Speciality: Applied Mechanic (Bachelor)

Educational and Professional Program: Automated and Robotic Mechanical Systems

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

CURRICULUM

(Enrolment 2021)

APPROVED
by Head of Academic Council
Igor Sikorsky Kyiv Polytechnic Institute

_____ Mykhaylo ILCHENKO

_____ 2021

Level	Bachelor	Form of study	full-time (full-time, part-time)
Speciality	131 Applied Mechanics	Institute	Mechanical Engineering
Educational and Professional Program	Automated and Robotic Mechanical Systems	Qualification	Mechanical Engineer
		Study duration	3 year 10 months
Graduation Department	Applied Hydro-Aeromechanics and Mechatronics	Base level	Full Secondary Education

I. Schedule of educational process

YEAR	September				October					November					December				January					February				March				April				May				June				July					August			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
I																			E	E	H	H																			E	E	H	H	H	H	H	H	H	H	H	H
II																			E	E	H	H																			E	E	H	H	H	H	H	H	H	H	H	H
III																			E	E	H	H																			E	E	H	H	H	H	H	H	H	H	H	H
IV																			E	E	H	H										E	P	P	P	P	P	R	R	R	R	A	A										

Symbols: Learning period; E Examination; P Practice; R Research; A Assessment; H Holiday

II. Summary table of time budget (Weeks)

YEAR	Learning period	Examination	Practice	Assessment	Research	Holiday	Total
I	36	4				12	52
II	36	4				12	52
III	36	4				12	52
IV	27	3	5	4	2	2	43

III. Practice

Type of practice	YEAR	Weeks
Pre-diploma Practice	4	5

IV. Graduates assessment

Subjects	Form of graduates assessment (exam, graduation project)	YEAR
Diploma Project	Graduation Project	4

V. Plan of Educational process

Code	Subjects	Distribution for terms (semesters)				ECTS Credits	Number of hours				
		Exams	Final tests	Individual task	Module test		Total	Lectures/practical lessons			Self-study
								Lectures	Practical	Laboratory	
1	2	3	4	5	6	7	8	9	10	11	12
1. Compulsory educational components											
1.1. General training cycle											
GC 1	Ukrainian language for professional purposes		2		2	2	60	18	18		24
GC 2	Ukraine in the Context of the Historical Development of Europe		1		1	2	60	18	18		24
GC 3	Basics of a Healthy Lifestyle		2		1,2	3	90	18	54		18
GC 4	Foreign Language		2,4		1,3	6	180		144		36
GC 5	Introduction to Philosophy		3		3	2	60	18	18		24
GC 6	Business Law		3		3	2	60	18	18		24
GC 7	Economics and Production Organization		4		4	4	120	36	36		48
GC 8	Labor Safety and Civil Defence		6		6	2	60	18		18	24
GC 9	Foreign Language for Professional Purposes	8	6		5,7	6	180		126		54
	Total number of part 1.1	**1**	**10**		**12**	**29**	**870**	**144**	**432**	**18**	**276**
1.2. Vocational training cycle											
PC 1	Fundamentals of Manufacturing Processes	1			1	4,5	135	36	18	18	63
PC 2	Chemistry		1		1	3	90	36		18	36
PC 3	Linear Algebra and Analytic Geometry		1	1	1	3,5	105	18	36		51
PC 4	Mathematics	1,2,3		1,2,3	1,2,3	17	510	126	144		240
PC 5	Engineering and Computer Graphics		1	1	1	4	120	36	36		48
PC 6	Physics	1	2		1,2	10	300	90	36	36	138
PC 7	Materials Science	2		2	2	4,5	135	36	18	18	63
PC 8	Electrical Engineering and Electronics		2		2	3	90	36		18	36
PC 9	Theoretical Mechanics	2,3	4	2,3,4	2,3,4	13	390	108	108		174
PC 10	Informatics		3		3	4	120	18		54	48
PC 11	Theoretical Fundamentals of Heat Engineering		3	3	3	3	90	36		18	36
PC 12	Mechanics of Materials and Constructions	3, 4			3,4	13	390	108	72	36	174
PC 13	Coursework in Mechanics of Materials and Constructions		4			1	30				30
PC 14	Metrology and Standardization	4		4	4	4,5	135	36	18	18	63
PC 15	Fluid and Gas Mechanics		4	4	4	3,5	105	36	18	18	33
PC 16	Theory of Mechanisms and Machines	4	5		4	5	150	36	18	18	78
PC 17	Coursework in Theory of Mechanisms and Machines		5			1	30				30
PC 18	Machine Parts and Design Principles	5			5	4,5	135	36	18	18	63
PC 19	Course Project in Machine Parts and Design Principles		6			1,5	45				45
PC 20	Fundamentals of Computer Aided Design and Engineering	5		5	5	6	180	36	54		90
PC 21	Fundamentals of Mathematical Modeling of Multi-Physics Systems	6		6	6	5,5	165	36		36	93
PC 22	Discrete-logic Automatic Control Systems	5		5	5	6	180	36		54	90
PC 23	Fundamentals of Industrial Electric Drive	6		6	6	5	150	36		36	78
PC 24	Fundamentals of Hydraulic Control Systems	7			7	3	90	36			54
PC 25	Units Design of Automated Mechanical Systems	7			7	4	120		54		66
PC 26	Course Project in Units Design of Automated Mechanical Systems		7			1,5	45				45
PC 27	Technology of Mechanical Engineering	8			8	3,5	105	36	9		60
PC 28	Coursework in Technology of Mechanical Engineering		8			1	30				30
PC 29	Pre-diploma Practice		8			6	180				180
PC 30	Diploma Project					6	180				180
	Total number of part 1.2	**20**	**16**	**16**	**29**	**151**	**4530**	**1044**	**657**	**414**	**2415**
	TOTAL IN NORMATIVE educational components	**21**	**26**	**16**	**41**	**180**	**5400**	**1188**	**1089**	**432**	**2691**

