CATALOG OF ELECTIVE DISCIPLINES

7M07 - Engineering, manufacturing and construction industries
(Code and classification of the field of education)

7M071 - Engineering and Engineering affairs
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

M103 - Mechanics and metalworking
(Code and classification of the educational program group)

7M07104 - Mechanical Engineering
(Code and name of the educational program)

Master
(Level of preparation)

set of 2024

Semey 2024

Developed
Academic Committee of OP 7M01704 "Mechanical Engineering", Head of AK Kozhakhmetova Dinara Oshanova
Manager of the OP Shayakhmetov Yerzhan Yarnarovich

Reviewed
at the meeting of the Commission on Academic Quality of the Faculty of Engineering and Technology
Protocol No. 3 dated January 15, 2024
at the meeting of the Commission on Academic Quality of the Higher School of Artificial Intelligence and Construction
Recommended for approval by the University Academic Council
Protocol No. 1 dated 06.06.24

Approved
at a meeting of the University Academic Council by protocol No. 3 of January 16, 2024.

at a meeting of the University Academic Council by protocol No. 6 of June 18, 2024.

Automation of tool production

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Generalization of knowledge about tool production, its automation, including at the design stage and using special software; at the stage of manufacturing and developing high-precision and economical technological processes for manufacturing tools. Show how, based on a thorough analysis of experience and design and technological practice, to develop a perfect technological process using modern productive equipment, fixtures and tools.

Purpose of studying of the discipline
The purpose of studying the discipline "Automation of tool production" is to generalize knowledge on the automation of production and apply it in the automation of tool production, taking into account its features.

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.

Learning outcomes by discipline
1. To know about tool manufacturing, its automation, including at the design stage;
2. Be able to choose the optimal tool for the types of processing, select the tool material, design it taking into account the features of automated processing;
3. Have the skills to develop high-precision and cost-effective technological processes for the manufacture of tools;
4. Have knowledge about modern problems of tool production; technological processes of manufacturing cutting tools;

Prerequisites
Preparation of machine-building production

Postrequisites
The control system in mechanical Improvement of automated production

Automation of technological processes in mechanical engineering

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course shows the automation of technological processes in mechanical engineering. Methods for calculating economic efficiency, mechanization and automation itself, the difficulties of these processes are considered. Formation of knowledge on the operation of mechanization and automation devices during the machining of parts on metal-cutting machines, both for general purposes and with numerical control; their optimal setting, design features.

Purpose of studying of the discipline
The purpose of studying the discipline "Automation of technological processes in mechanical engineering" is the formation of scientifically based knowledge and methods of calculation for the automation of technological processes of mechanical engineering production

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.

Learning outcomes by discipline
1.To know the properties and applications of various methods and methods of automation of technological processes; automation of transport and warehouse systems and creation of automated production;
2. Be able to calculate and choose the optimal modes of technological processes in automation conditions, choose the optimal tool and equipment, taking into account the specifics of process automation;
3.Have the skills to develop documentation for automated technological processes;
4. Have knowledge about the automation of technological processes using automatic lines.

Prerequisites
Improvement and optimization of technological processes in mechanical engineering Preparation of machine-building production

Postrequisites
The control system in mechanical Improvement of automated production

Flexible manufacturing cells and automated production lines in mechanical engineering

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of the concept of modern mechanical engineering as a production with a frequent change of manufactured parts and their

wide range. The course builds knowledge about production using automated production modules for mass, large-scale, serial and even small- scale production. The course deals with the automation of production. Knowledge is being formed on the intensification and automation of technologies, digitalization.

Purpose of studying of the discipline

The purpose of studying the discipline "Flexible production modules and automated lines in mechanical engineering" is to gain knowledge and competencies on innovative ways to automate various types of production

Learning Outcomes

ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.

ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.

Learning outcomes by discipline

1. Have knowledge about the properties and areas of rational use of various types of GPS and automatic lines; transport and warehouse systems of automated production; about loading and transport devices in automated production.

2. Be able to calculate and choose the optimal cutting modes in these processing conditions, choose simple tools and accessories for types of processing, taking into account the peculiarities of processing on automated lines.

3. Have the skills to develop documentation for technological processes using flexible production systems and automated networks.

Prerequisites

Innovative technologies in mechanical engineering Preparation of machine-building production

Postrequisites

Modernizathion of technological processes in mechanical engineering Improvement of automated production Innovative solutions of machine-building production

Methods of experimental design

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of the necessary knowledge about the methods of planning and processing the experiment. The course gives a theory about the main methods of planning an experiment, conducting the necessary experiments and measurements, processing the data obtained by methods of mathematical statistics. The ways of processing the results, knowledge of the theory and practice of the experiment are considered.

