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НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
ІМЕНІ ІГОРЯ СІКОРСЬКОГО»
Механіко-машинобудівний інститут
Кафедра прикладної гідроаеромеханіки і механотроніки

СЕРТИФІКАТНА ПРОГРАМА
«ГІДРОПНЕВМОАВТОМАТИКА СМАРТ СИСТЕМ»
«HYDROPNEUMATIC AUTOMATION FOR SMART SYSTEMS»
ЗА
ОСВІТНЬО-ПРОФЕСІЙНОЮ ПРОГРАМОЮ
«АВТОМАТИЗОВАНІ ТА РОБОТИЗОВАНІ МЕХАНІЧНІ СИСТЕМИ»
ПЕРШОГО (БАКАЛАВРСЬКОГО) РІВНЯ ВИЩОЇ ОСВІТИ

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кваліфікація

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3. Syllabuses of the educational components of the certificate program

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	Hydropneumatic automation of smart systems	
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		
Deepening of knowledge in the field of creation and operation of hydropneumatic automation tools and hydraulic and pneumatic smart systems and machines, acquisition of applied skills and abilities that ensure the implementation of general and professional competencies in the training of specialists in the field of automation of 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 parts", "Hydraulics", "Fundamentals of thermodynamics", 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>		
Machine-building hydraulics	4	test
Volumetric hydraulic and pneumatic machines and hydraulic transmissions	4	test
Gasdynamics	4	test
Compressor machines	4	test
Volumetric hydraulic drive	4	test
Pneumatic actuators and pneumatic control systems	4	test
Applied hydromechanics	4	test

Mobile hydraulics	4	test
Machine-building hydraulic automation	4	test
Mathematical modeling and design of hydraulic and pneumatic drive systems	4	test
Hydraulic and pneumatic turbomachines and transmissions	4	test
Design of hydraulic and pneumatic drives	4	test
Computational hydromechanics of hydraulic components	4	test
Testing and diagnostics of drive systems	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 the specialization of learning outcomes obtained during the study of the disciplines "Discrete control systems of executive devices", "Basics of mathematical modeling of physically heterogeneous systems", "Basics of construction and design", "Basics of hydraulic automation", "Design of units of automated mechanical systems ", "Liquid and gas mechanics". This certificate program is aimed at students' assimilation of the peculiarities of the creation and use of machines, systems and devices of hydropneumatic automation , 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
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<p>Expected learning outcomes</p>	<ul style="list-style-type: none"> ➤ The ability to use hydropneumatic automation systems and hydraulic and pneumatic machines in automated engineering systems. ➤ Knowledge of the basics of automated control for solving applied problems of automation of production and operational systems. ➤ Knowledge of applied programs and approaches to determining rational parameters and characteristics of systems and devices of hydropneumatic automation and robotics by means of computer modeling. ➤ The ability to build information models of the subject of research: describe its essential parameters, input and variable values, establish cause-and-effect relationships between them. ➤ The ability to set the task of designing a new hydropneumatic smart system or modernizing an existing one, and implement it using modern software products and technical means. ➤ The ability to use the means of information technologies of design in the tasks of technical preparation of production. ➤ The ability to determine, by means of computer modeling, the characteristics and rational parameters of systems and devices of hydropneumatic automation . ➤ Ability to develop, assemble, debug and modernize control systems and algorithms for multi-mode hydropneumatic systems and hydraulic and pneumatic machines.
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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	Machine-building hydraulics	5	4	4	test
Selective	Volumetric hydraulic and pneumatic machines and hydraulic transmissions	5	4	4	test
Selective	Gasdynamics	6	4	4	test
Selective	Compressor machines	6	4	4	test
Selective	Volumetric hydraulic drive	6	4	4	test
Selective	Pneumatic actuators and pneumatic control systems	6	4	4	test
2 year of study					
Selective	Applied hydromechanics	7	4	4	test
Selective	Mobile hydraulics	7	4	4	test
Selective	Machine-building hydraulic automation	7	4	4	test
Selective	Mathematical modeling and design of hydraulic and pneumatic drive systems	7	4	4	test
Selective	Hydraulic and pneumatic turbomachines and transmissions	7	4	4	test
Selective	Design of hydraulic and pneumatic drives	8	4	4	test
Selective	Computational hydromechanics of hydraulic components	8	4	4	test
Selective	Testing and diagnostics of drive systems	8	4	4	test

