

NJSC «Kazakh national research technical university after K.I.Satpaev»

Institute of Metallurgy and Industrial Engineering

Department of "Technological machines, transport and logistics»

CURRICULUM PROGRAM

"DIGITAL ENGINEERING OF MACHINERY AND EQUIPMENT" (profile direction (1 year))

**Master of engineering and technology in the educational program 7M07127 -
"Digital engineering of machinery and equipment"**

2nd edition

in accordance with the State Educational Standard of Higher Education 2018

Almaty 2020

Developed by:	Reviewed: meeting of the AC of the Institute	Approved by: EMC of KazNRTU	Page 1 of 23
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The program is compiled and signed by the parties:

from KazNRTU named after K.Satpayev:


1. The head of the department TM&TL
2. Director of M&MI
3. Chairman of EMC TM&O Department



K.K. Elemesov
K.K. Elemesov
L.A. Krupnik

from employers:

1. Head of the production Department of Altynalmas JSC deputy Director-Vice Rector for Methodical the work of the branch KNU LP "ICC"
2. General Director of Burmash LLP»
3. Commercial Director of AZTM JSC



F.M. Mukhanov
G. Kudaykulova
M. Kanatbaev

Approved at the meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K. Satpayev.

Qualification:

Level 7 National Qualifications Framework:
7M071 Engineering and Engineering (Master):
7M07111 Digital engineering of machinery and equipment

Professional competence: training of scientific, technical and engineering personnel with world-class competences in the field of digital technologies based on the integration of fundamental physical-mechanical and practice-oriented engineering and technical education with research and development for enterprises of the oil and gas, mining and metallurgical complex.

Brief description of the program:

The educational program (EP) of higher vocational education ensures the implementation of the state educational standard taking into account the type of higher education institution, the educational needs and requests of students, and includes a working curriculum, syllabuses (work programs of training courses), disciplines (modules) and other materials providing the quality of training students.

The main idea of the educational program is to implement a continuous process of training new-generation professional personnel capable of working to transform the new scientific potential of Kazakhstan from raw materials to innovation through the development and implementation of sustainable trends in the field of digital service and maintenance services.

The uniqueness of the study program “Digital Engineering of Machinery and Equipment” is determined by the competencies that the master has, having completed his education in this program.

Awarded degree / qualification: Master of Engineering and Technology in the specialty 7M07127 - "Digital engineering of machinery and equipment"

1. The purpose of the educational program

The goal of the program is to provide knowledge of engineering methodology, deep theoretical knowledge, skills and abilities required in professional activities. The ability to use the methods and means of digital technical diagnostics of technological machines and own practical skills in their use, analysis and processing of results using technology and computer application programs. The ability to plan and organize the maintenance and repair of technological machines and equipment;

The objectives of the EP in the direction of "7M07127 - Digital engineering of machinery and equipment" are formulated based on the environmental conditions and the need to position the program as a competitive educational product on the world market. They are determined by the competencies acquired by graduates in the process of mastering the program at the university, and give consumers information about the areas of vocational training, the profile of the program and the types of professional activity for which graduates of this educational program of the magistracy are preparing. It reflects the features of the goals of educational training of specialists in the field of technical services with scientific and innovative thinking, owning advanced technologies in the modern operational and service industry, able to integrate in the conditions of global digital engineering and solving socially important tasks of the Kazakhstan and regional service market.

OP is focused on professional social order through the formation of specific competencies (scientific-pedagogical, professional) related to the necessary types of research and practical activities, adjusted to the requirements of employers.

2. Types of employment

A feature of this master's program is the training of graduates who are able to conduct the following types of professional activity:

- production;
- research;
- organizational and managerial;
- production and technology.

3. Objects of professional activity

The objects of graduate professional activity are:

- secondary special educational institutions;
- manufacturing enterprises;
- design organizations;
- industrial institutes specializing in the design of technological equipment;
- organizations and companies specializing in the production of technological equipment.

EDUCATIONAL PROGRAM PASSPORT

1 Volume and content of the program

The term of study in the magistracy is determined by the volume of mastered academic credits. When mastering a set amount of academic credits and achieving the expected learning outcomes for a master's degree, the master's educational program is considered fully mastered. The profile master 60 academic credits with a study period of 1 years.

Planning 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 the credit technology of education.

The master's degree program implements educational programs of postgraduate education in management training with advanced professional training.

