higher education).
KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying this course, the master student should know:
- modern ideas about the role of pedagogical management in ensuring the competitiveness of an educational institution / organization;
- the content of the concept of "education management"; the main stages of the organization of the educational process;
- the main features of the marketing policy of an educational institution / organization;
- the main approaches used in the practice of human resource management of an educational institution / organization;
- the role of information and communication technologies in education.
- be able to:
- to be guided by the main trends of modern scientific and technological development;
- use various resources and tools for managing 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 the organization, management and marketing of education.

Psychology of management

THE CODE
CREDIT 2
PRE - REQUISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to familiarize students with modern ideas about the role and multidimensional content of the psychological component of management activities; increasing the psychological culture of the future master for the successful implementation of professional activities and self-improvement.
Tasks:
• Studying the theoretical and methodological foundations of management psychology - familiarity with various concepts, basic concepts, laws of management psychology .

• Study of the main socio-psychological problems of management and ways to solve them .
• Formation of students' mindset on the mandatory consideration of the psychology of the individual and the group in management.
• Familiarization with the methods of studying important social and psychological characteristics of the individual and the team, professional, interpersonal and intrapersonal problems by means of management psychology.
• Studying the basics of the psychology of the leader.

SHORT DESCRIPTION OF THE COURSE

The content of the course is aimed at the study by students of basic categories, basic concepts, directions, problems of general psychology and the possibility of their practical solution. The course "Psychology of Management" is of a practical nature and is aimed at determining the priority of the problems under study: psychology of the personality and activities of a leader, leadership, power and leadership, managerial communication, a group as an object of leadership, etc.

The study of the discipline, in addition to the theoretical and methodological part, has a pronounced practical focus and largely complements the courses in organizational psychology and social psychology.

Mastering the discipline ensures the formation and development of the ability of a future specialist to independently and reasonably design, as well as effectively apply the most appropriate psychological means for a specific situation to conduct a study of a person, activity and group in order to analyze their activities.

Operation of plants for additive manufacturing

CODE - MSN 202
CREDIT - 3 (2/0/1)
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of discipline is the study of methods for evaluating the reliability of additive systems at the design stage, the study of methods of reliability assessment additively their systems are in operation, the use of probability theory to predict and prevent equipment failure, the study of methods of diagnostics of operating equipment.

SHORT DESCRIPTION OF THE COURSE

The discipline " Operation of plants for additive manufacturing " includes the following main areas. Modern scientific concepts in the development of safety assessment of additive systems. The theory of the reliability of devices, machines and structures. Reliability indicators, mathematical models of reliability and survivability. Mathematical expectations of the number of failures and application of the theory of reliability and survivability to the design conditions of additive machines and structures. Vitality theory. Damage accumulation models. Fatigue Fracture Mechanics. Forecasting at the design stage. Monitoring the destruction of additive machines and mechanisms. Maintenance planning. In accordance with the above, teaching the discipline " Operation of installations for additive manufacturing " aims to equip future specialists with knowledge of the main provisions of the theory of reliability and survivability of additive systems.
KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE
After studying this discipline, m agister must :
know and be able to :
- to put into practice the basic provisions of the theory of reliability, to evaluate the reliability of additive systems , so eori th reliability in the additive industry , which relies on mathematics and technology ,
correctly represent :
- technological risks inherent in the proposed project, submitted to the technical expertise and be competent in matters of prov e Denis I Events th , designed x to minimize damage in the event of industrial accidents, to assess methods of 3 D printers, their forecasting and warning ,
skills :
- by evaluating Nia reliability and and manmade th risk and construction and upgrade technical systems.