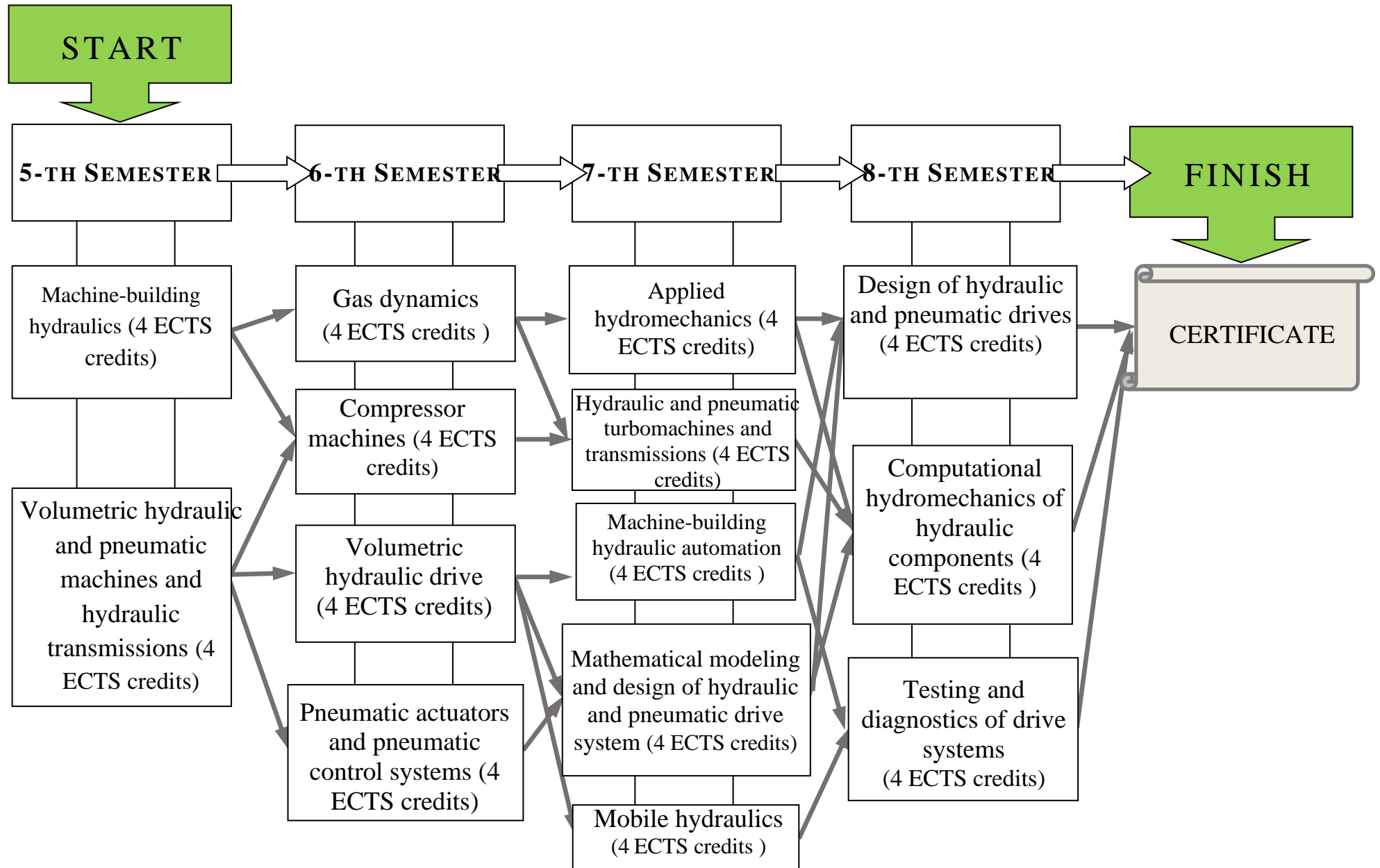
In order to receive a certificate, it is necessary to successfully listen to and learn the specified optional educational components.