The content of the magistracy educational 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, professional internships;
- 3) experimental research work, including the implementation of a master's thesis;
- 4) intermediate and final certification.

Objectives of the educational program:

Task 1: Specialists' readiness for industrial and technological activities ensuring the introduction and operation of new digital developments at the local level.

Task 2: Willingness of specialists to search for and obtain new information necessary to solve professional problems in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

Task 3: Specialists' readiness for scientific informational, ideological and problem communication in a professional environment and in a non-expert audience with a clear and deep rationale for their position, engage in organizational, managerial and operational service activities, be aware of the responsibility for making their professional decisions.

Task 4: Specialists' readiness for self-learning and continuous professional development throughout the entire period of scientific or professional activity.

2 Entry Requirements

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

The procedure for admission of citizens to the magistracy is established in accordance with the “Model rules for admission to studies in educational organizations that implement educational programs of post-graduate education”.

The formation of a contingent of undergraduates is carried out through the placement of the state educational order for the training of scientific and pedagogical personnel, as well as tuition fees at their own expense of citizens and other sources. Citizens of the Republic of Kazakhstan shall be granted the state the right to receive, on a competitive basis, in accordance with the state educational order, free post-graduate education, if they receive education at this level for the first time.

At the "entrance" the undergraduate student should have all the prerequisites necessary for mastering the corresponding educational program of the magistracy. The list of necessary prerequisites is determined by the higher education institution independently.

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

3 Requirements to complete the course and receive a diploma

Awarded degree / qualifications: A graduate of this educational program is assigned an academic degree of "Master of Engineering and Technology" in the direction of mining, metallurgy and oil and gas production.

A graduate who has mastered the master's degree program should have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use in professional activities new knowledge and skills, develop their innovative abilities;
- the ability to independently formulate research goals, establish the sequence of solving professional tasks;
- the ability to put into practice the knowledge of fundamental and applied sections of the disciplines that determine the direction (profile) of the graduate 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, protect, discuss and disseminate the results of their professional activities;
- Possession of skills for the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;
- readiness to lead the team in their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness for communication in oral and written forms in a foreign language for solving problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activity to which the master's program is oriented:

- production activities:
 - the ability to independently carry out production, field and laboratory and interpretation work in solving practical problems;
 - ability to professional exploitation of modern field and laboratory equipment and devices in the field of mastered master programs;
 - the ability to use modern methods of processing and interpreting complex information to solve production problems;
- project activity:
 - the ability to independently draw up and submit research and development projects;
 - readiness to design complex research and production works in solving professional problems;
- organizational and management activities:
 - readiness to use the practical skills of organizing and managing research and production works in solving professional problems;

- readiness for practical use of regulatory documents in the planning and organization of research and production work;

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

4 Work curriculum of the educational program

4.1. Duration 1 years

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY



APPROVED
 Rector KazNRTU named after K. I. Satpayev
 I.K. Beisembetov

2020.09.15

MODULAR CURRICULUM

Education program 7M07127 - Digital engineering of machines and equipment"

Form of study: full Duration of training: 1 year Academic Degree: Master of Engineering and Technology

The cycle	code	Name of disciplines	Semester	Academic credits	Lect.	Lab.	Pract.	IWS	Type of control	Chair
Profile training module										
Basic disciplines (BD) (20 credits)										
University component (16 credits)										
BD 1.1.1	LNG202	Foreign language (professional)	1	6	0	0	3	3	Exam	EL
BD 1.2.1	MNG274	Management	1	6	2	0	1	3	Exam	SS
BD 1.3.1	HUM204	Management Psychology	1	4	1	0	1	2	Exam	SEPMC
Choice component (4 credits)										
BD1. 4.1	TEC536	Management of technological complexes of equipment	1	4	1	0	1	2	Exam	TMT&L
BD1. 4.2	TRA231	Automated systems for solving logistics problems			1	1	0			
Major disciplines (MD) (25 credits)										
The module of innovative technologies										
Choice component										
MD2. 1.1	TEC526	Digital methods and means of measuring the parameters of technological machines	1	6	2	0	1	3	Exam	TMT&L
MD2. 1.2	TEC226	Methods and means of measurement and control of parameters of technological cars								
MD2. 2.1	TEC534	Innovative construction materials of technological machines	1	6	2	0	1	3	Exam	TMT&L
MD2. 2.2	TEC532	The use of digital technology in the design and construction of technological machines								
MD2. 3.1	TEC527	Digital methods and means of technical diagnostics of technological machines and equipment	1	6	2	0	1	3	Exam	TMT&L
MD2. 3.2	TEC544	Intelligent management of technological equipment complexes								

