

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
ІМЕНІ ІГОРЯ СІКОРСЬКОГО»**

Механіко-машинобудівний інститут
Кафедра прикладної гідроаеромеханіки і механотроніки

**СЕРТИФІКАТНА ПРОГРАМА
«ІНЖЕНЕРІЯ ЛОГІСТИЧНИХ СИСТЕМ»
«LOGISTIC SYSTEMS ENGINEERING»**

**ЗА
ОСВІТНЬО-ПРОФЕСІЙНОЮ ПРОГРАМОЮ
«АВТОМАТИЗОВАНІ ТА РОБОТИЗОВАНІ МЕХАНІЧНІ СИСТЕМИ»
ПЕРШОГО (БАКАЛАВРСЬКОГО) РІВНЯ ВИЩОЇ ОСВІТИ**

**за спеціальністю
галузі знань
кваліфікація**

**131 «Прикладна механіка»
13 «Механічна інженерія»
Бакалавр з прикладної механіки**

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1. DESCRIPTION OF THE CERTIFICATE PROGRAM

1 - General information		
Full name of higher education institution and faculty/department	National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute" (Education and Research Institute of Mechanical Engineering, Department of Applied Hydroaeromechanics and Mechatronics)	
Degree of higher education	Degree of higher education - first (bachelor's)	
Subject area (field of knowledge, specialty)	Field of knowledge - 13 "Mechanical engineering, specialty 131 "Applied mechanics"	
The official name of the certificate program	Logistics systems engineering	
Type of certificate and scope of the certificate program	Certificate of the established model NTUU «Igor Sikorsky Kyiv Polytechnic Institute», 56 credits	
Language of teaching	Ukrainian	
Validity period of the certificate program	Indefinitely	
The Internet is the address of permanent placement of the certificate program	http://pgm.kpi.ua/uk/pro-kafedru/dokumenty-kafedry https://mmi.kpi.ua/abituriientu/spetsialnosti-ta-spetsializatsii?id=730 http://osvita.kpi.ua/131-arms	
2 – Purpose of the certificate program		
Education of specialists in the field of creation and operation of automated logistics systems and lifting and transport machines, their acquisition of applied skills and abilities, which ensure the implementation of general and professional competences when performing design and construction and research developments in the field of mechanization, automation and robotization of logistics operations and lifting - transport works in production processes		
3 – Peculiarities of participation of students of the Certificate program		
Candidates of the certificate program can be students of NTUU «Igor Sikorsky Kyiv Polytechnic Institute», as well as external listeners. External trainees are required to pass a test to check their knowledge of the disciplines "Machine Details", "Theoretical Mechanics", "Theory of Mechanisms and Machines", which are the basis for mastering, deepening knowledge and skills during training under the certificate program. The certificate program is designed for 3rd and 4th year full-time students. Enrollment in the program takes place during the period when students exercise their right to freely choose academic disciplines for the next academic year.		
4 – List of educational components		
<i>Components of the certificate program</i>	<i>Number of ECTS credits</i>	<i>Final control form</i>
<i>Elective educational components</i>		
Industrial technologies and the basics of engineering logistics	4	test
Construction mechanics and metal structures of lifting and transporting machines	4	test
Fundamentals theory of three-dimensional modeling	4	test
Fundamentals theory of automatic control	4	test
Hydraulic power drive of lifting	4	test

and transport machines (LTM)		
Lifting machines	4	test
Robotics of logistics systems	4	test
Transport machines	4	test
Production and sales logistics	4	test
Transport and warehouse logistics	4	test
Automated electric drive and basics of electric automation	4	test
Technology and logistics of automated production	4	test
Introduction to mechatronics	4	test
Operation and maintenance of lifting and transport machines	4	test
<i>Total credits of the certificate program</i>	<i>56 ECTS credits</i>	

5 – Competencies and expected learning outcomes

The certificate program provides for the deepening of competences and specialization of learning outcomes obtained during the study of the disciplines "Fundamentals of construction and design", "Design of aggregates of automated mechanical systems", "Fundamentals of industrial electric drive", "Discrete control systems of executive devices", "Fundamentals of mathematical modeling of physically heterogeneous systems". This certificate program is aimed at students' assimilation of the peculiarities of the creation and use of logistics systems, lifting and transport machines, control systems of mechanisms and devices of automated logistics systems, taking into account the practical problems of the field of application. It is filled with unique content developed together with stakeholders, author's courses, which are based on the use of industrial equipment and are characterized by practicality and relevance, which allows you to gain additional knowledge and skills, expand the range of career opportunities in the field of machine-building automation.