Purpose of studying of the discipline

The purpose of studying the discipline "Methods of Experiment Planning" is to provide students with knowledge of the basics of mechanical engineering technology, about modern progressive methods of planning experiments, methods of processing and conducting experiments.

Learning Outcomes

ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.

ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.

ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline

1.To know about modern methods of experiment planning; classification of experimental planning methods; types of modeling and their application for solving problems and scientific research; fundamentals of experimental planning theory; fundamentals of mathematical experiment planning

2. Be able to draw up an experiment plan based on available data; calculate and build a mathematical model of the experiment during the research process;

3. Have the skills to draw up an experiment plan; mathematical modeling of the experiment; analysis of the theoretical foundations of mathematical planning and analysis of factor experiments with minimal costs for their conduct;

4. Have knowledge about the nature of dependence, the degree of influence of various factors on the target function, forecasting the value of the target function at certain values of factors; graphically present information about processes and objects.

Prerequisites

Tenzo and Vibrometry in mechanical engineering Research work of a master student, including internship and master s thesis I

Postrequisites

Final examination Organization and planning of research and innovation

Increasing the efficiency of the cutting tool

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of knowledge about effective modern metal-cutting tools. Methods for designing a metal-cutting tool, modern material and hard alloys used for its manufacture, innovative methods for manufacturing a cutting tool and methods for hardening its cutting part are described. Examples of calculation and graphical representation of the cutting tool are given. Methods for calculating and manufacturing stamps are considered.

Purpose of studying of the discipline
The purpose of studying the discipline "Improving the efficiency of the cutting tool" is scientifically based knowledge to improve the effective use of the tool using modern tools, this is hardening, hard alloy deposition, deposition.
Learning Outcomes
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.
Learning outcomes by discipline
1. Know about modern metal cutting tools;
2. Be able to choose the most effective tool, the optimal tool material;
3. Have the skills to develop high-precision and cost-effective technological processes for the manufacture of tools;
4. Have knowledge of modern problems of tool production; technological processes of manufacturing cutting tools;
Prerequisites
Preparation of machine-building production
Postrequisites
Modern problems of technologies of production machines

Statistical methods for planning an experiment

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course describes the acceleration of research work and the provision of optimal solutions. Describes statistical methods for designing an experiment, while varying by several factors. Shows the use of a multifactorial experiment so that during mathematical processing it is possible to choose the conditions for the following experiments until the optimum region is reached.
Purpose of studying of the discipline
The purpose of studying the discipline "Static Methods of Experiment Planning" is the formation of scientifically based ideas about the methods of planning an experiment and their use in practice
Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
Learning outcomes by discipline
1. To know about modern methods of processing experimental results; types and methods of statistical planning of the experiment and their application for solving problems and scientific research;
2. Be able to draw up an experiment plan based on statistical data;
3. Have the skills to draw up an experiment plan; analyze statistical data and process them;
4. Demonstrate basic knowledge about statistical data, the degree of influence of this data on the target function;
Prerequisites
Tenzo and Vibrometry in mechanical engineering
Postrequisites
Organization and planning of research and innovation

Theoretical foundations of modeling cutting processes

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of the student`s basic knowledge of modeling the basic processes of cutting metals (turning, milling, grinding and drilling). The course program considers mathematical modeling methods (stochastic, etc.) and also the possibility of using the finite element apparatus. Development of a scientific understanding of modern modeling methods, cutting theory and cutting modeling, both theoretical and by the finite element method.

Purpose of studying of the discipline
The purpose of the discipline "Theoretical foundations of modeling cutting processes" is the formation of knowledge about various modern cutting processes, their features, the use of mathematical apparatus and various software for their modeling.
Learning Outcomes
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.

Learning outcomes by discipline
1.Өндірісті ғылыми, конструкторлық, технологиялық дайындау; жүйелерді математикалық модельдеу; өңдеудің әртүрлі түрлерінде кесу процестерін модельдеу тәсілдерін білу.
2.Қолда бар деректерді пайдалана отырып, процесті модельдеу үшін бастапқы ақпаратты дайындай білу; кесу процесінің әртүрлі процестерін модельдеу; кесу күштерінің аналитикалық моделі үшін қажетті есептеулер жүргізу.
3.Математикалық және бағдарламалық жасақтаманы қолдана отырып, негізгі кесу процестерін модельдеу дағдыларына ие болу; кесу процестерін модельдеу үшін заманауи бағдарламалық жасақтаманы қолдану.
4.Машина жасаудың заманауи мәселелері; өндірісті автоматтандырудың негізгі бағыттары; кесу процестерін модельдеудің негізгі бағыттары туралы негізгі білімді көрсету.
Prerequisites
System analysis, optimization and mathematical modeling in mechanical engineering
Postrequisites
Final examination Engineering methods of calculation Innovative solutions of machine-building production Dynamic calculation of design studies