Practice-oriented module									
MD2. 4	AAP248	Internship	2	7				Report	TMT&L
Research module (13 credits)									
MSE RW	AAP207	Master's student experimental research work, including internship and master's project implementation	2	13				Report	TMT&L
Module of final attestation (12 credits)									
FA	ECA206	Registration and defense of the master's thesis	2	12				Defense of dissertation	
Total:				70					

Vice-Rector for Research and Academic Affairs

Chairman of APC

Director of the Institute of M&IE

Head of department TM,T&L





D. Nauryzbaeva

K. Tulegenova

K. Yelemessov

K. Yelemessov



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

Requirements for the level of training of a graduate student are determined on the basis of Dublin descriptors of the second level of higher education (magistracy) and reflect the mastered competencies expressed in the achieved learning results.

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

The descriptors reflect learning outcomes that characterize the learner’s abilities:

1) demonstrate developing knowledge and understanding in the field of digital diagnostics of equipment for mining, metallurgical and oil and gas production, based on advanced knowledge of this field, in the development and / or application of ideas in the context of the study;

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

3) to collect and interpret information for the formation of judgments, taking into account social, ethical and scientific considerations;

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

5) training skills necessary for independent continuation of further education in the field of digital diagnostics of the equipment for mining, metallurgical and oil and gas production.

6 Competences to complete the training

6.1 Requirements for core competencies of graduate students should:

1) have an idea:

- on current trends in the development of scientific knowledge;
- about actual methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

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

- about the current state of the economic, political, legal, cultural and technological environment of the global business partnership;

- on the organization of strategic enterprise management, innovation management, theories of leadership;

- about the main financial and economic problems of enterprises.

2) know:

- methodology of scientific knowledge;

- the main driving forces of changes in the structure of the economy;

- features and rules of investment cooperation;

- at least one foreign language at a professional level, allowing for scientific research and practical activities.

3) be able to:

- apply scientific methods of knowledge in professional activities;
- critically analyze existing concepts, theories and approaches to the study of processes and phenomena;
- integrate knowledge gained in various disciplines, use them to solve analytical and management tasks in new unfamiliar conditions;
- to conduct a microeconomic analysis of the economic activity of the enterprise and use its results in the management of the enterprise;
- put into practice new approaches to the organization of marketing and management;
- to make decisions in complex and non-standard situations in the field of organization and management of the economic activity of an enterprise (company);
- put into practice the norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations;
- to think creatively and creatively to solve new problems and situations;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- summarize the results of experimental research and analytical work in the form of a master's thesis, article, report, analytical note, etc.

4) have skills:

- solving standard scientific and professional tasks;
- scientific analysis and solving practical problems in the organization and management of the economic activities of organizations and enterprises;
- research problems in the field of management and marketing and use the results to improve the methods of enterprise management;
- professional communication and intercultural communication;
- oratory, correct and logical design of their thoughts in oral and written form;
- Expansion and deepening of knowledge necessary for everyday professional activities and continuing education in doctoral studies;
- use of information and computer technologies in the field of professional activity.

5) be competent:

- in the field of research methodology in the specialty;
- in the field of modern problems of the world economy and the participation of national economies in world economic processes;
- in the organization and management of the enterprise;
- in the implementation of industrial relations with various organizations, including the bodies of state service;
- in ways to ensure continuous updating of knowledge, expansion of professional skills and abilities.

Competencies acquired by students during the development of the educational program «Digital engineering of machines and equipment»