	TOTAL IN NORMATIVE educational components	21	26	16	41	180	5400	1188	1089	432	2691
	2. Optional educational components										
	2.1. General training cycle										
GS 1	Educational component 1 GU- Catalog		3		3	2	60	18	18		24
GS 2	Educational component 2 GU- Catalog		4		4	2	60	18	18		24
	Total number of part 2.1		2		2	4	120	36	36		48
	2.2. Vocational training cycle										
PS 1	Educational component 1 F- Catalog		5	5	5	4	120	36		36	48
PS 2	Educational component 2 F- Catalog		5		5	4	120	36		36	48
PS 3	Educational component 3 F- Catalog		6		6	4	120	18		54	48
PS 4	Educational component 4 F- Catalog		6		6	4	120	36		36	48
PS 5	Educational component 5 F- Catalog		6		6	4	120	72			48
PS 6	Educational component 6 F- Catalog		6	6	6	4	120	36		36	48
PS 7	Educational component 7 F- Catalog		7	7	7	4	120	36		36	48
PS 8	Educational component 8 F- Catalog		7		7	4	120	36		36	48
PS 9	Educational component 9 F- Catalog		7		7	4	120	18		54	48
PS 10	Educational component 10 F- Catalog		7	7	7	4	120	36		36	48
PS 11	Educational component 11 F- Catalog		7	7	7	4	120	36		36	48
PS 12	Educational component 12 F- Catalog		8	8	8	4	120	36	36		48
PS 13	Educational component 13 F- Catalog		8	8	8	4	120	18		45	57
PS 14	Educational component 14 F- Catalog		8	8	8	4	120	18		36	66
	Total number of part 2.2		14	8	14	56	1680	468	36	477	699
	TOTAL IN SELECTIVE educational components		16	8	16	60	1800	504	72	477	747
	TOTAL	21	42	24	57	240	7200	1692	1161	909	3438

Approved by University Academic Council, Meeting protocol № 3 from March 15, 2021

Head of the Department _____ / Oleksandr LUHOVSKYI /

Director of the Institute _____ / Mykola BOBYR /

Study duration: 3 year 10 months

Compulsory educational components:

Optional educational components:

Qualification: Mechanical Engineer

180 ECTS Credits

60 ECTS Credits

Chair of Applied Mechanics and Mechatronics

Educational and Professional Program: Automated and Robotic Mechanical Systems

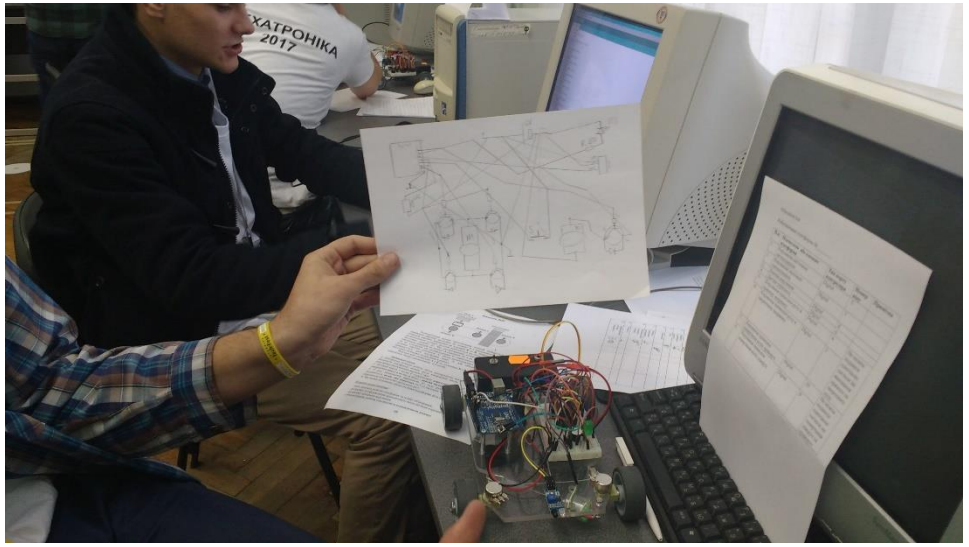
Peculiarity directions:

“Mechatronics in Mechanical Engineering”

“Hydraulic and Pneumatic Smart-System”

“Mechanics in Logistic Engineering”

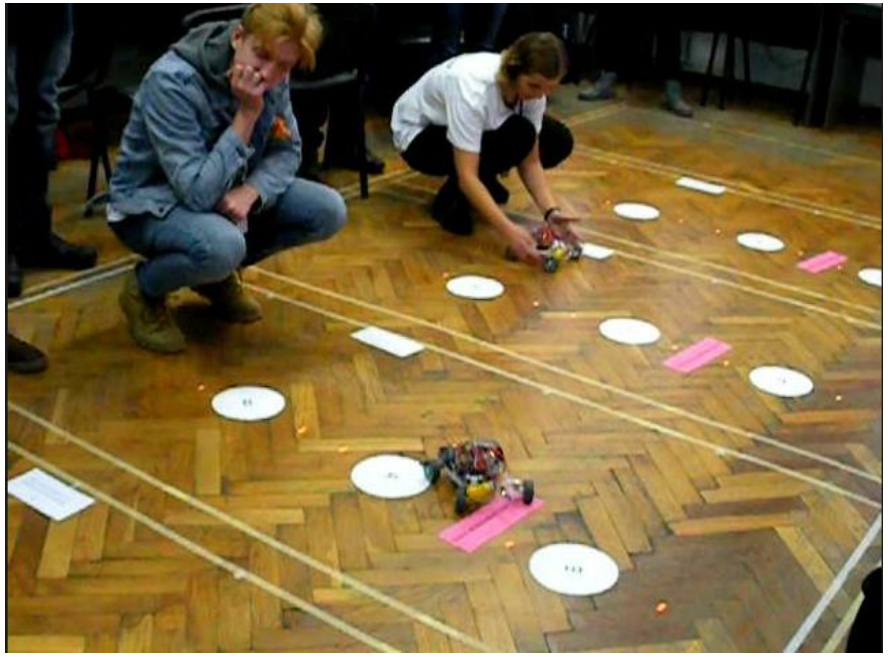
Concept - circuit solution – constructing – control algorithm – testing



Technical games - group workshop – command solution – group project

Summer school “Mechatronics” (for students of technical Universities)

2-weeks Summer curse for 4 groups (36 students) from Seven Technical Universities:
Certificate “Mechatronics in Mechanical Engineering”



НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ ІМЕНІ ІГОРЯ СІКОРСЬКОГО»

СЕРТИФІКАТ

№ 93/19

ДАНИЙ СЕРТИФІКАТ ЗАСВІДЧУЄ, ЩО

Сиса Дар`я Станіславівна

ЗАКІНЧИЛА ЛІТНЮ ШКОЛУ
«МЕХАТРОНІКА В МАШИНОБУДУВАННІ»

ТА ОТРИМАЛА БАЗОВІ ЗНАННЯ З СТРУКТУРНОГО СИНТЕЗУ, СКЛАДАННЯ СИСТЕМ КЕРУВАННЯ ЕЛЕКТРОПНЕВМОАВТОМАТИКИ ТА ПОБУДОВИ АЛГОРИТМІВ КЕРУВАННЯ МЕХАТРОННИХ СИСТЕМ