Theory of cutting and high precision machining

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Mastering in-depth knowledge in the field of cutting theory, the basics of tribology, various types of high-precision machining. Analysis of each type of processing, tool used, cutting conditions, workpiece material, cutting tool material and conclusions about the possibility of high-precision processing in each case. Ranking of each case, economic and technical substantiation of high-precision processing.

Purpose of studying of the discipline
The purpose of studying the discipline "Theory of cutting and high-precision machining" is a systematic deepening of knowledge and practical competence for solving problems of cutting theory in relation to modern methods of high-precision machining
Learning Outcomes
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.
Learning outcomes by discipline
1. To know the basic terms and concepts of high-precision machining; geometry, kinematics, cutting dynamics; the main deformations of the treated surface and wear of cutting tools; to know the main processing methods and their technological characteristics.
2. Be able to calculate the cutting force and the power spent on cutting, determine the stability of cutting tools, and establish quality indicators of the surface to be treated.
3. Have the skills to select parameters, type of tool for high-precision machining;
4. Have knowledge of ways to optimize the cutting process, use a cutting tool and demonstrate the basic knowledge necessary to ensure the reliability of the high-precision cutting process.
Prerequisites
Innovative technologies in mechanical engineering Technical regulation in mechanical engineering
Postrequisites
Modernizathion of technological processes in mechanical engineering

Introduction to experiment

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of the concept of the theory of experiment, multifactorial and factorial experiments, development of methods for conducting an experiment, mathematical processing of results. The methods of the theory of experiment aimed at planning and conducting a research experiment are described; substantiation and verification of the adequacy of the results obtained. Comparison of the universality of experimental methods.
Purpose of studying of the discipline
The purpose of studying the discipline "Introduction to the theory of experiment" is the formation of theoretical knowledge on the conduct of the experiment, processing its results using the existing mathematical apparatus
Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
Learning outcomes by discipline
1. To know about the modern theory of experiment; classification of experimental planning methods; fundamentals of experimental

planning theory;
2. Be able to make an experiment plan based on available data; calculate and build a mathematical model of the experiment during the research process;
3. Have the skills to analyze the theoretical foundations of mathematical planning and analysis of factor experiments;
4. Have basic knowledge about the theory of the experiment; the main dependencies and the nature of dependence, the degree of influence of various factors on the target function;

Prerequisites
Tenzo and Vibrometry in mechanical engineering

Postrequisites
Dynamic calculation of design studies Research practice Research work of a master student, including internship and master s project II

Measurement of vibration and shock

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course shows modern production with systems for registration and analysis of process parameters (static, quasi-static, dynamic). Methods for measuring variable (in time) processes, such as vibrations of mechanical vibrations, are described. One of the parameters of vibration processes is the amplitude of vibrations (vibration displacement) and vibration frequency (vibration velocity). Two measurement methods are shown: contact and non-contact.

Purpose of studying of the discipline
The purpose of studying the discipline is the formation of students` theoretical knowledge on the application of modern methods and principles of measurement

Learning Outcomes
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline
1.Have basic and special knowledge in the field of important parameters of vibration processes, such as vibration amplitude (movement during vibration), vibration frequency (vibration velocity parameters);
2. Be able to use methods of measuring variable (over time) processes, such as vibrations, for example, mechanical vibrations;
3. Have the skills to use a complex of registration systems and systems for analyzing process parameters during processing (static, quasi-static, dynamic) ;
4. Demonstrate basic knowledge about modern problems of vibration and shock measurement.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Applied theory of mechanical vibrations Simulation of oscillations in a mechanical system

Engineering methods to ensure the reliability of the machines

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
The reliability criteria of machines and units are considered, the causes of failure are investigated. The course provides knowledge on the theory of equipment reliability. The technique for calculating the reliability of machine-building equipment is considered. Methods for providing numerical indicators of machine reliability. The course forms knowledge on machine reliability management, engineering and organizational and technical methods.

Purpose of studying of the discipline
The purpose of teaching the discipline is to study methods of ensuring the reliability of machines arising in the design, manufacture and operation. Mastering and researching methods of calculating and predicting the reliability of technical devices.