Basic competencies (B)	
B1	Possess knowledge of the philosophical concepts of natural science and the basics of the methodology of scientific knowledge in the study of various levels of organization of matter, space and time; the ability to actively social mobility; the willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences
B2	Study of the basics of education management, management of global educational processes, analysis and selection of strategic initiatives, project as a strategy for managing the development of an educational institution/organization, special and managerial competencies
B3	understanding the nature and significance of the relationship between production processes and their impact on the operational efficiency of trouble-free use of technological equipment of mining, metallurgical and oil and gas production, which allows rational use of natural resources, waste-free technology and reduce the negative impact on the environment
B4	Ability to freely use the state language and a foreign language as a means of business communication; ability to actively communicate in scientific, industrial and socio-public spheres of activity; readiness for independent research work and work in a scientific team, the ability to generate new ideas (creativity)
Professional competencies (P)	
P1	The ability to formulate problems, tasks and methods of scientific research, to obtain new reliable facts based on observations, experiments, scientific analysis of empirical data, to refer scientific works, to make analytical reviews of accumulated information in world science and industrial activities, to summarize the results obtained in the context of previously accumulated knowledge in science and to formulate conclusions and practical recommendations based on representative and original research results
P2	Professional competence, including in accordance with the requirements of industry professional standards, providing deep theoretical knowledge and practical skills in the field of technology for the development of solid minerals and hydrocarbons
P3	Master the basics of designing, expert and analytical activities and performing research using modern approaches, methods, equipment and computer systems. It is able to make descriptions of the principles of operation and device of the designed products and objects with justification of the adopted technical decisions.
P4	Skills of development of technological maps of processes of restoration and increase of wear resistance of details, practical skills of drawing up design and technical documentation; practical skills of verification of compliance of the developed technological process to requirements of standards, specifications and other normative documents
P5	Ready to independently or as part of a team to organize the work of production enterprises for the operation, diagnosis, repair and maintenance of equipment in accordance with the specifics of production
P6	It is able to receive and process information from various sources using modern information technologies, is able to apply applied software tools in solving practical issues using personal computers with the use of General and special purpose software tools, including in remote access mode

Foreign language (professional)

Professional English for Project Managers

CODE - LNG202

CREDIT - 6 (0/0/3/3)

ADVERTISING –Academic English, Business English, IELTS 5.0-5.5

PURPOSE AND TASKS OF THE COURSE

The goal of the course is to develop the knowledge of English for undergraduates for their current academic research and to increase the effectiveness of their work in the field of project management.

BRIEF DESCRIPTION OF THE COURSE

The course is aimed at developing vocabulary and grammar for effective communication in the field of project management and at improving the skills of reading, writing, listening and speaking at the “Intermediate” level. It is expected that undergraduates will acquire their vocabulary of business English and learn grammatical structures that are often used in the context of management. The course consists of 6 modules. The third module of the course is completed with an intermediate test, and the sixth module is accompanied by a test at the end of the course. The course ends with a final exam. Undergraduates also need to study independently (MIS). MIS - independent work of undergraduates under the guidance of a teacher.

KNOWLEDGE, SKILLS, SKILLS TO COMPLETE COURSE

Upon successful completion of the course, it is expected that undergraduates will be able to recognize the main idea and the main message, as well as specific details when listening to monologues, dialogues and group discussions in the context of business and management; understand written and oral speech in English on topics related to management; write management texts (reports, letters, emails, meeting minutes), following the generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, talk about different business situations, using appropriate business vocabulary and grammatical structures - in pair and group discussions, meetings and negotiations.

Management

CODE - MNG274

CREDIT 6 (2/0/1/3)

REQUEST: “Project Management” discipline is based on knowledge gained from studying disciplines in undergraduate courses

PURPOSE AND TASKS OF THE COURSE

The purpose of teaching the discipline "Project Management" is to master the project management methodology in various fields of activity, cultivating a culture adequate to modern project management and information technologies, creating conditions for the introduction of new information technologies in the area of project

implementation. The course is based on international project management guidelines (Project Management Body of Knowledge).

BRIEF DESCRIPTION OF THE COURSE The content of the discipline is aimed at studying modern concepts, methods, tools of project management with the aim of applying them in the future practical activities of a specialist to solve problems of planning and execution of projects.

KNOWLEDGE, SKILLS, SKILLS TO COMPLETE COURSE

Be able to:

- prepare documents for the project initialization stage, such as a feasibility study, project charter, etc.
- develop and analyze documents related to the planning of project activities, apply various methods of decision support;
- promptly monitor the execution of works and track deadlines;
- select personnel, resolve conflicts between team members;
- manage the risks arising from the implementation of projects.

Knowledge gained during the passage of the discipline:

- Modern standards in the field of project management and their characteristics;
- PMI's approach to project management;
- Investment planning;
- Accounting for project risks;
- Methods to optimize the use of available resources;
- Ways to resolve conflict situations;
- Analysis of actual indicators for the timely adjustment of progress.