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. Descriptions of educational components of the certificate program

Discipline	Machine-building hydraulics
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Natalia Seminska, Alona Murashchenko
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines «Physics», «Fundamentals of design and engineering»
What will be studied	The course studies the basic laws of equilibrium and movement of fluids, the use of energy of working fluids. Hydraulics occupies the first place in the application of industry, in particular in hydraulic engineering, thermal power engineering. «Machine-building hydraulics» studies applications in the field of volumetric, hydraulic and pneumatic drives.
Why it is interesting / necessary to study	Designing and creating modern drives is not possible without studying the basics of machine-building hydraulics. It is important to study the laws and characteristics of working fluids. The correct use of liquid energy in drives makes it possible to create various mobile, powerful, autonomous devices that have a wide range of applications.
What can be learned (learning outcomes)	The main tasks of studying the course « Engineering hydraulics" are mastering the basics of hydraulics; familiarization with the existing types of hydraulic machines, hydraulic and pneumatic drives and their characteristics and properties; mastering the methods of determining parameters of operating modes of hydraulic machines, hydraulic and pneumatic drives.
How to use the acquired knowledge and skills (competencies)	Ability to solve problems in professional activities based on analysis and synthesis. The ability to theoretically substantiate the decisions made in the process of design and construction work in the field of mechanical engineering. The ability to justify the choice, determine the operating parameters of the automated production equipment of machine-building enterprises and design their typical units. Ability to analyze technical and economic and operational indicators of hydraulic machines, hydraulic and pneumatic drives, their systems and elements.
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 (written test)

Discipline	Volumetric hydraulic and pneumatic machines and hydraulic transmissions
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Ihor Hryshko
Requirements for the beginning of the study	Successful mastery of knowledge and skills acquired in the study of the disciplines "Mathematics", "Physics", "Theory of machines and mechanisms", "Machine parts", "Fundamentals of construction and design"
What will be studied	The principle of operation of various volumetric machines (manual, gear, gerotor, screw, plate, axial and radial piston). Features of their design and operation in different modes.
Why it is interesting / necessary to study	Understanding the principle of operation of a volumetric machine makes possible to competently, reasonably select, if necessary, assemble or develop, one of the main components of the hydraulic system.
What can be learned (learning outcomes)	Clearly understand the possibilities and applications of different in their design and output parameters of volumetric machines. Understand the functional value of any pump or motor component. Ability to choose the necessary type of volumetric machine for specific parameters and tasks. Calculation of the main parameters of volumetric machines. On own experience to evaluate the work of volumetric machines in different modes.
How to use the acquired knowledge and skills (competencies)	The acquired theoretical knowledge makes it possible to easily understand the operation of any hydraulic system. Identify possible malfunctions and predict its operation. Practical experience gained through close cooperation with the company "HIDRAVLIK Line" gives the skills to work with hydraulic equipment of any complexity.
Information support	Study and work programs of the discipline, rating system of evaluation, lecture notes (electronic edition).
Form of classes	Lectures, laboratory classes, independent work
Semester control	Test (written test)

Discipline	Gasdynamics
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Volodymyr Turyk
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the subjects "Linear algebra and analytical geometry", "Higher mathematics", "General physics", "Theoretical mechanics", "Theoretical foundations of heat engineering", "Machine-building hydraulics".
What will be studied	Gas dynamics is a branch of mechanics that studies the high-speed movement of gas (steam, multiphase mixture) under conditions where the properties of the movement are affected by the compressibility of the substance.
Why it is interesting / necessary to study	The subject of study of the discipline: thermodynamic and acoustic characteristics of gas-dynamic processes; laws of conservation of mass, momentum, moment of momentum and energy; influence of gas compressibility on flow parameters; characteristic equations of isentropic flow; wave processes of small and strong disturbances; shock waves; normal and oblique shocks; one-dimensional theory of the Laval nozzle in calculation and non-calculation regimes; one-dimensional gas flow with friction; expendable, thermal, mechanical nozzle of supersonic speeds; interaction of compressible shocks with the boundary layer; flat and axisymmetric flow of compressible gas.
What can be learned (learning outcomes)	Learning outcomes:: ability to independently formulate, analyze and solve problems of gas dynamics and to determine: space-time parameters fields of gas flows moving at high subsonic and supersonic speeds; conditions for the creation of such flows, their interaction with streamlined bodies and channel walls under given single-valuedness conditions; the ability to analytically, numerically or experimentally determine the parameters of high-speed flows, which makes it possible to create rational designs of objects of new technology without the danger of gas-dynamic or thermal blocking of flow parts of pneumatic systems, aircraft and rocket engines, channels of magneto-hydrodynamic systems, etc.
How to use the acquired knowledge and skills (competencies)	Competencies: application of techniques and methods of gas dynamics for calculations, analysis of work and optimization of elements and structures of pneumatic systems, turbomachines, energy and technological installations, high-speed wind tunnels and equipment for physical research, including in the field of the latest technologies.
Information support	Textbooks, educational material, in particular, the available electronic edition (Turick V.M. "Fundamentals of gas dynamics"), packages of group laboratory work.
Form of classes	Lectures, laboratory works, practical classes.
Semester control	Test (written test)