Design and operation of machines and equipment for gas and flame atomization

CODE - MSN294
CREDIT - 3 (2/0/1)
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of teaching the discipline is to study the methodology of modern methods of designing atomization systems . Undergraduates must have knowledge of the basic techniques for constructing atomization , distinguish between modern architecture, have an idea of atomization , its features and scope.
SHORT DESCRIPTION OF THE COURSE

The course " Design and Operation of Machines and Equipment for Gas and Flame Atomization " is intended to study methods of designing atomizers , to develop skills in designing gas atomization systems . The main sections are: the architecture of modern atomizers , device programming, studying the possibilities of creating software models, developing and debugging atomizers .
KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying the discipline, a master student must:
know:
- basic techniques for constructing gas atomization systems , to distinguish the architecture of modern atomizers , to have an idea of the element base of atomizers , its features and scope;
be able to:
- choose the architecture of the programmable system, evaluate the capabilities of the developed atomizers in accordance with the features of the input and output data and processing algorithms;
own:
- practical skills in the use of gas atomizers in the design of additive systems.

Organization and management of technological processes of 3 D printing additive manufacturing

CODE - MSN251
CREDIT - 3 (2/0/1)
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of teaching the discipline is to systematize and integrate previously acquired knowledge in the disciplines of bachelor's and master's training in the direction of " Additive Manufacturing ".
Determination and formalization of tasks facing additive manufacturing ; drawing up requirements for the components of additive systems; the concept of design problems for highly efficient additive modules and systems of objects

for additive purposes; obtaining methodological foundations for system design of additive systems, taking into account the specifics of automated production, a reasonable choice of an automation object and a comprehensive accounting of technical, economic and social aspects.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, the student must:

s nat:

- goals, objectives, methods and stages of designing additive devices and additive systems ;
- set of requirements to the control systems of the additive machines for various technological purposes, predyavlyaemy x at different x industry x industry, to actuators and control systems;

at the Met:

- it is technically and economically justified to choose the element base for the circuit implementation of the control of a special-purpose additive system;
- define requirements and develop terms of reference for the individual subsystems of additive systems, including additive ma Twa ;

in ladet:

- skills of an integrated approach to the design of special purpose additive systems;
- skills of generalization and use of experience in the field of creation and operation of additive control systems.

Implementation of additive technologies in production

CODE - MSN 225

CREDIT - 3 (2/0/1)

PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

A study of the theoretical foundations of the introduction of additive technologies in production, technology additive systems, constructing technology control systems with fuzzy logic, fuzzy logic rules, technologies to create a knowledge base of expert control systems, ad di tive management systems , of Adachi theory and technique of additive GOVERNMENTAL systems and etc. This knowledge is necessary for the subsequent understanding of the principles of constructing additive systems.

SHORT DESCRIPTION OF THE COURSE

The course examines the theoretical foundations in nedrenie additive technologies in production , technology to create the rules of the knowledge base of expert control systems, adaptive control systems, technology multilevel information processing, the optimal control problem , of Adachi theory and technology of intelligent systems , and others.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, the master student must

know:

- additive technologies, technologies for constructing systems with fuzzy logic, with a knowledge base, expert systems, adaptive systems, etc .;

be able to:

- to develop additive control systems with fuzzy logic, expert control systems, adaptive control systems, etc.;

own:

- skills in the development of additive control settings

Organization and implementation of maintenance and repair of additive plants

CODE - MSN256

CREDIT - 3 (2/0/1)

PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to study the principles of modeling the motion of multi-link systems, which are the majority of additive systems that are multi-link, at the design stage . The study of basic of RGANIZATION and and carrying out maintenance and repair of additive systems .

SHORT DESCRIPTION OF THE COURSE

The course " Organization and implementation of maintenance and repair of additive plants " is intended to study the principles of design and analysis

of mechanical systems (for example, various kinematic connections) using a developed special additive apparatus. This additive engineering design and modeling of additive systems (within the framework of the laws of theoretical mechanics) allows you to model translational and rotational motion in three planes. Repair a set of tools for specifying the parameters of links (mass, moments of inertia, geometric parameters), kinematic constraints, local coordinate systems, methods of specifying and measuring movements.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, the student must:

Know:

- functional purposes of methods of mathematical modeling and optimization of the movement of multi-link systems of additive plants .