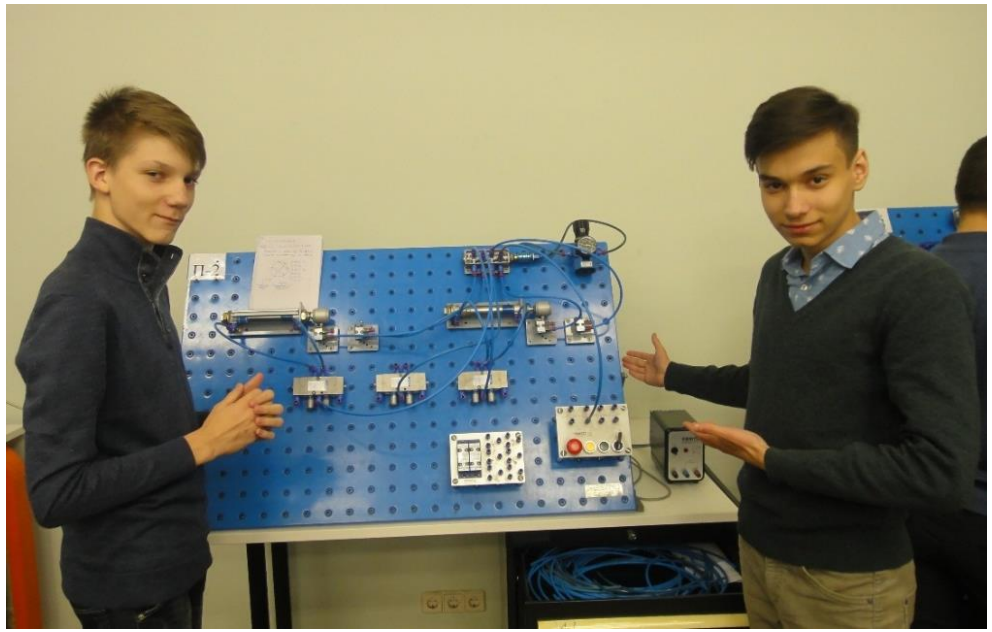
ТЕРМІН НАВЧАННЯ З «26» ЧЕРВНЯ 2019 Р. ПО «03» ЛИПНЯ 2019 Р.

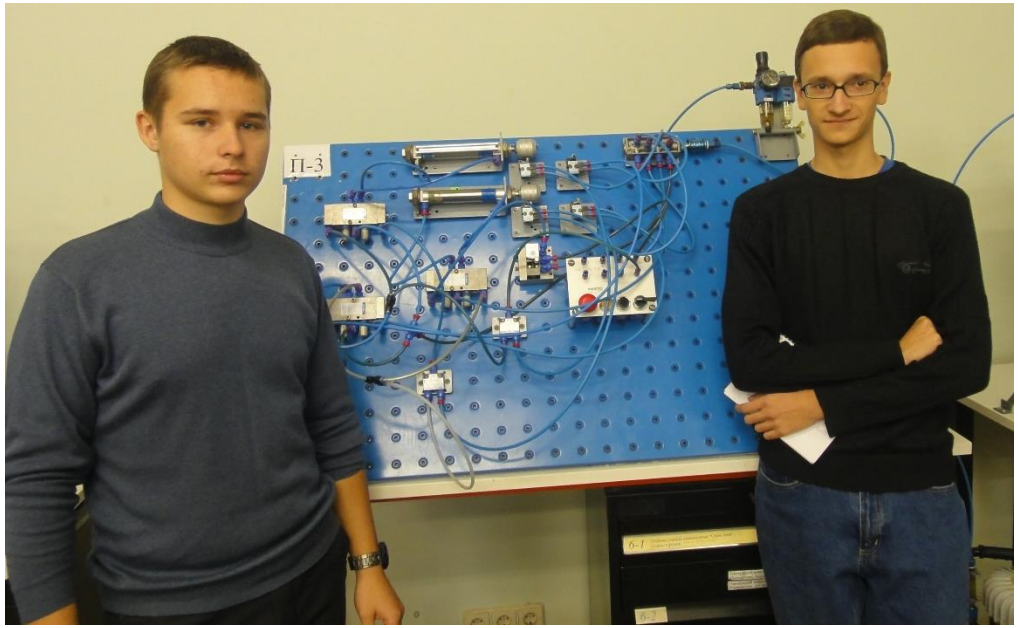
ЛІТНЯ ШКОЛА ПРОВОДИЛАСЬ ЗГІДНО ЛИСТА ІНСТИТУТУ МОДЕРНІЗАЦІЇ ЗМІСТУ ОСВІТИ МОН № 22.1/10-1079

ЗАСТУПНИК ДИРЕКТОРА ММІ _____ ДАНИЛЬЧЕНКО Ю.М.