Learning Outcomes
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
ON8 Be able to critically assess their strengths and weaknesses.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.

Learning outcomes by discipline
1. Have knowledge of reliability management of machinery and equipment, basic and specialized knowledge in the field of professional sciences in complex engineering and scientific activities;
2. Be able to use engineering methods and organizational and technical measures to manage the reliability of machinery and equipment;
3.Have the skills to calculate the reliability of machine-building equipment;
4. Demonstrate basic knowledge of calculation methods and reliability criteria for machine-building equipment.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Theoretical foundations of modeling cutting processes System analysis, optimization and mathematical modeling in mechanical engineering

Innovative technologies in mechanical engineering

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of knowledge about innovative technologies in the field of mechanical engineering, which includes innovative methods for obtaining blanks by casting, pressure treatment, powder metallurgy and cutting methods, modern processing methods, modern metal-cutting machines, tools for processing complex- shaped parts, methodological foundations for creating and arranging innovative technological machining and assembly processes. New methods of processing and manufacturing parts are described.

Purpose of studying of the discipline
The purpose of the discipline: Familiarization of students with innovative technologies in mechanical engineering, these are modern processing methods, innovative methods for obtaining blanks, powder metallurgy, additive technologies.

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline
1. To know basic and specialized knowledge in the field of mathematical, natural and professional sciences in complex engineering and scientific activities, in particular in mechanical engineering;
2. Be able to use knowledge in the field of innovative technologies in solving practical problems of processing parts and obtaining blanks;
3. Have the skills to use application software packages in scientific and engineering activities in order to develop technological processes using innovative technologies;
4. Demonstrate basic knowledge about modern problems of mechanical engineering; the main directions of innovative technologies and methodological foundations for the creation of a modern technological and production process;

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Flexible manufacturing cells and automated production lines in mechanical engineering Theory of cutting and high precision machining

Preparation of machine-building production

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of knowledge about the preparation of mechanical engineering production in three stages of integrated training: design training; technological and planning stages of processing parts on time, volumes and financial costs. Works, methods that create competitive products in mechanical engineering are described. Measures for the development, implementation and control of norms and conditions for engineering products are determined.

Purpose of studying of the discipline
The purpose of teaching the discipline is to study the stages of preparation of machine-building production, solving problems that arise at various stages with ensuring the reliability of machines at the stage of design preparation, problems with product manufacturing and financial planning.

Learning Outcomes
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
ON8 Be able to critically assess their strengths and weaknesses.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.

Learning outcomes by discipline
1.To know basic and specialized knowledge in the field of mathematical and professional sciences in complex engineering and scientific activities;
2. Be able to use methods of system analysis and mathematical and computer modeling in solving problems of preparation of machine-building production at all its stages;
3. Have the skills to use application software packages in scientific and engineering activities in order to create competitive machine-building products;
4. Demonstrate basic knowledge about modern problems of mechanical engineering; activities for the development, implementation and control of standards and conditions for mechanical engineering products.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Flexible manufacturing cells and automated production lines in mechanical engineering Automation of technological processes in mechanical engineering Automation of tool production System management of processes in mechanical engineering

System analysis, optimization and mathematical modeling in mechanical engineering

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Knowledge is formed on the methods of analysis, mathematical modeling, allowing to study the influence of the control action on the functioning of systems, optimization of their parameters within the criteria. The course applies a systematic approach to solving: scientific problems in the field of high-tech production; development of the technological process, taking into account the limitations of the process.

Purpose of studying of the discipline
Familiarization of students with the methods of system analysis, with methods of modeling cutting processes and various systems; methods of both mathematical and computer modeling; knowledge of the modern level of system analysis and modeling of complex systems.

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline

1. To know basic and specialized knowledge in the field of mathematical, natural and professional sciences in complex engineering and scientific activities;
2. Be able to use the methods of system analysis and mathematical modeling, the basics of theoretical and experimental research;
3. Have the skills to use application software packages in scientific and engineering activities in order to automate machine-building production;
4. Demonstrate basic knowledge about modern problems of mechanical engineering; the main directions of system analysis and modeling of complex systems;

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination Theoretical foundations of modeling cutting processes

Improvement and optimization of technological processes in mechanical engineering

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
Knowledge about the tasks and methods for optimizing technological processes in mechanical engineering is being formed. Various methods for optimizing technological processes for processing parts are considered. Methods for analyzing technological processes and choosing the optimal path for optimization and improvement are described. The software for choosing the optimal processing conditions is determined, examples of technological processes are given.