Be able to:

to develop new approaches to mathematical modeling and optimization of the movement of multi-link systems of additive plants .

Own:

- skills in the implementation of the acquired knowledge in the practical implementation of projects.

Modern and advanced materials processing technologies

CODE - MSN224

CREDIT - 2 (1 / 0 / 1)

PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

- relying on the theoretical foundations of methods for processing materials by pressure, develop and select the most modern and promising types of technological processes using advanced equipment and tooling.
- The objectives of the course include:
- Introduction to modern E and perspective view s of processes that differ the greatest accuracy, performance, and would ensure a minimum consumption of raw materials.
- Trained to use in the development of modern x and perspective views s processes forming by means of high-precision methods of plastic deformation.

SHORT DESCRIPTION OF THE COURSE

The course contains a training program aimed at leveling the basic knowledge of students in the field of modern and promising types of technological processes for processing materials . It contains full-time, according to the model curriculum SES, with a predominance of education of undergraduates in the practical skills of work on the selection of a method of obtaining the details depending on the type of production . The course is structured in such a way as to teach undergraduates not only the basic concepts of modern material processing technologies , but also teach how to use these tools to solve problems of an applied and scientific nature . To teach how to optimize processes, apply adequate models and methods for solving practical problems in choosing a particular technology for manufacturing a part using modern methods and tools of information technology, automate routine processes, be productive and efficient.

Master's students will be able to:

- develop the most modern and promising types of technological processes
- reasonably choose from a set of typical technological processes based on the specified requirements for the quality of parts and the conditions for their processing the most modern and promising technological process

Photonics and advanced laser systems and technologies

CODE - MSN 298

CREDIT - 3 (2 / 0 / 1)

PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

- based on the theoretical foundations of the laser 's systems and technology , design and choose the most advanced and promising e kinds of advanced laser systems and technologies using progressive equipment and tooling.
- Introduction to modern E and perspective view of s is

foremost x LASER x systems and techniques that differ the greatest accuracy, performance, and would ensure a minimum consumption of raw materials.

- Trained to use is foremost x LASER 's systems and technology in the

development of modern x and perspective views s processes additive manufacturing .

- Application of traditional methods of laser technology , but characterized by increased accuracy and productivity.
- Using high energy techniques.
  - To teach how to use algorithmic methods for solving problems of laser systems and technology

SHORT DESCRIPTION OF THE COURSE

The course includes a training program aimed at leveling the basic knowledge of students in the field of modern and promising x kinds of processes is foremost x LASER 's systems and technology . The course is structured in such a way as to teach undergraduates not only the basic concepts of advanced laser systems and technologies , but also teach how to use these tools to solve problems of an applied and scientific nature . Learn how to optimize processes, to apply adequate models and methods for solving practical problems in the choice of this or that is foremost x LASER 's systems and technology .

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

Undergraduates will know:

- the most modern and promising types of advanced laser systems and technologies
- to develop the most modern and promising types of advanced laser systems and technologies
- reasonably select is foremost x LASER x systems and technologies from a set of standard processes based on predetermined quality requirements for parts and processing conditions the most modern and perspective workflow

3D scanning and digitization

CODE - MSN297

CREDIT - 3 (2 / 0 / 1)

PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

- relying on the theoretical foundations of 3D scanning methods , develop and select the most modern and promising types of technological processes.
- The objectives of the course include:
- Introduction to modern E and perspective view ami processes ZD-scanning , which would have the highest accuracy, productivity

- Teach to use when developing modern x and perspective views s processes ZD-scanning .
- Application of traditional 3D scanning methods , but with increased accuracy and productivity.
- Using high energy techniques.
  - To teach to use algorithmic methods for 3D scanning