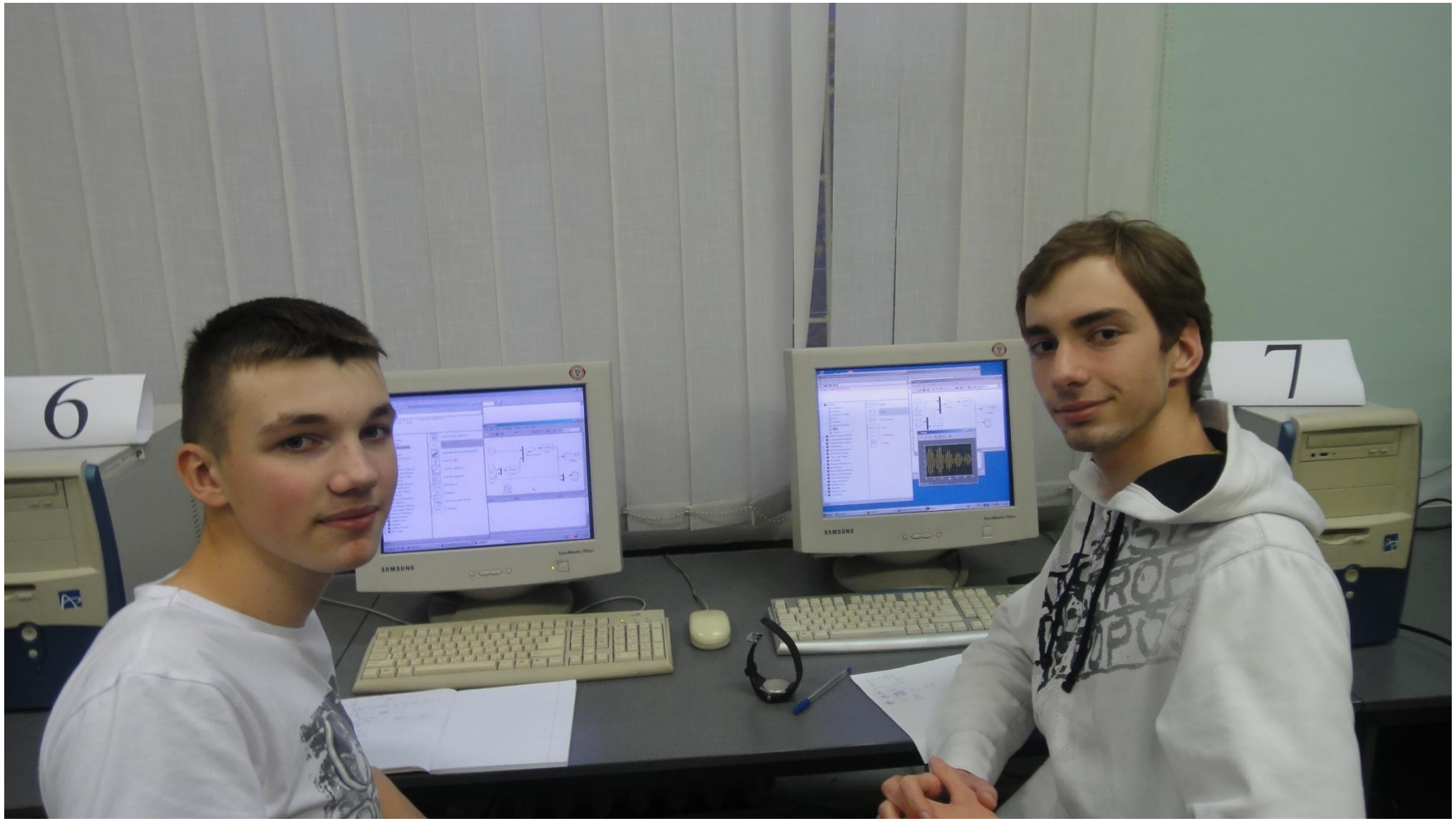
КООРДИНАТОРИ ШКОЛИ:		ВИКЛАДАЧІ ШКОЛИ:	
_____	ГУБАРЕВ О.П.	_____	БЄЛІКОВ К.О.
_____	УЗУНОВ О.В.	_____	МУРАЩЕНКО А.М.
_____	ГАНПАНЦУРОВА О.С.	_____	УСТИМЕНКО Т.О.