Competencies enhanced by the certificate program	<ul style="list-style-type: none"> ➤ Ability to describe and classify a wide range of technical objects and processes, based on deep knowledge and understanding of basic mechanical theories and practices, as well as basic knowledge of related sciences ➤ The ability to choose rational approaches and technical means for the creation, testing and operation of control systems of technical objects and systems, machines and mechanisms with means of mechanics, hydropneumatic automation, electromechanics, mechatronics and robotics ➤ The ability to choose rational approaches and technical means for the automation of technical objects and systems, machines and mechanisms by means of mechanics, hydropneumatic automation, electromechanics, mechatronics and robotics, to create competitive technical objects, to apply criteria for evaluating their functional, operational, energy and general efficiency ➤ The ability to use instrumental means of construction, justify and develop rational constructive solutions of automated mechanical systems, machines, systems of hydropneumatic automation, electromechanics, mechatronics and robotics and their elements and aggregates, in accordance with the given operational, functional, economic, ergonomic and other requirements when solving practical problems ➤ The ability to use modern approaches and tools of automated design to create automated mechanical systems, machines, systems of hydropneumatic automation, electromechanics,
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	<p>mechatronics and robotics and their components to ensure the performance of specified functions, operational characteristics and performance indicators</p> <ul style="list-style-type: none"> ➤ The ability to use modern tools for the development of mathematical and simulation models of automated mechanical systems, machines, systems of hydro- pneumatic automation , electromechanics, mechatronics and robotics and their components in order to determine rational design and operational parameters, modes and conditions of operation, assessment of functionality and efficiency by computer modeling
<p>Expected learning outcomes</p>	<ul style="list-style-type: none"> ➤ The ability to use modern methodologies for the design of transport and storage systems, mechanisms of logistics systems and lifting and transporting machines (LTM), their control and management. ➤ Knowledge of approaches to the organization of production processes, analysis of the infrastructure of the commodity market and development of the production structure of a machine-building enterprise, taking into account technological and logistical components of production processes, methods and means of automation of production processes, as well as analysis of existing and design of new production and logistics systems. ➤ Knowledge of the basic principles of choosing directions and means of production automation; methods of evaluating the productivity of various options for automating production processes; approaches to the development of structural schemes and planning of automatic lines, flexible production systems and automated transport and storage systems. ➤ Knowledge of the basics of automated control for solving applied problems of automation and robotization of production and transport and warehouse systems. ➤ Knowledge of rigging and installation methods; calculations and testing of rigging means; methods of installation of forklifts and machines of continuous transport; principles of operation, maintenance and repair of LTM ➤ . ➤ The ability to set the task of designing a new automated logistics system, a lifting and transporting machine or modernizing an existing one, and to implement it using modern software products and technical means. ➤ The ability to analyze various production processes according to the production process and according to the level of the organizational hierarchy; distinguish technological and logistical components of production processes; justify the forms of organization and phases of production preparation; to solve the main tasks of material and technical support of production, related to procurement logistics and maintenance of stocks. ➤ Ability to plan needs in material resources; manage material flows in production; to calculate optimal batches of production; make a production schedule; place equipment in the company's workshops in accordance with logistics requirements; evaluate the efficiency of production logistics and distribution channels and logistics service.

	<ul style="list-style-type: none"> ➤ The ability to develop schematic solutions and evaluate various options for automation and robotization of production processes, to select automation tools and logistic equipment for automatic lines , flexible production systems, and automated transport and storage systems . ➤ The ability to perform analysis and give a comparative assessment of parameters and characteristics of mechanisms and machines that are presented on the market; to draw up basic structural and constructive diagrams of mechanisms, machines, their systems and complexes; perform calculations of kinematic and power parameters, in particular for transitional periods; develop algorithms for control systems of mechanisms and machines; perform working drawings of parts, assemblies, mechanisms and machines. ➤ The ability to carry out design and construction and research developments in the field of mechanization, automation and robotization of loading , unloading and transportation operations in technological processes; to develop basic schemes of logistics systems with their necessary equipment.
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6 - Peculiarities of evaluation of learning outcomes

Each educational component of the certificate program has a corresponding methodical support, a mandatory part of which is the rating system used to evaluate the training results of the applicants. According to the decision of the department, the completion of an individual task may be provided for obtaining a certificate under this certificate program.