Purpose of studying of the discipline
The purpose of the discipline: Acquaintance of students with the methods of improvement and optimization of technological processes, the use of system and dimensional analysis and computer modeling in the optimization of technological processes.

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline
ON 3 Summarize the technical conditions and accuracy standards, based on the official purpose of the machines, develop technological processes for the machining of typical machine parts ON 6 To study the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as to consolidate practical skills in applying modern methods of scientific research, processing and interpreting experimental data in a dissertation research
ON 7 To study modern high-tech production, methods and methods of automating technological processes, calculate the efficiency and the ability to quickly change the range when using various CNC machines and automatic lines
1.To know basic and specialized knowledge in the field of mathematical, natural and professional sciences in complex engineering and scientific activities;
2. Be able to use knowledge and methods of analyzing technological processes and choosing the most optimal way to optimize and improve it;
3. Have the skills to use application software packages in scientific and engineering activities in order to optimize technological

processes;
4. Demonstrate basic knowledge about modern problems of mechanical engineering; the main directions of improvement of modern technological processes;

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Flexible manufacturing cells and automated production lines in mechanical engineering Automation of technological processes in mechanical engineering

Tenzo and Vibrometry in mechanical engineering

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of ideas about tensovibrometry - methods and devices. Forms knowledge about strain measurements, assessment of the stress-strain state of the object under study. The course provides knowledge on the experimental determination of the stress-strain state of moving nodes. On the methods of strain measurement: X-ray, optical, brittle coating, electroplating, with the help of strain gauges and strain gauges.

Purpose of studying of the discipline

The goal is to form students` theoretical knowledge on the application of modern measurement methods and principles

Learning Outcomes

ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline

1. To study the conditions of actual operation of parts, assemblies and load-bearing structures of machines for checking and optimizing design schemes, establishing criteria for equal strength and improving the constructive shape of individual assemblies and parts;
2. Be able to establish the actual external loads, statistical or functional patterns of their occurrence;
3. Be able to assess the impact of various environmental conditions on the object of study;
4. Have an idea of the impact of technological operations of manufacturing machine-building parts and assemblies on strength and reliability;
5. Gain practical skills in determining quantitative indicators of reliability of machine components and parts during normal operation and under special operating conditions.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination Methods of experimental design Introduction to experiment Statistical methods for planning an experiment

Oscillation theory

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course shows possible types of motions in non-linear oscillatory systems, their features, development and formation, characteristics of stationary and non- stationary processes. When analyzing ideal mathematical models of such systems, it is necessary to use approximate analytical and qualitative methods for solving equations. When studying the course, mathematical analysis and other examples from theoretical mechanics, strength of materials are used.

Purpose of studying of the discipline

The purpose of studying the discipline is the formation of students` theoretical knowledge on the analysis of possible types of movements in nonlinear oscillatory systems, the main characteristics of stationary and non-stationary processes

Learning Outcomes

ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of mathematical, natural and professional sciences in complex engineering and scientific activities;
2. Be able to use mathematical analysis methods in solving such problems;
3. Have the skills to use examples of solutions from theoretical mechanics, material resistance;
4. Demonstrate basic knowledge about modern problems of the theory of oscillations; the main directions of the system analysis of the characteristics of stationary and non-stationary processes;

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Applied theory of mechanical vibrations Simulation of oscillations in a mechanical system

Technical regulation in mechanical engineering

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of knowledge on technical regulation: scientific organization of labor, production process, time cost structure, its classification and study, the structure of a scientifically based time norm, components and methods of regulation, the methodology for the formation of technical standards for various processing methods and methods for organizing the work of processing regulation in machine-building organizations.

Purpose of studying of the discipline

The purpose of teaching the discipline is to study the methods of normalizing processes in mechanical engineering, the methods of forming technical standards for various processing methods, and their scientific justification.

Learning Outcomes

ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
ON8 Be able to critically assess their strengths and weaknesses.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.

Learning outcomes by discipline

ON 5 Generalize theoretical knowledge as a scientific tool for improving the reliability of an experimental study of an object (substantiating the parameters and conditions of observation, measurement accuracy)
ON 7 To study modern high-tech production, methods and methods of automating technological processes, calculate the efficiency and the ability to quickly change the range when using various CNC machines and automatic lines.
ON 8 Formulate the basic methods and principles for achieving quality in mechanical engineering, apply them in practice to achieve economically justified accuracy and quality of the resulting product
ON 9 Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation in the form of a master`s project
1. Have basic knowledge in the field of scientific organization of labor, the structure of employee`s time expenditure, its classification and methods of its study;
2. Be able to use the methodology of forming technical standards for various processing methods;
3. Have the skills to form technical standards for various processing methods and ways to organize the work of rationing processing in machine-building organizations;
4. Demonstrate basic knowledge about the scientific organization of labor, the production process and its parts, the structure of the employee`s time and its classification.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Computational modeling of the processing time norm Theory of cutting and high precision machining

Dynamic calculation of design studies

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of knowledge about materials, aluminum alloys and polymers, which are non-linear elastic, which raises questions of their calculation. The need for calculation methods in the dynamic analysis of structures made of a non-linear elastic material is described. Description of the problem in the dynamic calculation of nonlinear systems and in the calculation of structures made of linear elastic material.