Discipline	Compressor machines
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Konstantin Belikov
Requirements for the beginning of the study	Successful mastery of knowledge and skills acquired in the study of the disciplines "Volumetric hydraulic and pneumatic machines and hydraulic transmissions", " Machine-building hydraulics", "Theoretical mechanics", "Theory of mechanisms and machines", "Materials science", "Hydroaeromechanics and hydraulics", "Machine parts"
What will be studied	Principles of operation of compressor machines. Classification of compressor machines. Basics of calculation and design of compressor machines. Structure and components of compressor stations.
Why it is interesting / necessary to study	Compressor machines are widely used in various industries as sources of pneumatic energy. Also, in the tasks of heat and mass transfer of air and gas mixtures, air conditioning, vacuum creation, etc.
What can be learned (learning outcomes)	Design of the main components of compressor machines. Calculation of the main parameters of compressor machines. Analysis of characteristics. Determination of the efficiency of the compressor machine. The procedure for preparatory and start-up work of compressor machines. Conducting tests.
How to use the acquired knowledge and skills (competencies)	Calculation and selection of the necessary compressor to power the pneumatic system. Design of parts and components of compressor machines.
Information support	Study and work programs of the discipline, rating grading system, lecture notes (electronic edition), study guide (electronic edition)
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Volumetric hydraulic drive
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oksana Ganpanturova
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Machine-building hydraulics", "Volumetric hydraulic and pneumatic machines and hydraulic transmissions", "Discrete control systems of actuators"
What will be studied	Development and construction of hydraulic schemes. Design of hydraulic apparatus structures, development of technical documentation. Calculation of design parameters of hydraulic devices and operating modes of hydraulic systems. Conducting practical studies of the performance characteristics of hydraulic devices and operating parameters of hydraulic systems.
Why it is interesting / necessary to study	Practical work with any hydraulic equipment (development or modernization of systems, maintenance, setting parameters, troubleshooting, etc.) requires basic knowledge of both the design features of individual hydraulic devices and the ability to create and read hydraulic diagrams.
What can be learned (learning outcomes)	Basic principles of construction of hydraulic apparatus structures of drive systems. Methods of designing and modernization of efficient hydraulic drive control systems. Typical solutions of practical problems of calculation of systems and design of devices facing the engineer-developer of hydraulic drives.
How to use the acquired knowledge and skills (competencies)	Design and calculate the design of hydraulic devices, actuators and their components. Develop design documentation for hydraulic drive systems. Select modern element base of the system depending on the operating conditions of the drive. Develop schemes of hydraulic hardware controls and electro-relay circuits and coordinate their interaction. To assemble, adjust and diagnose hydraulic drive systems and put them into operation.
Information support	Study and work programs of the discipline, rating grading system, lecture notes (electronic edition), study guide (electronic edition)
Form of classes	Lectures, laboratory classes
Semester control	Test (written test)