STRUCTURE OF THE CERTIFICATE PROGRAM

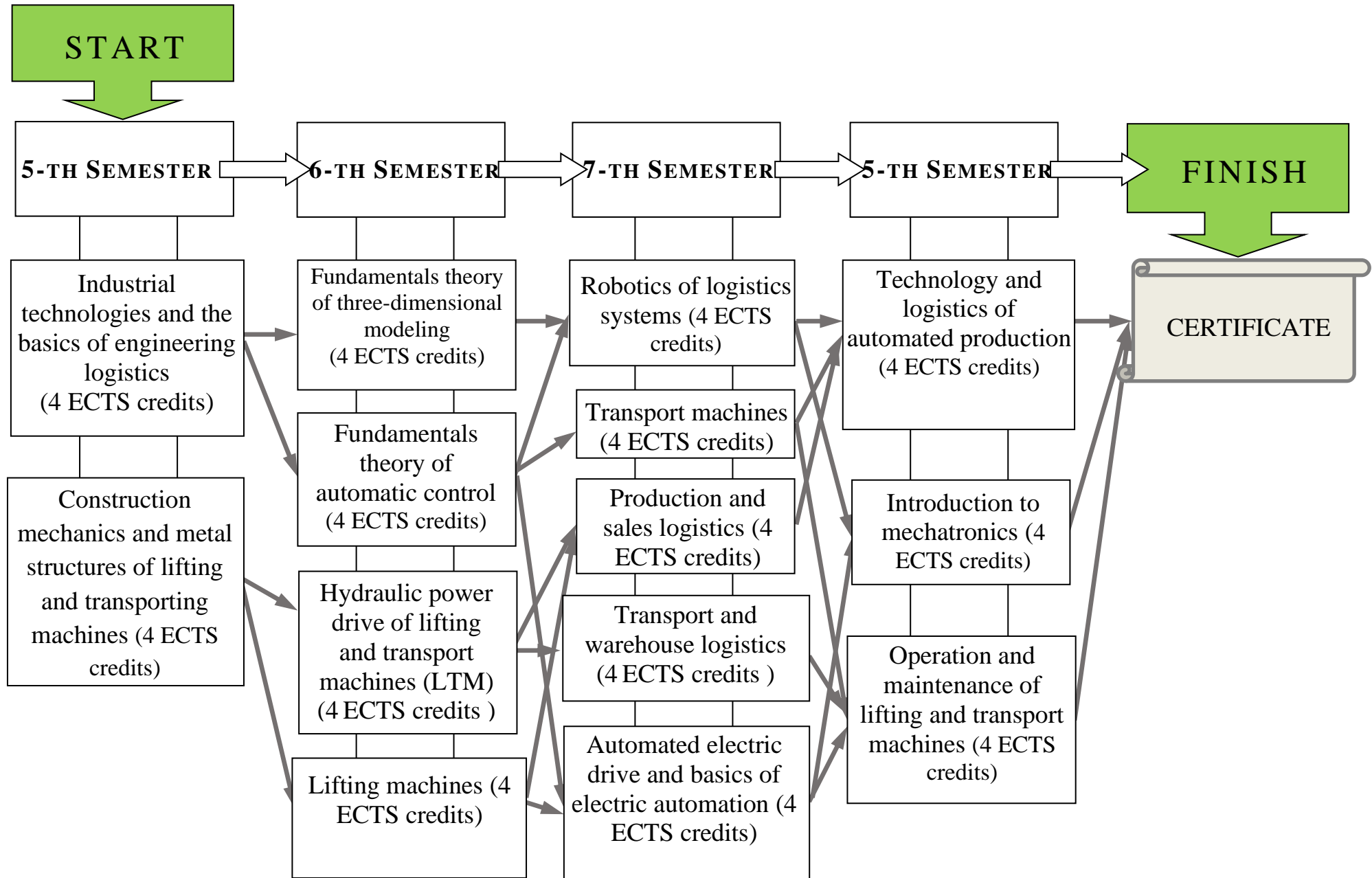
Type of educational component	The name of the educational component	Semester	Number of credits	One hour per week	Form of control
1st year of study					
Selective	Industrial technologies and the basics of engineering logistics	5	4	4	test
Selective	Construction mechanics and metal structures of lifting and transporting machines	5	4	4	test
Selective	Fundamentals theory of three-dimensional modeling	6	4	4	test
Selective	Fundamentals theory of automatic control	6	4	4	test
Selective	Hydraulic power drive of lifting and transport machines (LTM)	6	4	4	test
Selective	Lifting machines	6	4	4	test
2 year of study					
Selective	Robotics of logistics systems	7	4	4	test
Selective	Transport machines	7	4	4	test
Selective	Production and sales logistics	7	4	4	test
Selective	Transport and warehouse logistics	7	4	4	test
Selective	Automated electric drive and basics of electric automation	7	4	4	test
Selective	Technology and logistics of automated production	8	4	4	test
Selective	Introduction to mechatronics	8	4	4	test
Selective	Operation and maintenance of lifting and transport machines	8	4	4	test

In order to receive a certificate, it is necessary to successfully listen to and learn the specified optional educational components.

The total volume of the certificate program is 56 credits.

In order to increase the level of professional and practical training, students studying under the educational program "Automated and Robotic Mechanical Systems" must take into account the specialization of the chosen certificate program when completing pre-diploma practice and completing the thesis (the topic of the work is agreed separately with the head of the certificate program).

CERTIFICATE PROGRAM ROADMAP



Conditions for participation in the certificate program

The program is designed for students who have basic knowledge in the field of mechanics, hydraulics, electrical engineering, design, modeling of processes and systems.

Enrollment of trainees in the certificate program is carried out on the basis of the submitted application, while:

- external students submit an application no later than April of the current academic year to enroll them for the next academic year;
- students studying under the educational program "Automated and robotic mechanical systems" submit applications within the established deadlines for enrollment in optional disciplines.

Assessment

The assessment will take place in accordance with the Regulation on the system of assessment of learning outcomes at NTUU «Igor Sikorsky Kyiv Polytechnic Institute». The conditions for obtaining and distributing points for each educational component of the certificate program are reflected in the relevant syllabuses .

Release requirements

Completed educational program of 56 ECTS credits.

Based on the results of the student's mastery of the certificate program, acquisition of certain professional knowledge, abilities and skills, a certificate of NTUU «Igor Sikorsky Kyiv Polytechnic Institute». Information about mastering the certificate program is indicated in the annexes to the diploma of the European model.