Skills:

- project management in accordance with modern project management requirements; - use MS Project software in the project management process

Management psychology

CODE-HUM204

CREDIT – 4 (1/0/1/2)

PREREQUISITE –

The course is aimed at teaching undergraduates the basics of management psychology. It will examine the specifics of management psychology, psychological patterns of management activity, personality and its potential in the management system; motivation and effectiveness in the organization, leadership and leadership in modern management of organizations, social group as an object of management, psychological foundations of managerial decision-making, business communication and management conflicts, psychology of responsibility, creating an image as an integral part of the culture of communication, psychology of advertising.

Management of technological equipment complexes

CODE-TEC536

CREDIT – 4 (1/0/1/2)

PREREQUISITE –

The discipline "management of technological complexes of equipment" provides for the study of the organization and operation of enterprises that service production complexes of technological equipment in the system of industrial purpose. The purpose of teaching the discipline is to master the methodology for managing the complex of technological equipment of industrial enterprises of the mining, metallurgical and oil industries and methods for calculating their production capacities, as well as to study the optimal algorithms for managing production systems when servicing production facilities. The discipline is divided into two main parts, which include sections of management and calculation of industrial enterprises, taking into account the specific conditions of their location and operation, and further development with a prospective expansion and increase in production capacity. Another direction will allow students to get acquainted with the best methods of managing modern industrial production based on the use of modern technologies.

As a result of mastering the discipline, the master must:

be Able to:

- identify the types of specialization of equipment of a manufacturing enterprise;
- calculate the duration of the production cycle;
- determine the number of places and design characteristics of production flow management systems, conveyors and process equipment for production;
- analyze the working day schedule to determine the time standards;
- calculate the labor intensity of work;
- calculate calendar and planned production standards;
- build schedules for scheduled preventive repairs;
- determine the wages of the main workers;
- develop technological planning of diagnostics and repairs for mechanical or Assembly shops.

Must have an understanding of:

- the production cycle of manufacturing parts;
- methods for setting time standards;
- the passport of the equipment and their purpose;
- about operational and production planning;
- about the organization of design and technological preparation of production;
- about the structural elements of the company's workshops.

Automated systems for solving logistics problems

CODE – TRA231

CREDIT – 4 (1/1/0/2)

PREREQUISITE –

The purpose of the discipline is the acquisition of skills for solving logistics problems by undergraduates using automated systems. Specialized logistics company management software. Features of the implementation of the KANBAN system. MySAP Buisness Suite e-business platform. Integrated SAP NetWeaver integration platform. Logistics software based on the SAP platform. Automated SAP platform technologies for Supply Chain Management (SCM) and Customer Ralationship Management (CRM).

Digital methods and tools for measuring the parameters of technological machines

CODE-TEC526

CREDIT – 6 (2/0/1/3)

PREREQUISITE –

Digital methods and tools for measuring and controlling technological machines. Devices and digital methods for measuring temperatures, pressures, flow rates of liquids and gases, linear and angular values, measuring forces and moments, non-destructive testing of materials and products, motion and vibration parameters, gas composition, quality of technical liquids, quality of fuels and oils. Metrological and dynamic characteristics of measuring and control devices. Selection of modern technical means for measuring and controlling the parameters of technological machines, depending on their design and operating conditions. Evaluation of the accuracy and reliability of measuring instruments. Rules for installation and operation of technical measuring instruments. Types of testing of technological machines – control, research, parametric, delivery, diagnostic, resource, etc. Test benches and equipment. Assessment of the technical condition of technological machines based on test results.

As a result of mastering the discipline, the master must:

Know:

- Basic concepts of measurement theory, digital, physical quantities and units of measurement, and General laws and rules of measurement;
- objects and methods of digital measurements;
- fundamentals of technical measurements in mechanical engineering
- means of measurement;
- measurement error;
- Instrument error and the measurement error of the instrument
- principles of unity of measurement;
- basic concepts of interchangeability and its types;
- state system for ensuring the uniformity of measurements (GSS) –
- intersectoral systems of standards: ESKD, ESTD, ESPD, SRPP;

- product quality management system;
- universal and special measuring devices;

Be able to:

- Select measurement systems for monitoring and regulating process parameters, evaluate the reliability and economic efficiency of the selected measurement system;
- Select methods to compensate for measurement errors caused by external factors (changes in ambient temperature, exposure to electric and magnetic fields, etc.)
- control the linear and angular dimensions of parts;
- choose universal and special measuring instruments;
- perform verification of measuring instruments in production;
- design technological processes and technical control operations.