Discipline	Pneumatic actuators and pneumatic control systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleksandr Haletskyi
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Fluid and Gas Mechanics", "Discrete control systems of executive devices"
What will be studied	Basic pneumatic devices of the automation system; Structure and principle of operation of pneumatic valves with pneumatic and electropneumatic control; Electropneumatic converters, sensors and their characteristics. Construction of pneumatic control circuits.
Why it is interesting / necessary to study	Modern production requires the training of specialists capable of solving complex tasks and problems in the field of applied mechanics using pneumatic control circuits and carrying out innovative professional activities.
What can be learned (learning outcomes)	<p>As a result of mastering the discipline, knowledge is gained on the architecture of the structure of pneumatic systems and elements of automatic control of pneumatic systems; principles of building algorithms for controlling pneumatic automation devices with a combined version of control systems; use of modern methods of finding optimal solutions and rational parameters of technical devices; modern approaches, means and technical solutions for creating modern automatic systems with pneumatic actuators.</p> <p>Acquired skills: apply techniques and methods of creating pneumatic automation systems in accordance with the requirements and features of the machine-building industry; use innovative technical solutions and approaches to the creation, design and modernization of pneumatic actuators as part of pneumatic automation systems.</p> <p>Experience is gained: to choose and apply rational methods and technical means for solving specific tasks of automation in mechanical engineering; carry out an evaluation of the effectiveness of pneumatic automation systems with a pneumatic automatic control system; to make decisions for the rationalization of technical decisions when designing or modernizing automation objects, taking into account technical requirements and operational features.</p>
How to use the acquired knowledge and skills (competencies)	The ability to make informed decisions when designing pneumatic automation systems, critically analyze and forecast performance parameters of new and existing pneumatic actuators and pneumatic automation systems; the ability to develop control systems for pneumatic drives, to rationally approach the creation of new and modernization of existing control systems, to create competitive automation systems of technical objects and systems, to evaluate the effectiveness of existing, modernized or developed pneumatic automation systems.
Information support	Synopsis of lectures, virtual laboratory works, Rating System of Evaluation
Form of classes	Lectures, laboratory, computer workshop
Semester control	Assessment (written assessment)

Discipline	Applied hydromechanics
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleg Yakhno, Dmytro Kostiuk
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines «Mechanics of liquid and gas », "Gasodynamics", "Volume hydraulic and pneumatic machines and hydraulic transmissions", "Materials science"
What will be studied	Fundamentals of fluid mechanics and heat-mass exchange in processes occurring in mechatronics and hydraulic drive systems. In particular, for further application in such a field as aero-hydrodynamic schemes of ekranoplanes, studying the pulsation of hydro-aerodynamic loads on the rotor shaft of wind turbines, hydrodynamic models of various filter elements and much more.
Why it is interesting / necessary to study	The study of fluid and gas mechanics is the basis of fluid hydrodynamics, which makes it possible to obtain solutions in the development of hydroaerodynamics that are used in wind energy units, swimming units, flying units, submersible cavitators and others.
What can be learned (learning outcomes)	The ability to study the theory of vortices is used to develop the dynamics of the atmosphere, the theory of an airplane wing, the theory of a propeller, a ship propeller, and a supercavitator during deep dives.
How to use the acquired knowledge and skills (competencies)	Ability to study the basics of solid body mechanics, resistance of materials, technical hydromechanics and fluid and gas mechanics To solve complex, unpredictable tasks and problems in specialized areas of professional activity and/or training, which involves the collection and interpretation of information (data), the selection of methods and tools, the use of innovative approaches. Build information models of the subject of research: describe its essential parameters, input and variable values, establish cause-and-effect relationships between them.
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 (written test)