2. Опис освітніх компонентів сертифікатної програми

Discipline	Industrial technologies and the basics of engineering logistics
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Departmen	Applied hydroaeromechanics and mechatronics
Teachers	Yurii Danylchenko
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired while studying the discipline "Technology of construction materials"
What will be studied	Industrial technologies: branches of production, technologies of material production, production and technological processes. Basics of the organization of production processes: classification of production by types and strategies, structure and forms of production organization, phases of production preparation. Infrastructure of industrial enterprises: infrastructure of the commodity market, production structure of a machine-building enterprise, production infrastructure, structure of the production cycle. Basics of engineering logistics: macro- and macro-logistics, objects of logistics management, material flows, logistics systems, logistics planning.
Why it is interesting / necessary to study	The successful operation of any industrial enterprise in a market economy is determined by the competitiveness of its products, which is primarily achieved by minimizing production and logistics costs in changing market conditions. The solution of this task is based on a set of knowledge about the technology of industrial production and the organization and functioning of an industrial enterprise in interaction with suppliers of materials and consumers of products.
What you can learn (learning outcomes)	The purpose of the discipline is the formation of primary system knowledge regarding the organization of production processes, analysis of the infrastructure of the commodity market and the development of the production structure and infrastructure of a machine-building enterprise, taking into account the technological and logistical components of production processes. This knowledge is basic for further mastering methods and means of automation of production processes, as well as analysis of existing and design of new production and logistics systems.
How to use the acquired knowledge and skills (competencies)	Analyze various production processes by production flow and by level of organizational hierarchy. To distinguish technological and logistical components of production processes. To justify the forms of organization and phases of production preparation. To solve the main problems of material and technical support of the manufacturer, related to procurement logistics and maintenance of stocks.
Information support	Study and work programs of the discipline, rating system, lecture notes (electronic edition).
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Construction mechanics and metal structures of lifting and transporting machines
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits (120 hours)
Language of instruction	Ukrainian
Department	Прикладної гідроаеромеханіки і механотроніки
Teachers	Nyezhtsev Oleksiy
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Theoretical Mechanics", "Mechanics of Materials and Structures", "Theory of Mechanisms and Machines"
What will be studied	<p>Beams with a moving load. Lines of influence of bearing reactions, bending moments and transverse forces in single-span, multi-span and cantilever beams. Selection of cross-sections and determination of the dimensions of composite beams. Calculation of traveling beams of cargo cranes. Calculation of sections of telescopic booms. Calculation of the farm. Determination of reactions, forces in truss rods using lines of influence from stationary and moving loads. Constructions, calculation and design of farms. Construction of influence lines of statically uncertain systems. Fundamentals of the dynamics of metal structures of lifting and transporting machines (LTM).</p> <p>Materials of LTM metal structures. Calculations of strength by the methods of limit states and allowable stresses. Fatigue durability and survivability of LTM metal structures. Calculations and designing of welded, bolted and hinged joints in LTM metal structures. Cranes of the bridge type. Types of bridges and their main parameters. Calculated load combinations. Calculation of structures of gantry cranes, influence of spacer loads and distortions. Boom cranes. Types of crane booms, areas of their application and calculation. Constructions and calculations of crane towers. Constructions of portal cranes, their main parameters, calculations. Constructions of tower cranes, their basic parameters, calculations.</p>
Why it is interesting / necessary to study	There are no such industrial enterprises, ports, railway stations, construction and other organizations that do not use LTM. Their reliability depends primarily on their metal structures. The main task of the discipline is for students to master the methods of calculating strength, rigidity and stability for the design of reliable and economical metal structures. To ensure the necessary reliability of the metal structure, its main elements must have sufficiently large cross-sectional areas, but the economy requires that the consumption of materials used in the manufacture of structures should be as low as possible. In order to find an acceptable compromise between the requirements of reliability and economy, basic knowledge of calculation methods and the principles of designing metal structures, taking into account the requirements of the LTM safety rules, is necessary.
What can be learned (learning outcomes)	<p>Methods of determining forces and stresses in the elements of metal structures of LTM from stationary and moving loads.</p> <p>The principles of designing LTM metal structures with minimal metal consumption while ensuring their reliability and durability.</p> <p>Modern trends in the development of metal structures.</p>
How to use the acquired knowledge and skills (competencies)	<p>Determine the forces and stresses in the elements of metal structures from stationary and moving loads.</p> <p>Perform calculations of LTM metal structures for strength, stability, deformability and fatigue life.</p> <p>To design metal constructions of LTM with minimum metal consumption, ensuring their bearing capacity and convenient installation.</p>
Information support	Educational and work programs of the discipline, syllabus, rating system of evaluation, lecture notes, textbooks and study guides (in the library of KPI named after I. Sikorskyi) methodical materials for laboratory classes
Form of classes	Lectures, laboratory works
Semester control	Test (written assessment work)