Purpose of studying of the discipline

Formulate the rationale for design schemes of structures, determine the most dangerous combination of loads, select rational materials for machine elements

Learning Outcomes

ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of design and dynamic calculation of structures in complex engineering and scientific activities;
2. Be able to use calculation methods for dynamic calculations of structures made of various types of material;
3. Have the skills to use application software packages in scientific and engineering activities to automate dynamic calculations;
4. Demonstrate basic knowledge of dynamic calculations of structures made of nonlinear elastic material and linear elastic material;

Prerequisites

Introduction to experiment

Postrequisites

Final examination Research work of a master student, including internship and master s project III

Engineering methods of calculation

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course forms knowledge for the design and design of products, assemblies, objects. Describes automated systems for designing parts, programs used for calculation, drawing drawings, calculations and modeling using computer technology. Examples of calculation methods in engineering, strength and stiffness calculations with the possibility of automation are given; methods for calculating typical schemes in mechanics, their graphic description.

Purpose of studying of the discipline

Learning how to design various geometric spatial objects, how to obtain their drawings at the level of graphic models and the ability to solve these problems using various methods of optimizing calculations during design.

Learning Outcomes

ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON8 Be able to critically assess their strengths and weaknesses.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of mathematical and engineering sciences in the field of design and engineering of products, components, objects;
2. Be able to use the methods of system analysis and mathematical modeling, the basics of theoretical and experimental research;
3. Have the skills to use application software packages in scientific and engineering activities in order to design parts, perform engineering calculations;
4. Demonstrates basic knowledge of calculation methods in engineering, these are calculations for strength and stiffness with the possibility of automation; methods for calculating standard circuits in mechanics.

Prerequisites

Basic and profile disciplines of the EP Theoretical foundations of modeling cutting processes

Postrequisites

Final examination Research practice Research work of a master student, including internship and master s project III

Innovative solutions of machine-building production

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

Solutions are listed that give the engineering industry as a multiplier for the development of related industries, which increase the employment of the population and increase the competitiveness of the economy. Knowledge is being formed to increase production efficiency and innovation for development in related areas - mechanical engineering, machining of parts, automation and modern materials science, innovative technologies.

Purpose of studying of the discipline

Studying ways to increase production efficiency in mechanical engineering and innovative solutions for the further development of the field.

Learning Outcomes

ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.
ON8 Be able to critically assess their strengths and weaknesses.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of mathematical and professional sciences in complex engineering and scientific activities;
2. Be able to use methods of analysis and mathematical modeling to develop innovative solutions for the engineering industry;
3. Have the skills to develop the processes of machining parts, automation, innovative technologies;
4. Demonstrate basic knowledge about modern problems of mechanical engineering; the main directions of increasing production efficiency.

Prerequisites

Flexible manufacturing cells and automated production lines in mechanical engineering System management of processes in mechanical engineering

Postrequisites

Final examination

Simulation of oscillations in a mechanical system

Discipline cycle	Profiling discipline

Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of knowledge about the modeling of oscillatory processes (mechanical) by solving problems. The studies in modeling programs are described. The theory of vibrations in machining is a way of studying machining processes. The theory of oscillations is based on general and experimental physics. The main attention is paid to the generality of mathematical analysis for oscillations of various nature.

Purpose of studying of the discipline
The purpose of studying the discipline is the formation of students` theoretical knowledge about the modeling of oscillatory processes (mechanical) by solving specific physical problems.

Learning Outcomes
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline
1. Have basic and specialized knowledge in the field of the theory of oscillatory processes in mechanical processing;
2. Be able to use methods of systematic and mathematical analysis for fluctuations of various nature;
3. Have the skills to study phenomena in the various modeling programs available;
4. Demonstrate basic knowledge about modern problems of oscillation theory, modeling of oscillatory processes;

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Modernizathion of technological processes in mechanical engineering

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course describes the methods of modernization of technological processes of parts, examples of technological processes of processing, constructive and technological methods are given: this is the combination of design, manufacture, operation and repair of parts into one technological process; accounting for technological heredity during processing, from the receipt of the workpiece and ending with the operation of the product.