Gymnasium and Lyceum communications – Autumn School

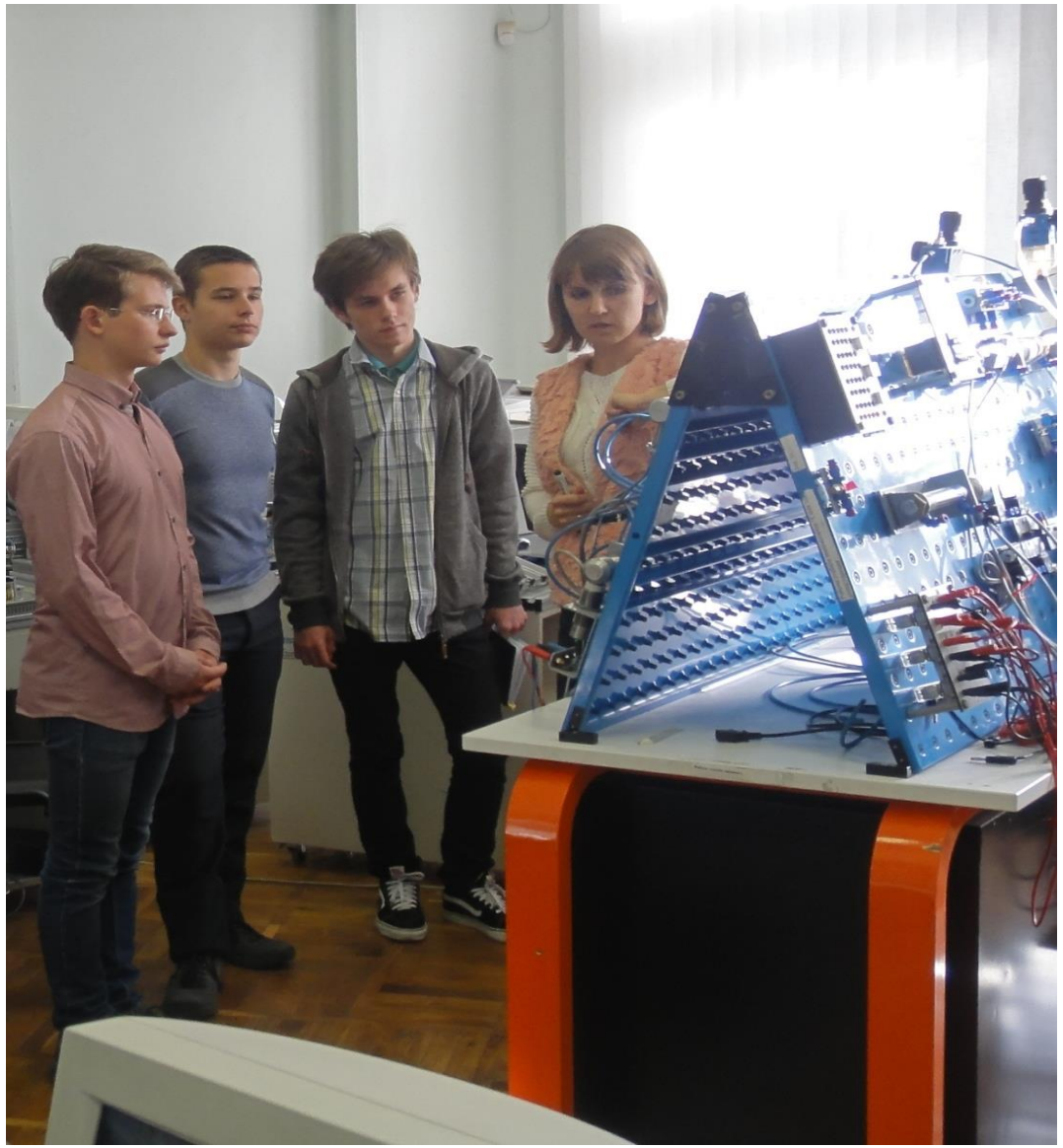




Pneumatics, hydraulics, electro-relay circuits, diagram solutions, physical principals, executing actuator system