Discipline	Fundamentals theory of three-dimensional modeling
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Andrii Titov
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired while studying the disciplines "Informatics", "Engineering and computer graphics", "Basics of construction and design", "Industrial technologies and basics of engineering logistics"
What will be studied	General principles of modeling in Kompas-3D, SolidWorks, Catia. Typical three-dimensional elements. Creation of cross-sectional elements, kinematic elements, creation of 3D models based on flat drawings. Construction of parametric models. Creating assemblies. Creation of associative drawings. Additional modeling capabilities.
Why it is interesting / necessary to study	Computer systems of three-dimensional modeling are used in all modern enterprises to automate the technological processes of product design. The computer workshop provides an opportunity to easily master modern computer systems of three-dimensional modeling.
What you can learn (learning outcomes)	Knowledge of the main aspects of modern modeling methods, practical mastering of modern application programs of three-dimensional modeling with the aim of their further application to solve specific educational, research and production tasks.
How to use the acquired knowledge and skills (competencies)	To use three-dimensional modeling systems when designing various structures and their components, drawing up design documentation.
Information support	Study and work programs of the discipline, rating system, lecture notes (electronic edition), computer workshop (electronic edition)
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Fundamentals theory of automatic control
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechanotronics
Teachers	Oleksandr Okhrimenko
Requirements for the beginning of the study	General natural science knowledge of mathematics and physics courses; Knowledge of disciplines studied in 1-2 courses: Higher Mathematics (Differential and Integral Analysis), Linear Algebra, General Physics, Theoretical Mechanics, Mechanics of Materials and Structures
What will be studied	General patterns of functioning inherent in automatic systems of different physical nature will be studied, and on the basis of these laws develops the principles of building high-quality control systems..
Why it is interesting / necessary to study	Automatic control theory is a section of cybernetics (technical cybernetics) that studies the ways of controlling various technical devices, technological processes and productions, regardless of the nature of their functioning.
What can be learned (learning outcomes)	The subject of study of the discipline are the theoretical foundations of automation. Includes basic data on terminology and the concept of automation. Local systems of automatic regulation and their tasks. Objects of automatic regulation. Structural and functional schemes of regulatory systems. Classification of systems. Stabilization, tracking, software, extreme systems. The principles of regulation by deviation, perturbation, combined, adaptive. Functional implementation schemes. Mathematical characteristics of automation elements. Differential equations, transfer functions, frequency characteristics. The concept of typical links of regulatory systems and their characteristics. Typical links. The concept of the object of regulation and the types of influences on it. Classification of objects and their dynamic characteristics. Acceleration curves, graphic processing of static and astatic objects of regulation. The concept of the regulator. Classification. Ideas about the laws of regulation. Dynamic characteristics of regulators and their analytical and graphic representation. Structural schemes of regulators. Formation of regulation laws. The concept of a transitional process in the SAR. Indicators of the quality of the transition process are dynamic and residual deviation, quadratic quality criterion, adjustment time. Typical transient processes. Dynamic adjustment factor. The choice of the law of regulation. The concept of stability of regulatory systems. Criteria of stability and their verification.
How to use the acquired knowledge and skills (competencies)	Thanks to automatic regulation, it is possible to achieve the goal of stabilizing various values of the regulated process, software control of output values, tracking any external factors and adapting them when considering the design of various mechanical machines or processes.
Information support	Textbooks, tutorials, virtual laboratory work, individual tasks. https://classroom.google.com/c/MTUyMDIzODcyMjYx?cjc=6hibgv3
Form of classes	Lectures, laboratory, practical Home control work
Semester control	Test

Discipline	Hydraulic power drive of lifting and transport machines (LTM)
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechanotronics
Teachers	Dmytro Kostiuk
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Building Mechanics and Metal Structures LTM", "Mathematics", "Physics", "Theory of Machines and Mechanisms", "Machine Parts"
What will be studied	Basic principles of hydraulics and hydraulic drive, the principle of operation of hydraulic equipment used in the hydraulic drive of lifting and transport machines (LTM). Design and calculation of the main parameters of hydraulic drives of LTM. Schematic solutions of hydraulic drives used in LTM Features of hydraulic drives and their operation in the LTM.
Why it is interesting / necessary to study	Hydraulic drive is widely used in modern LTM. This is due to the many advantages of the hydraulic drive over other types of drives. The hydraulic drive is widely used in heavy-duty automated industrial lines, mobile construction equipment and works. Consider it, a modern qualified engineer must know the basic principles of operation of hydraulic drives and their application in the lifting and transport machines to obtain maximum efficiency of the equipment, be able to develop, maintain and work with systems equipped with hydraulic drive
What can be learned (learning outcomes)	The basic principles of hydraulics and to study the basic principles of operation of hydraulic drives, understanding and development of hydraulic schemes of LTM, the basic principles of equipment selection to ensure efficient and reliable operation of hydraulic drives
How to use the acquired knowledge and skills (competencies)	Design of hydraulic schematics and calculation of LTM hydraulic power drive basic parameters and characteristics. Maintenance and safety during work with the equipment.
Information support	Training and working programs of the discipline, RSO, lecture notes (electronic edition)
Form of classes	Lectures
Semester control	Test