Purpose of studying of the discipline
To study methods and means of achieving the required quality of the product; to know the basics of the production of construction materials, the latest trends in the production of parts and blanks.

Learning Outcomes
ON2 Show the learning skills necessary to independently continue further education in the field of study.
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline
1. To know the physics of the processes of forming a part or workpiece by plastic deformation, mechanical and electrophysical processing, thermo- and thermochemical surface treatment;
2. Be able to analyze the basic technological process, choose modern technological equipment;
3. Have work skills in the design, manufacture, further operation and repair of parts;
4. Demonstrate knowledge about methods and methods of modernization of technological processes for manufacturing parts in mechanical engineering;

Prerequisites
Flexible manufacturing cells and automated production lines in mechanical engineering Theory of cutting and high precision machining

Postrequisites
Final examination Research practice

Organization and planning of research and innovation

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
Formation of the presentation of scientific research (formulation of topics, goals, objectives); methodology of theoretical, experimental research. The course presents an analysis of theoretical and innovative research, conducting experiments and developing conclusions and recommendations. The course provides knowledge on innovations in scientific activity, their promotion and implementation, the

main criteria for registration and protection of copyright and other rights.

Purpose of studying of the discipline

Planning of management of research and innovation " – to promote the formation of knowledge about the methodology and methods of implementation of science-based research

Learning Outcomes

ON2 Show the learning skills necessary to independently continue further education in the field of study.
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline

1. Demonstrate basic and specialized knowledge in the field of mathematical sciences, on the main issues of scientific research and professional sciences in engineering and scientific activities;
2. Be able to use methods of system analysis and mathematical modeling, analysis of theoretical and innovative research;
3. Have the skills to conduct experiments and develop conclusions and recommendations;
4. Have basic knowledge on the development of innovations in scientific activity, their effective promotion;

Prerequisites

Methods of experimental design Introduction to experiment Statistical methods for planning an experiment

Postrequisites

Final examination Research work of a master student, including internship and master s project III

Applied theory of mechanical vibrations

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course formulated moments of the theory of oscillations of linear and nonlinear mechanical systems. Methods for calculating machine-building products (systems) are described. Methods for calculating plates and shells are shown, information is given on self-oscillations and aeroelastic oscillations. The oscillations resulting from shock, periodic loads are described. Digitization of calculations on special software is shown, their description is given.

Purpose of studying of the discipline

Formulate the rationale for design schemes of structures, determine the most dangerous combination of loads and vibrations, select rational materials for machine elements

Learning Outcomes

ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of the theory of oscillations of linear and nonlinear mechanical systems;
2. Be able to use mathematical modeling methods in the calculation of plates, shells;
3. Have the skills to use application software packages in scientific and engineering activities to calculate fluctuations ;
4. Demonstrate basic knowledge about self-oscillations and aeroelastic vibrations, vibrations resulting from shock loads, periodic loads;

Prerequisites

Oscillation theory Measurement of vibration and shock

Postrequisites

Final examination

Computational modeling of the processing time norm

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

Formation of skills for modeling time norms using formulas, in cases where the duration of machining operations can be regulated by technical conditions, processing conditions, and physical laws. The development and modeling of norms based on the norms of labor costs consists in the use of norms with the given norms of labor costs for typical movements.

Purpose of studying of the discipline

Studying methods for modeling and designing time norms using formulas, influencing factors and main costs using various methods for optimizing calculations.

Learning Outcomes

ON4 Analyze, think creatively and creatively approach new problems and situations. The ability to independently apply methods and means of cognition, learning and self-control.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

ON8 Be able to critically assess their strengths and weaknesses.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of modeling and designing time standards in complex engineering activities;
2. Be able to develop and model norms based on labor cost standards;
3. Have the skills to design time standards using formulas, influencing factors and basic costs in cases where the duration of machining operations can be regulated by technical conditions, processing conditions, physical laws;
4. Demonstrate knowledge about modern problems of mechanical engineering; calculation of reasonable time standards during processing;

Prerequisites

Technical regulation in mechanical engineering

Postrequisites

Final examination

The control system in mechanical

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course summarizes knowledge about the types of control systems in mechanical engineering. Describes the structure of enterprise management, the basis of which is the organization of production. The structure of management in mechanical engineering - complexity, levels of formalization and centralization, coordination mechanisms. Distinguish between engineering data management systems, quality management systems, cost management and product prices.