Discipline	Mobile hydraulics
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleh Levchenko, Oleksandr Haletskiy
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Volumetric hydraulics", "Machine-building hydraulics", "Machine parts", "Fundamentals of construction and design".
What will be studied	Application directions of a mobile hydraulics. Open and closed hydraulic circuits. Hydrostatic transmissions, feed pumps, flushing units, bypass valves. Load sensitive hydraulic systems: open and closed center. Variable displacement pumps of mobile machines with manual and automatic regulators. Two-pump systems with relief valves. Flow dividers and summatoms. Sectional directional valves of mobile machines, 7/3 directional valves, differential pressure valves, anticavitation valves, shock valves, rollover valves. 6/3 open center directional valves: parallel, tandem and series connection. Schemes of load-independent flow control, pre-switched and post-switched. Holding and safe lowering of weight, controlled check valves, brake and balancing valves. Hydraulic and electronic joysticks. Priority valves, static and dynamic. Steering, with open and closed center, reactive and non-reactive. Specialized software for simulating the operation of hydraulic systems of mobile machines (FluidSim-Hydraulics 5.0).
Why it is interesting / necessary to study	The purpose of the lectures is to provide the basics of knowledge in the field of mobile hydraulics.
What can be learned (learning outcomes)	An important component in the training of mechanical engineers is also their acquisition of knowledge on the hydraulics of mobile machines.
How to use the acquired knowledge and skills (competencies)	Assemble, debug and diagnose control systems of hydraulic drives of mobile machines.
Information support	Educational and work programs of the discipline, RSE, lecture notes (electronic edition), study guide (electronic edition)
Form of classes	Lectures, laboratory classes, individual tasks
Semester control	Test (written evaluation test)

Discipline	Machine-building hydraulic automation
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleksandr Luhovskyi, Andriy Zilinskyi
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines «Machine-building hydraulics», «Volume hydraulic and pneumatic machines and hydraulic transmissions», «Volume hydraulic drive», «Discrete control systems for actuators»
What will be studied	Acquaintance with control methods in cyclic automation systems. Acquaintance with the element base hydraulic logic devices of automation. Construction of schematic diagrams of logical blocks of cyclic automation systems. Peculiarities of programming cyclic systems and peculiarities of pumping units for cyclic automation systems.
Why it is interesting / necessary to study	In production, many technological processes require removal of a person from the process. At the same time, there are many cases of multiple repetition of technological operations. The problem can be solved by implementing cyclical automation systems with path control, pressure control or time control.
What can be learned (learning outcomes)	You can learn the basic principles of building cyclic hydraulic automation systems with path control, pressure control, or time control. Learn the basic principles of building cyclic systems with logical control units. Understand the existing element base of hydraulic automation systems, understand the possibilities of programming cyclic systems. To deal with examples of the implementation of cyclic systems in industry, agriculture and medicine.
How to use the acquired knowledge and skills (competencies)	Calculate and design cyclic systems of hydraulic automation. Develop basic hydraulic schemes for automation systems. Develop design documentation for hydraulic drive systems of automatic systems. Select a modern element base for automation systems. Carry out assembly, debugging and diagnostics of hydraulic drive systems and put them into operation.
Information support	Textbooks, study guides, virtual laboratory work, packages of group laboratory work, packages of professional application programs
Form of classes	Lectures, practical, laboratory
Semester control	Test (written test)

Discipline	Mathematical modeling and design of hydraulic and pneumatic drive systems
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Oleksandr Uzunov, Oleksandr Galeckij, Igor Nochnichenko
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Higher Mathematics", "General Physics", "Theoretical Mechanics", "Theory of Mechanisms and Machines", "Basics of construction and design", "Fluid and Gas Mechanics", "Basics of mathematical modeling of physically heterogeneous systems".
What will be studied	Examples of hydraulic and pneumatic drive systems and their distribution into typical functional components. Software tools for modeling processes. Forms of mathematical dependencies and peculiarities of building mathematical models of dynamic processes. The concept of the second generation simulation modeling. A library of typical elements for building models. Model testing and evaluation indicators of hydraulic and pneumatic drive systems. Analytical method for evaluating the work capacity and accuracy of systems in steady state. Formulation of the design problem of hydraulic and pneumatic drive systems and the design algorithm. Development of a functional and principle diagram of a technical system. Transformation of the schematic diagram into a mathematical model. Testing, adjusting the model of the hydro and pneumatic drive and determining its parameters that provide the predicted characteristics.
Why it is interesting / necessary to study	Mathematical modeling of the action of elements and systems requires their understanding both at the level of principles and at the level of the influence of parameters on their characteristics. Having learned to build models and simulate technical systems, students receive a powerful tool for their research and design.
What can be learned (learning outcomes)	Understand the principles of operation and the structure of hydraulic and pneumatic drive systems. Understand the principles of dividing systems into typical elements and approaches to building mathematical models. Develop mathematical models to determine static and dynamic characteristics. Evaluate the influence of parameters on the characteristics of elements and systems. Design elements and systems.
How to use the acquired knowledge and skills (competencies)	Acquired knowledge and skills are used to develop mathematical models, modeling and designing elements and hydraulic and pneumatic drive systems.
Information support	Textbooks, study guides, virtual laboratory work, packages of group laboratory work, packages of professional application software.
Form of classes	Lectures, laboratory classes, independent work
Semester control	Test (written test)