Discipline	Lifting machines
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Yurii Horbatenko, Andrii Petryshyn
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Construction mechanics and metal constructions of LTM", "Electrical engineering and electronics", "Theory of mechanisms and machines", "Mechanics of materials and structures", "Fundamentals of construction and design", "Industrial technologies and the basics of engineering logistics"
What will be studied	Designs and main layout schemes of lifting machines depending on production conditions. Theory and practical methods of calculations and design of mechanisms of lifting machines: lifting, moving, turning, braking, control systems, etc.
Why it is interesting / necessary to study	To create theoretical foundations and learn practical skills of researching the parameters and characteristics of mechanisms and machines in general; design and calculations of mechanisms, machines, their systems and complexes for the performance of predefined technological tasks, under certain operating conditions under specified load modes.
What you can learn (learning outcomes)	Perform analysis and comparative assessments of parameters and characteristics of mechanisms and machines that are presented on the market; perform calculations of kinematic and power parameters, in particular for transitional periods; perform working drawings of parts, assemblies, mechanisms and machines.
How to use the acquired knowledge and skills (competencies)	Carry out design and construction work of lifting equipment for machine-building, metallurgical, chemical and other branches of industry, carry out integration of lifting equipment into automatic production lines.
Information support	Study and work programs of the discipline, rating system, lecture notes (electronic edition), teaching manual for laboratory practice (electronic edition).
Form of classes	Lectures, practical classes.
Semester control	Test (written test)

Discipline	Robotics of logistics systems
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechanotronics
Teachers	Ihor Nochnichenko, Oleh Levchenko
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines: "Informatics", "Basics of mathematical modeling of physically heterogeneous systems", "Basics of construction and design", "Theory of mechanisms and machines", "Informatics", "Discrete control systems of executive devices".
What will be studied	Design , development, construction, operation and use of robots, as well as computer systems for their control, sensor (based on the output signals of sensors) feedback and information processing of automated technical systems (robots). Types of robots and manipulators of logistics systems, schematic and constructive solutions, kinematic schemes of industrial robots, calculation of kinematics of industrial robots, basic algorithms and programs for programming robots.
Why it is interesting / necessary to study	The development of online trade and online services has increased the volume of work in the warehouse (formation of orders, inventory, control of shipments and receipts, monitoring of goods movement, delivery, etc.) so much that people are not able to cope with it, so the replacement of people with robots is unpredictable. That is why we are witnessing explosive growth in the field of logistics automation and robotics. According to the research group ABI Research , by 2025 more than 4 million robots may work in global warehouses .
What can be learned (learning outcomes)	Construction of mathematical models of robotics and logistics systems, taking into account modes and conditions of their operation. Gain knowledge and skills in the field of design, manufacturing and transportation of complex logistics systems. To study the methods of economic and mathematical modeling of logistics systems.
How to use the acquired knowledge and skills (competencies)	Develop automated technical systems (robots) and create robotic complexes designed to automate complex technological processes, both from an economic point of view in terms of logistics, and to know the engineering component of logistics processes.
Information support	Textbooks, study guides, virtual labs, packages of group labs
Form of classes	Lectures, laboratory
Semester control	Assessment (written assessment)

Discipline	Transport machines
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Yurii Horbatenko, Andrii Petryshyn
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Electrical engineering and electronics", "Fundamentals of automatic control theory", "Theory of mechanisms and machines", "Mechanics of materials and structures", "Fundamentals of construction and design", "Building mechanics and metal structures LTM", "Industrial technologies and basics of engineering logistics", "Forklifts", "Fundamentals of industrial electric drive"
What will be studied	Designs, principle of operation and purpose of typical machines and complexes for transporting goods and passengers. The specifics of the choice of transport vehicles depending on the type of cargo. Project calculation and types of control of transport machines. Characteristics and theory of cargo transportation: bulk, artificial, etc.
Why it is interesting / necessary to study	It is necessary to study in order to master the theory and gain practical skills from the basics of cargo transportation in both manufacturing and other industries. Gain experience in designing mechanisms and machines and their complexes with parameters that will ensure optimal performance and reliability of the cargo movement process under given conditions.
What you can learn (learning outcomes)	Carry out the design of transport equipment and its systems based on the analysis of production needs; to draw up basic structural and constructive diagrams of mechanisms, machines, their systems and complexes; perform calculations of traction and load-carrying bodies, drive stations; to develop algorithms for control systems of mechanisms and machines in order to automate the process of transporting goods.
How to use the acquired knowledge and skills (competencies)	To carry out design and construction and research developments in the field of mechanization and automation of loading and unloading and transportation operations in technological processes; to develop basic schemes of logistics systems with their necessary equipment.
Information support	Study and work programs of the discipline, rating system, lecture notes (electronic edition), study guide
Form of classes	Lectures, practical classes, individual assignments
Semester control	Test (written test)