SHORT DESCRIPTION OF THE COURSE
The course contains a training program aimed at leveling the basic knowledge of students in the field of modern and promising types of technological processes 3D scanning . The course is structured in such a way as to teach undergraduates not only the basic concepts of modern 3D scanning technologies , but also teach how to use these tools to solve problems of an applied and scientific nature . To teach how to optimize processes, apply adequate models and methods for solving practical problems in choosing one or another 3D scanning technology using modern methods and tools of information technology, automate routine processes, be productive and efficient.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE
Undergraduates will know:

- the most modern and promising types of 3D scanning

Master's students will be able to:

- to develop the most modern and promising types of 3D scanning
- reasonably choose from a set of typical technological processes 3D-scanning based on the specified requirements for the quality of parts

Reverse engineering

CODE - MSN265
CREDIT - 2 (2 / 0 / 1)
PRE - REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

- based on the theoretical foundations of methods of feedback processing razrab quipment and choose the most advanced and promising e kinds of processes using progressive equipment and tooling.
- The objectives of the course include:

- Introduction to modern E and perspective view s of processes that differ the greatest accuracy, performance, and would ensure a minimum consumption of raw materials.
- Trained to use in the development of modern x and perspective views s processes Rivers Engineering .
- The use of traditional methods of reverse engineering as well , but characterized by an increased accuracy and productivity.
- Using high energy techniques.

- To teach how to use algorithmic methods to solve reverse engineering problems

SHORT DESCRIPTION OF THE COURSE

The course includes a training program aimed at leveling the basic knowledge of students in the field of modern and promising x kinds of processes reverse engineering as well . The course is structured in such a way that would teach undergraduates not only the basic concepts of modern technology again rabotki, but also to learn to use these tools to solve problems of applied and scientific nature of engineering reverse . To teach how to optimize processes, apply adequate models and methods for solving practical problems in choosing a particular technology for manufacturing a part using modern methods and tools of information technology, automate routine processes, be productive and efficient.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

Undergraduates will know:

- the most modern and promising types of technological processes reverse engineering
- develop the most modern and promising types of technological processes reverse engineering
- reasonably choose from a set of typical technological processes based on the specified requirements for the quality of parts

Qualimetry in mechanical engineering

CODE - **ISO**

CREDIT - 2 (1/ 0 / 1)

PREREQUISIT - quality management systems .

PURPOSE AND OBJECTIVES OF THE COURSE

The goal of teaching the discipline "Qualimetry in mechanical engineering" is to study quality parameters, their properties, measure quality parameters of methods for

assessing quality parameters, measure quality parameters of complex objects with many quality parameters, measure non-cut quality parameters, develop methods for objective assessment of quality parameters

SHORT DESCRIPTION OF THE COURSE

We study the methodology for the development of evaluation techniques for comparing the quality parameters of several homogeneous objects for their ranking, that is, determining in place on the comparison scale to determine the best option. Qualimetry allows you to determine objectively the best option. This is very important for the development of industry, services, education and science. An objective scientific assessment of the best option will allow you to identify the really best option, this makes it possible to better allocate resources in the implementation of any activity, shows guidelines for further movement, allows you to understand the approach of the process to the intended goal.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

The course provides an opportunity for undergraduates to learn the methods of qualimetry, its importance for industry. The ability to correctly and quickly evaluate different objects according to several quality parameters significantly increases production efficiency, makes it possible to accurately determine the paths for further development, shows guidelines for moving forward, etc .:

- the ability to use the main features of the qualimetric assessment of the quality of different objects;
- practical skills in performing the methodology for assessing the quality parameters of several objects;
- the ability to perform a professional analysis of a comprehensive assessment of the quality level of an object and make a decision on its further improvement;

Optimal machine design

CODE - **ISO**

CREDIT - 2 (1/ 0 / 1)

PREREQUISIT –theory of mechanisms and machines, machine parts, resistance of materials .