Discipline	Hydraulic and pneumatic turbomachines and transmissions
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Dmytro Kostiuk
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired during the study of disciplines "Mechanical Engineering Hydraulics", "Gas Dynamics", "Mechanics of Materials and Structures", "Fundamentals of Mathematical Modeling of Physically Heterogeneous Systems", "Compressor Machines"
What will be studied	Design, the principle of operation and features of operation of hydraulic and pneumatic turbomachines. Fundamentals of design of structures of hydraulic and pneumatic turbomachines, Calculations of design parameters of hydraulic and pneumatic turbomachines. Carrying out practical research on hydraulic turbomachines.
Why it is interesting / necessary to study	Hydraulic and pneumatic turbomachines are widely used in almost all sectors of the industry. Practical work with any hydraulic equipment (development or modernization of systems, maintenance, adjustment of parameters, maintenance, troubleshooting, etc.) requires basic knowledge of both the design features of individual hydraulic devices and their work in the network and control of their characteristics.
What can be learned (learning outcomes)	Find out the principles of operation of hydraulic and pneumatic turbomachines and hydrokinetic transmissions. Develop design solutions and designs of hydraulic and pneumatic turbomachines, and hydraulic and pneumatic actuators. Carry out a design of systems of hydraulic and pneumatic actuators, and hydraulic and pneumatic turbomachines according to the set operational characteristics, modes and indicators. Find typical solutions to practical problems of calculation of systems and design of devices facing the engineer-developer of hydraulic drives
How to use the acquired knowledge and skills (competencies)	Design and calculate the design of hydraulic turbomachines. Develop design documentation for hydraulic equipment. Select equipment for the hydraulic system depending on the technical requirements. Carry out assembly, adjustment and diagnostics of hydraulic drive systems and put them into operation
Information support	Curriculum and working programs of the discipline, RSO, lecture notes (electronic edition).
Form of classes	Lectures, laboratory classes
Semester control	Test

Discipline	Design of hydraulic and pneumatic drives
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Serhii Nosko
Requirements for the beginning of the study	Successful mastering of the knowledge and skills acquired during the study of the disciplines "Applied hydromechanics", "Machine-building hydraulic automation", Mathematical modeling and design of hydraulic and pneumatic drive systems", "Volume hydraulic and pneumatic machines and hydraulic transmissions", "Pneumatic drive and pneumatic automation".
What will be studied	Development and construction of hydropneumatic schemes. Element base for building automated hydropneumatic systems (main types of drives, guiding and regulating equipment, control and measuring devices, logic and calculation apparatus). Calculation of static and dynamic parameters of hydropneumatic drives. Design methods of hydraulic and pneumatic drives and practical development of control algorithms Development of technical documentation
Why it is interesting / necessary to study	Practical work with any hydropneumatic equipment (development or modernization of systems, maintenance, setting parameters, identifying and eliminating problems, etc.) requires basic knowledge of both the structural features of individual hydraulic devices, as well as the ability to design hydraulic and pneumatic drives. This allows you to relatively quickly change the amount of equipment involved, adapting the system to changes in production tasks, which is one of the modern trends in the development or modernization of automated hydropneumatic drives
What can be learned (learning outcomes)	Basic principles of construction and calculation of hydropneumatic drives. Methods of design and modernization of effective operational performance control systems of hydraulic and pneumatic drives. Typical solutions to practical system calculation and design problems faced by the engineer-developer of hydraulic and pneumatic drives. Modern approaches, tools and technical solutions for building hydropneumatic automated systems using pneumatic and hydraulic automation tools.
How to use the acquired knowledge and skills (competencies)	Ability to use modern design methodologies of hydraulic and pneumatic actuators, control and control devices, and hydraulic and pneumatic machines. Ability to design control systems for hydraulic and pneumatic actuators. The ability to present the results of one's engineering activities in compliance with generally accepted norms and standards
Information support	Textbooks, study and work programs of disciplines, RSO, lecture notes (electronic edition), study guide (electronic edition), packages of individual tasks.
Form of classes	Lectures, practical, independent work
Semester control	Assessment (written assessment)