Discipline	Production and sales logistics
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Yurii Danylchenko, Andrii Petryshyn
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Industrial technologies and basics of engineering logistics", "Load-lifting machines", "Hydraulic drive of LTM"
What will be studied	<p>Planning in production logistics, logistical principles of production organization, flow management at the production stage, transport and warehouse subsystem in production logistics, control and evaluation of the efficiency of production logistics.</p> <p>Organization of the distribution system, distribution channels in industrial and consumer markets and the service market, inventory management in distribution channels. Organization of logistics service.</p>
Why it is interesting / necessary to study	The main functional components of the logistics of an industrial enterprise that determine the effectiveness of its work on the market of goods and services are supply logistics, production logistics and distribution logistics (distribution). Coordination of the work of these components is the basis of minimizing costs of the enterprise's logistics system and quick response to changes in the market situation, which is the goal of the logistics strategy of industrial enterprises.
What you can learn (learning outcomes)	<p>The practical implementation of the interaction of supply logistics, production logistics and distribution logistics aims to ensure the optimization or synchronization of the links of the production and logistics chains.</p> <p>The learning outcomes are knowledge of logistic approaches to the organization of the production cycle, the organization of flow production on the basis of logistics, the creation of flexible production and logistics systems.</p>
How to use the acquired knowledge and skills (competencies)	Planning of the need for material resources, management of material flows in production, operational and production planning of production, calculation of the optimal batch of production, drawing up a production schedule, location of equipment in the workshops of the enterprise in accordance with logistics requirements, assessment of the efficiency of production logistics, assessment of the efficiency of distribution channels and logistics service .
Information support	Educational and work programs of the discipline, rating system, lecture notes (electronic edition).
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Transport and warehouse logistics
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechanotronics
Teachers	Andriy Petryshyn, Pavlo Protsenko
Requirements for the beginning of the study	Knowledge and skills in disciplines "Ukrainian language", "Higher mathematics", "Informatics", "Fundamentals of hydroautomatics", "Automated mechanical systems units design", "Fundamentals of industrial electric drive"
What will be studied	Principles of the modern transport logistics concepts. Objects of logistics management and logistics operations. Logistical approach to managing material flows in manufacturing and trade. Technology of material resources movement. Warehouse logistics.
Why it is interesting / necessary to study	Logistics is the foundation of modern business. Logistics approaches in transportation and warehousing tend to increase efficiency and reduce the transportation cost.
What can be learned (learning outcomes)	Theory on the logistics concepts, strategies and tactics, as well as principles and laws of material flows movement and distribution. Methods for the development and implementation transport and warehouse logistics. Mastering the skills of logistics thinking and improving logistics systems and mechanisms for their functioning. Skills in assessing economic efficiency and the consequences of implementing logistics decisions.
How to use the acquired knowledge and skills (competencies)	Analysis, modeling and evaluation of logistics solutions. Reengineering and optimization of business processes. Choosing a scenario for the development of company logistics. Calculation of stock needs. Stock optimal level determination. Costs optimization for the stock maintenance. Organization of purchases. Planning procurement operations. Supplier selection. Organization of interaction with the supplier. Type of transportation selection. Optimal carrier selection. Transportation planning and organization. Logistics chains development for the various types of goods. Warehouse design and organization of warehouse logistics. Numerical modeling of warehouse logistics and logistics of communal services.
Information support	Textbooks, manuals, virtual laboratory work, packages of group laboratory works, professional software
Form of classes	Lectures, practical and laboratory work
Semester control	Test

Discipline	Automated electric drive and basics of electric automation
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Vasyl Lukavenko, Andrii Zilinskyi
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired during the study of disciplines: "Mathematics", "Physics", "Forklifts", "Fundamentals of automatic control theory", "Informatics", "Electronics and electrical engineering".
What will be studied	Principles of operation, structure of motors: alternating current and direct current, their mechanical and electromechanical characteristics, starting methods, speed regulation, switching schemes, static and dynamic characteristics and modes of operation. Features of the structure and regulation of asynchronous motors with a short-circuit as the most common, and a phase rotor. Braking: electric, generator with energy return to the network, anti-circuit, dynamic. Frequency converters and their application as modern devices for effective control of an asynchronous electric drive. Features of stepper and linear motors and operating principles of control circuits. Electric drive systems of elevators, their design features and control schemes. Tracking electric drive. Servo drive. Methods and means, analog and digital devices, hardware and software devices for performing experimental research.
Why it is interesting / necessary to study	The goal of the educational discipline is the formation of students: basic knowledge about the components, structure, principle of operation and functioning of direct and alternating current AED; basics of design and operation of electric drives of technological objects, which combine the power electric part, mechanical transmission device, electronic control unit. After studying the course, students demonstrate knowledge of: the physical essence of analytical dependencies in relation to AC and DC electric machines; mechanical and electromechanical characteristics of electric motors and understanding the essence of electromagnetic and energy processes occurring in AC and DC electric drives.
What you can learn (learning outcomes)	The study of the discipline ensures the availability of the necessary knowledge for competent operation and the initial skills of analysis and modernization of AED control schemes based on modern achievements; performing diagnostics of the electric drive and restoring its efficiency; use of measuring devices and signal conversion devices for measuring electrical and mechanical quantities;
How to use the acquired knowledge and skills (competencies)	Solve practical tasks of creating and operating AED. To carry out experimental studies of the operation of AED using modern computer technologies, which is facilitated by the implementation of the cycle of laboratory works on the experimental study of AED, provided by the educational program.
Information support	Study and work programs of the discipline, rating system, lecture notes (electronic edition), teaching manual for laboratory practice (electronic edition).
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Technology and logistics of automated production
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Yurii Danylchenko, Andrii Petryshyn
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Robotics of logistics systems", "Technology of construction materials", "Industrial technologies and basics of engineering logistics", "Load-lifting machines", "Transport and warehouse logistics", "Production and sales logistics" »
What will be studied	The main directions of production automation and ways of increasing its productivity and efficiency. Features of automated production technology. Automation of the main and auxiliary operations of technological processes of mechanical processing. Automation of transport and warehouse operations of machining production. Logistic support of automated production.
Why it is interesting / necessary to study	Modern mechanical engineering is focused on the creation of "unmanned factories" ("Lights-Out" Manufacturing) based on the wide implementation of complex production and transport logistics systems. Successful implementation of this task requires future specialists to understand the technological and logistical support of such production and knowledge and skills in the application of modern technical means and methods of organization and management of end-to-end material flows in production.
What you can learn (learning outcomes)	Basic principles of choosing directions and means of production automation. Methods of evaluating the productivity of various options for automating production processes. Approaches to the development of structural schemes and planning of automatic lines, flexible production systems (FPS) and automated transport and storage systems (ATSS).
How to use the acquired knowledge and skills (competencies)	Develop schematic solutions and evaluate various options for automating production processes. Select means of automation and logistic equipment of automatic lines, FPS ATSS. Develop structural diagrams and planning of automatic lines, FPS and ATSS.
Information support	Educational and work programs of the discipline, rating system, lecture notes (electronic edition).
Form of classes	Lectures, practical classes, individual assignments
Semester control	Test (written test)