Purpose of studying of the discipline

To acquaint undergraduates with automated control and design systems in mechanical engineering.

Learning Outcomes

ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
ON8 Be able to critically assess their strengths and weaknesses.

Learning outcomes by discipline

1. Have basic and specialized knowledge about the features and types of control systems in mechanical engineering;
2. Be able to use methods of system analysis of the management structure in mechanical engineering using basic concepts such as complexity, levels of formalization and centralization, coordination mechanisms;
3. Have the skills to use application software packages in scientific and engineering activities in order to automate the management of machine-building production;
4. Demonstrate basic knowledge of engineering data management systems, quality management management systems, cost and price management for the final product

Prerequisites

Automation of technological processes in mechanical engineering Automation of tool production

Postrequisites

Final examination Research practice

Improvement of automated production

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course forms knowledge on improving the automation system, production efficiency, mobility. The methods of automation and the result of an increase in the level of competitiveness, an increase in the use of the resource base are described. Automation measures aimed at reducing the number of employees and increasing production efficiency, improving product quality and working conditions are shown.

Purpose of studying of the discipline

To acquaint with computer-aided design systems in mechanical engineering, ways of changing automation and, as a result, an increase in the level of production efficiency.

Learning Outcomes

ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of mathematical and professional sciences in complex engineering and scientific activities;
2. Be able to use methods of system analysis of automation in production and mathematical modeling;
3. Have the skills to use application software packages in scientific and engineering activities in order to automate machine-building production;
4. Demonstrates basic knowledge in the field of developing a set of measures for automation of production processes, based on the

specified parameters;

Prerequisites

Flexible manufacturing cells and automated production lines in mechanical engineering Automation of technological processes in mechanical engineering Automation of tool production

Postrequisites

Final examination

Modern problems of technologies of production machines

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course provides knowledge on high technologies: combined processing; quality assurance by technological methods; cost reduction and productivity increase; development of innovative technologies that save energy and materials; formation of the surface layer by technological methods - alloying, welding, various coatings; regular provision of changes in the quality of the surface layer and operational properties of blanks by technological methods.

Purpose of studying of the discipline

Study of the regularities operating in the manufacturing process of modern machine parts.

Learning Outcomes

ON2 Show the learning skills necessary to independently continue further education in the field of study.
ON3 Show the ability to conduct experiments according to specified methods with processing and analysis of the results, apply standard test methods to determine the physical and mechanical properties and technological indicators of the materials used and finished products.
ON5 Be able to critically assess their strengths and weaknesses. Apply the skills of scientific research on the formulated topic, obtaining new scientific and applied results, their analysis, systematization, generalization and presentation.

Learning outcomes by discipline

1. Know the theory of basing; the theory of dimensional chains;
2. Be able to calculate and find ways to implement dimensional relationships in the machine during its assembly;
3. Have the skills to form the required material properties and dimensional relationships of the part during its manufacture;
4. Demonstrate the ability to develop technological processes for machining machine parts;

Prerequisites

Basic and profile disciplines of the EP Increasing the efficiency of the cutting tool

Postrequisites

Final examination

System management of processes in mechanical engineering

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course describes the ways of digitalization of technological and processes in mechanical engineering. Lists ways to organize innovative digitalized production; digitalization of production management processes; use of software in the development of technological processes; digitalization of scientific research in the field of their production, scientific activities and improvement of production, equipment and technologies in mechanical engineering.

Purpose of studying of the discipline

The purpose of the discipline: Familiarization of students with the ways and methods of digitalization of technological and production processes in mechanical engineering, with methods for modeling cutting processes and various systems; methods of both mathematical and computer modeling;

Learning Outcomes

ON6 Demonstrate the ability to conduct a preliminary feasibility study of design solutions.
ON7 Explain how to perform organizational and planning calculations for the creation or reorganization of production sites, apply progressive methods of operating technological equipment.
ON9 Apply knowledge of legal, social, environmental and cultural aspects of integrated engineering activities.

Learning outcomes by discipline

1. Have basic and specialized knowledge in the field of mathematical sciences, digitalized manufacturing and professional sciences in complex engineering and scientific activities;
2. Be able to use methods of system analysis and mathematical modeling, organize innovative digitalized production; digitalization of management processes of machine-building production;
3. Have the skills to use modern equipment and software in the development of effective technological processes;;
4. Demonstrate basic knowledge about the digitalization of scientific research and the search for improvement of production, equipment in mechanical engineering;

Prerequisites

Preparation of machine-building production

Postrequisites

The control system in mechanical Innovative solutions of machine-building production