Discipline	Computer hydromechanics of hydraulic drive devices
Educational level	First (bachelor's)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Dmytro Kostiuk
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Informatics", "Fundamentals of design and engineering", "Applied hydromechanics", "Gas dynamics", "Mathematical modelling and design of systems of hydraulic and pneumatic actuators", "Hydraulic and pneumatic turbomachines and transmissions"
What will be studied	General information about computer modelling systems for hydromechanical, thermal and mass transfer processes, basics of hydromechanical process modelling, review of basic software packages used to solve computer hydromechanical problems, features of 2D and 3D models construction, types of boundaries and boundary conditions, features creating of the mesh, monitoring of the calculation, conditions for stopping the calculation, visualization and analysis of the obtained data.
Why it is interesting / necessary to study	Nowadays, computer modelling is widely used in the study of hydrodynamic processes and the development and modernization of equipment. Increasing the availability of computing and modelling makes it possible in many cases to replace expensive and time-consuming, and in some cases impossible, real experiments for computational hydrodynamics (CFD) research. Tasks of this type are found in almost all fields of engineering from the calculation of ventilation systems to the research of state-of-art airplanes. Therefore, modern engineers and scientists need knowledge in this field
What can be learned (learning outcomes)	The basic principles of construction of models of computer hydromechanics in specialized software packages, rational choice of model for the decision of the set task, carrying out the analysis of the received results
How to use the acquired knowledge and skills (competencies)	Create models of hydraulic and pneumatic drive components, model liquid or gas flows in devices of hydraulic and pneumatic systems, such as valves, pumps, etc., and determine the main characteristics of the observed flow.
Information support	Curriculum and working programs of the discipline, RSO, lecture notes (electronic edition).
Form of classes	Lectures, laboratory classes, individual tasks
Semester control	Test

Discipline	Testing and diagnostics of drive systems
Educational level	Перший (бакалаврський)
Course	4
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian
Department	Applied hydroaeromechanics and mechatronics
Teachers	Ihor Nochnichenko
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired during the study of disciplines: "Informatics", "Fundamentals of mathematical modeling of physically heterogeneous systems", " Fundamentals of construction and design".
What will be studied	The main concepts and types of testing and diagnosis of the main malfunctions of technical physically diverse systems, electro -pneumatic position drives, electro -hydraulic systems. The main equations characterizing the reliability and causes of failure of drive system units. Analysis of reliability indicators and determination of statistical characteristics of drives, determination of drive reliability at the design stage, prediction of drive reliability, maintenance and repair.
Why it is interesting / necessary to study	Testing and research must be carried out in any technical systems, both during development and operation. The ability to master the skills of testing and diagnostics allows you to develop and carry out regular maintenance of hydraulic and pneumatic devices and systems. Also check and evaluate the technical condition of hydropneumatic equipment, organize preventive control and repair with replacement of modules.
What can be learned (learning outcomes)	Determination of typical malfunctions of the hydro-pneumosystem; installation and trial start-up of the hydro-pneumosystem; determination of equipment protection methods against vibration; conducting tests of hydro and pneumatic systems and equipment; maintenance of hydraulic and pneumatic systems, drives, control and automation tools in technical systems.
How to use the acquired knowledge and skills (competencies)	According to the existing methods and algorithms, with a known scheme, to organize installation, commissioning and experimental testing of hydropneumatic equipment and systems. Develop and carry out regular maintenance of hydraulic and pneumatic devices and systems, carry out inspections and evaluate the technical condition of hydropneumatic equipment. Organize preventive control and repair with replacement of modules. Modernize the existing hydraulic and pneumatic systems under known operating conditions, load, speed, consumption of working fluid.
Information support	Textbooks, study guides, virtual labs, packages of group labs
Form of classes	Lectures, laboratory
Semester control	Assessment (written assessment)