Discipline	Introduction to mechatronics
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechanotronics
Teachers	Alona Murashchenko
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines: «Discrete control systems for actuators», «Informatics», «Robotics of logistics systems", "Automated electric drive and basics of electric automation"
What will be studied	The principle of creating automated control of production processes using controller programming. Examples of the use of mechatronics in various industries based on the study of programs used in automated processes. Programming of automation links of production processes and technical facilities using computer programs.
Why it is interesting / necessary to study	Mechanotronics is widely used from modern industry to control systems in residential buildings. The study of programming algorithms makes it possible to solve problems of automation by any process that can be implemented without human physical labor.
What can be learned (learning outcomes)	Ability to use basic ideas about the variety of approaches and means of creating control systems for any production process. Ability to develop control systems for hydraulic and pneumatic actuators based on freely programmable controllers used in the management of production processes. Methods of increasing production efficiency due to the use of programmable control controllers for automation.
How to use the acquired knowledge and skills (competencies)	Solve practical tasks of automation of technical objects by writing the algorithm of the control program of various systems and practically check the correctness of their writing on educational stands, modular stands, which are production process automation lines. The ability to increase the degree and quality of automation of existing facilities through modernization and reengineering of hydropneumatic automation systems, optimization of work modes and composition, use of innovative technical solutions and approaches
Information support	Study and work programs of the discipline, RS (rating system), lecture notes (electronic edition), study guide (electronic edition)
Form of classes	Lectures, practical, laboratory
Semester control	Test

Discipline	Operation and maintenance of lifting and transport machines
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleksii Niezhentsev
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Construction mechanics and metal constructions of LTM", "Automated electric drive and basics of electric automation", "Industrial technologies and basics of engineering logistics", "Forklifts", "Transport and warehouse logistics"
What will be studied	Installation of lifting and transporting machines (LTM). Rigging equipment, mounting devices and equipment (ropes, slings, sleepers, grabs, block clamps, hoists, winches, jacks, mounting masts, sheaves, portals, mounting cranes, anchors, support platforms). Production of rigging and installation works. Calculation and testing of rigging means. Installation of lifting machines (overhead, gantry, tower and portal cranes, hoists). Installation of continuous transport machines (belt and chain conveyors, bucket elevators). Operation and repair of LTM. LTM maintenance and repair system. Friction and wear in LTM nodes. Types and properties of lubricants, lubrication methods and systems. Technological process and main operations of LTM repair. Malfunctions of typical LTM parts and ways to restore them. Repair of parts and assembly units of LTM.
Why it is interesting / necessary to study	There are no industrial enterprises where LTMs are not used. In order to fully implement the technical capabilities inherent in the design of machines, to ensure high productivity in work with strict compliance with the rules of safety and operation of LTM, it is necessary to master the knowledge, abilities and skills necessary for solving the tasks of increasing the reliability of LTM, creating and implementing progressive technologies for their installation, operation and repair.
What you can learn (learning outcomes)	Methods of production of rigging and assembly works. Conducting calculations and testing rigging means. Methods of installation of lifting machines (bridge, gantry, tower and portal cranes, elevators) and machines of continuous transport (belt and chain conveyors, bucket elevators). Principles of operation, maintenance and repair of LTM. Methods of increasing wear resistance and reducing the harmful effect of wear on the work of LTM. Methods of repair of parts and assembly units of LTM.
How to use the acquired knowledge and skills (competencies)	To ensure trouble-free and reliable operation during the operation of LTM. Perform calculations and tests of rigging equipment. Analyze the causes of failure of machine parts and assemblies. Make a list of defects and make defections of parts, determine the causes of failure of mechanisms and metal structures of LTM. Determine the reparability of parts, taking into account the methods of restoring worn surfaces, propose ways to eliminate defects, and assign equipment and tools. Choose rational methods of carrying out repair work, order spare parts, assemblies, lubricants taking into account their needs, compile repair information, operational schedules, calculate the need for spare parts, lubricants, tools and devices.
Information support	Study and work programs of the discipline, rating system, lecture notes, methodical instructions for laboratory classes
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)