Have: in the calculation of parameters of elements of measuring systems, in the verification and adjustment of measuring devices and primary converters in volumes sufficient for research and operation in industrial conditions;

Methods and means of measurement and control of parameters of technological cars

CODE – TEC226

CREDIT – 6 (2/0/1/3)

PREREQUISITE –

Methods and gauges and the control of technological cars. Devices and methods of measurement of temperatures, pressure, expenses of liquids and gases, linear and angular sizes, measurement of forces and the moments, not destroying control of materials and products, parameters of movement and vibration, structure of gases, quality of technical liquids, quality of fuel and oils. Metrological and dynamic characteristics of measuring apparatuses and the control. A choice of means of measurement and the control of parameters of the process equipment depending on their design and operation conditions. An estimation of accuracy and reliability of measuring apparatuses. Rules of installation and operation of means of measurements.

Kinds of tests of the process equipment - control, issledovatelskie, parametrical, delivery, diagnostic, resource, etc. Test beds and the equipment. An estimation of a technical condition of the process equipment by results of tests.

The organization of carrying out laboratory and a practical training on discipline with application of measuring apparatuses, the control and tests. Requirements of safety precautions regulations at tests of cars in educational laboratories. A technique of working out of subjects of independent works the master (IWM). Rules of working out of test tasks on discipline

Innovative construction materials for technological machines

CODE-TEC534

CREDIT – 6 (2/0/1/3)

PREREQUISITE -

the purpose of this course is for undergraduates to study the natural relationships between the composition, structure and properties of structural materials.

The main objectives of the course are to form undergraduates:

- ideas about obtaining innovative metals and alloys; classification and properties of modern structural materials;
- knowledge of the basics of the crystal structure of metals; methods and methods of changing the properties of metals in the production process;
- ability to determine the properties of metals by their micro-and macrostructure; measure the hardness of structural materials; choose innovative structural materials for technological machines in accordance with their purpose; choose tool materials for processing various structural materials.

BRIEF DESCRIPTION OF THE COURSE

Historical review of the use of materials, basic concepts about materials: a modern classification of materials (metallic and non-metallic materials, ferrous and non-ferrous metals and their alloys), application of materials; Basic properties of materials: physical, chemical, mechanical and technological, building materials: the process of crystallization, types of crystal lattices, phase in alloys; Diagrams of state of alloys: diagrams of state of double alloys, the phase diagram of iron-carbon alloys; Heat treatment of metals and alloys: the main types of heat treatment, chemical-thermal and thermomechanical treatment; Classification and marking of metals and alloys: carbon and alloy steels; gray, ductile and high-strength cast irons; aluminum, copper, titanium and their alloys, the main properties and structure of non-metallic materials: plastics, glass, ceramics and wood materials.

The course program provides lectures, laboratory and practical classes, as well as organization of independent work of students, group and individual consultations.

In the course of studying this course, the master's student must attend a course of lectures, perform laboratory and practical work provided by the program. A special place in the development of this course is given to independent work of students.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

- know the basics of the crystal structure of new metals; methods for obtaining metals and alloys; methods and methods for changing the properties of metals and alloys; as well as the classification of modern structural materials and their basic properties;
- be able to determine the properties of metals and alloys by their micro-and macrostructure; measure the hardness of structural materials; choose structural materials for products manufactured in training workshops; choose tool materials for processing various structural materials.

The use of digital technology in the design and construction of technological machines

CODE – TEC532

CREDIT – 6 (2/0/1/3)

PREREQUISITE

OBJECTIVES OF THE DEVELOPMENT OF DISCIPLINE

Purpose of the discipline

To acquaint undergraduates with the use of digital systems for designing technological machines and equipment, modern digital developments and the main directions of development of digital designing and designing technological machines, as well as with the technological preparation of their production.

Objectives of the discipline.

To give undergraduates knowledge in the field of digital systems for designing technological machines and equipment for mining, metallurgical and oil and gas production, to acquaint with modern developments and main directions of development of digital design of technological machines and production preparation.