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching "Foundations of optimal design of machines and mechanisms" is the design of machines and mechanisms essential part of ency- alternating engineering. These are professional skills that take a long time to learn, creativity, courage of thinking, knowledge of working methods, etc. Introduces the basic skills of design choice work- machine circuit, its layout, design embodiments , the technical task compiling holding kinematic calculations, power calculations, the choice of design elements, drive and TL .

SHORT DESCRIPTION OF THE COURSE

In the process of studying this course, knowledge and skills are given for carrying out design work to create working projects for which factories will be able to produce new original machines and mechanisms. At present, all attention for the training of designers in mechanical engineering is given to familiarization with the available computer programs for drawing and calculating machines. But the computer itself will not design a machine or mechanism. A machine is not designed by a computer and in the designer's head, and then he enters it into the computer's memory using computer graphics programs. This course teaches you how to create a new machine in a person's head. This is the statement of the problem, the choice of the necessary scheme, drive, interaction of machine elements with each other, structural elements - bearings, shafts, gear wheels, couplings, etc. The course examines the technological process of creating a new machine design, from a sketch design to working drawings of parts and an assembly drawing, etc.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

The course provides an opportunity for masters to learn the methodology of designing machines and mechanisms, all stages of the design process, their content and significance are studied.

Skills and skills acquired during the course:

- the ability to use the knowledge gained from previous courses for real design work;
- practical skills in performing specific design work on the terms of reference for the design of equipment;
- the ability to perform a professional analysis of a working project;
- to apply advanced design methods with obtaining high quality parameters of the machine;

Digital Manufacturing Design

CODE - **ISO**

CREDIT - 2 (1/ 0 / 1)

PREREKVISIT - quality management systems, design fundamentals for engineering production .

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of teaching the discipline "Design of digital production" is "modernization and automation of existing and design of new effective machine-building industries for various purposes, means and systems for their equipment, production and technological processes using automated systems for technological preparation of production.

SHORT DESCRIPTION OF THE COURSE

Preparation of assignments for the modernization and automation of existing mechanical engineering, production and technological processes and industries, tools and systems necessary for the implementation of automation and modernization; participation in the development of projects for machine-building industries, taking into account technological, design, operational, aesthetic, economic and managerial parameters that ensure their efficiency; development of projects for engineering industries;

development and implementation of optimal technologies for the manufacture of mechanical engineering products; modernization and automation of existing and design of new efficient machine-building industries using automated systems for technological preparation of production; organization of work on the design of new engineering industries, their elements, modernization and automation of existing ones; participation in the development of plans and programs for organizing innovative activities at the enterprise; mathematical modeling of processes, tools and systems of engineering industries using modern technologies for scientific research.

KNOWLEDGE , ABILITY, SKILLS TO COMPLETE THE COURSE

The course enables undergraduates to participate in the development of projects for mechanical engineering industries, taking into account technological, design, operational, aesthetic, economic and managerial parameters, to develop generalized options for solving design problems, analyze and choose optimal solutions, predict their consequences, plan the implementation of projects; the ability to develop and implement effective technologies for machine-building products, participate in the modernization and automation of existing and design of new machine-building industries for various purposes, means and systems for their equipment, production and technological processes using AMTPP;

Master's thesis defense

CODE - ECA501

CREDIT –7

The purpose of the master's thesis is:
demonstration of the level of scientific / research qualifications of a master student, the ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.

SHORT DESCRIPTION
A master's thesis is a final qualifying scientific work, which is a generalization of the results of an independent study by a master student of one of the urgent problems of a specific specialty of the corresponding branch of science, which has internal unity and reflects the course and results of the development of the chosen topic.
Master's thesis is the result of the research / experimental research work of the master's student, carried out during the entire period of study of the master's student.
The defense of a master's thesis is the final stage of the master's preparation. A master's thesis must meet the following requirements:
- research should be carried out in the work or actual problems in the field of additive manufacturing should be solved ;
- the work should be based on the definition of important scientific problems and their solution;
- decisions must be scientifically grounded and reliable, have internal unity;
- the thesis should be written individually.

Content