KNOWLEDGE, SKILLS, SKILLS TO COMPLETE COURSE

As a result of studying this discipline, undergraduates should have an idea

- on systems of digital design of technological machines and their application at the design stage;

- about modern developments and the main directions of development of digital design of mining, metallurgical and oil and gas production and technological preparation of their production.

know:

- principles of technology digital design of machines and technological processes in industrial engineering;

- structure and capabilities of modern digital graphic systems.

be able to:

- use modern elements of digital design systems in solving technological and design problems;

- work with databases, subsystems and application packages that form the system of digital design of machines and technological processes of their manufacture

Digital methods and tools for technical diagnostics of technological machines and equipment

CODE-TEC527

CREDIT – 6 (2/0/1/3)

PREREQUISITE

The purpose of studying the discipline is to form undergraduates ' knowledge on assessing the current technical condition of the main technological mining, metallurgical and oil and gas equipment, choosing the most informative diagnostic signs about their

condition, methods for collecting and processing diagnostic information, choosing tools and methods for decision-making, planning maintenance and repair of equipment.

When studying the discipline, training is provided on the technique and technology of digital vibration diagnostics of equipment, analysis of the main defects of technological machines and their diagnostic features, the basics of technical diagnostics of the mechanical part of drives, parametric diagnostics of production equipment. Special attention is paid to methods for recognizing the state of equipment, predicting its changes, and planning maintenance and repair work.

The task of studying the discipline is to acquire the necessary skills and abilities for their application in the operation of industrial equipment in the industry.

As a result of mastering the discipline, the master must:

Know:

- systems of technical maintenance and repair of equipment of technological machines, their advantages and disadvantages;
- existing digital methods of technical condition assessment – technological equipment;
- tools for collecting and processing diagnostic information;
- methods of forming a set of diagnostic features and evaluating their informativeness;
- digital methods of technical condition assessment;
- models and methods for analyzing signals of fast-moving processes;
- defects of various machines and their diagnostic parameters;
- methods of parametric diagnostics of technological equipment.
- Be able to:
 - perform statistical processing of measurement signals;
 - determine the main operational parameters of the equipment;
 - evaluate the effectiveness and reliability of diagnostic results;
 - plan maintenance and repair work based on an assessment of the current technical condition of the equipment.

Intelligent management of technological equipment complexes

CODE – TEC544

CREDIT – 6 (2/0/1/3)

PREREQUISITE

The discipline provides studying of questions of the organization and operation of the enterprises on service of production complexes of the technological equipment in system of branch appointment. The purpose of teaching - the development of the methodology of management of complex technological equipment of industrial enterprises of mining, metallurgical and oil industries and methods of calculation of their production capacity, as well as the study of optimal control algorithms of production systems in the maintenance of production facilities.

Master's project defense

CODE-ECA206

The CREDIT is 12

The purpose of the master's thesis is:

demonstration of the level of scientific/research qualification of a master's student, the ability to independently conduct scientific research, testing the ability to solve specific scientific and practical problems, knowledge of the most General methods and techniques for solving them.

BRIEF DESCRIPTION

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

Master's thesis – project-the result of research /experimental research work of a master's student, conducted during the entire period of study of a master's student.

The defense of the master's thesis / project is the final stage of master's training. The master's thesis / project must meet the following requirements –

- the work must conduct research or solve current problems in the field of operation and digital diagnostics of technological equipment in the mining, metallurgical and oil and gas industries;
- the work should be based on identifying important scientific problems and solving them;
- decisions must be scientifically based and reliable, have internal unity;
- the dissertation work must be written individually;

7 ECTS Diploma Supplement

The application is developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and does not constitute official proof of education. Without a diploma of higher education is not valid. The purpose of completing the European application is to provide sufficient information about the diploma holder, the qualifications obtained by him, the level of this qualification, the content of the training program, the results, the functional purpose of the qualification, as well as information about the national education system. In the application model, which will be used for the transfer of estimates, the European system of transfer or credit transfer (ECTS) is used.

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

Developed by:	Reviewed: meeting of the AC of the Institute	Approved by: EMC of KazNRTU	Page 21 of 23
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7.1 Annex to the certificate according to the standard ECTS

The app is developed according to the standards of the European Commission, the Council of Europe and UNESCO/Sepe. This document serves only for academic recognition and is not an official confirmation of the document of education. It is not valid without a higher education diploma. The purpose of filling out the European application is to provide sufficient information about the diploma holder, the qualification they have received, the level of this qualification, the content of the training 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 for transferring ratings 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 traveling abroad for professional recognition, additional legalization of the diploma of education will be required. The European diploma Supplement is completed in English upon individual request and is issued free of charge.

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