Building the diagram for mechanics corresponding algorithm creation for PLC
(The first steps in STL and C control algorithmic programing)



Certificate “Mechatronics in Mechanical Engineering” adds points by student entering the university

Specialized laboratories

Mechatronic and modular systems

(PLC, sensors, servo system, modular stations, cyclic mechatronic systems, mechatronic modules, room 126-1)

Discreet-logic control systems:

(mechanics, hydraulics, pneumatics, electro-pneumatics, electro-hydraulics, room 300-1)

Compressor machine:

(screw compressor, reciprocating compressor, room 05-1)

Hydraulic drive and pump:

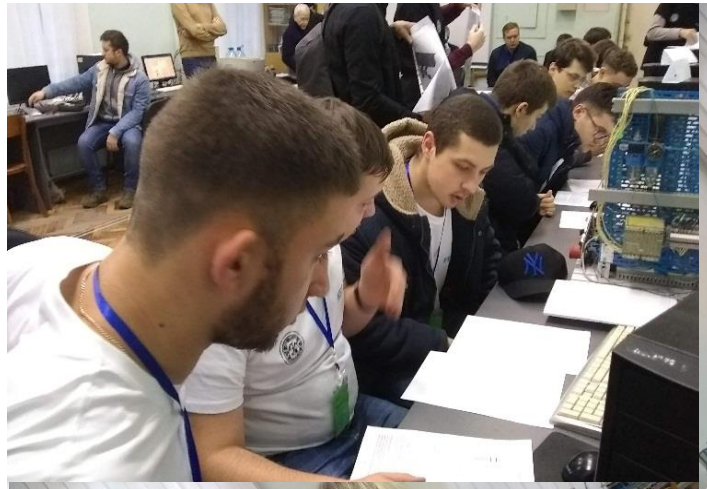
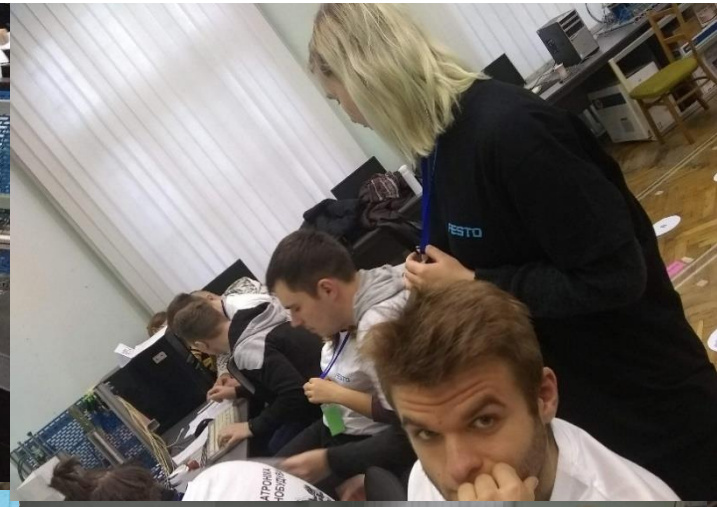
(gear pump and motor, piston pump and motor, vane pump, cylinders, Hydro-engines, room 06-1)

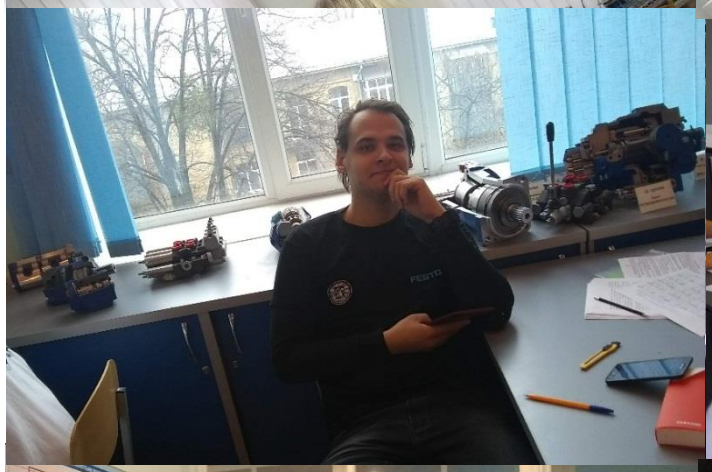
Modeling of Multi-Physics Systems:

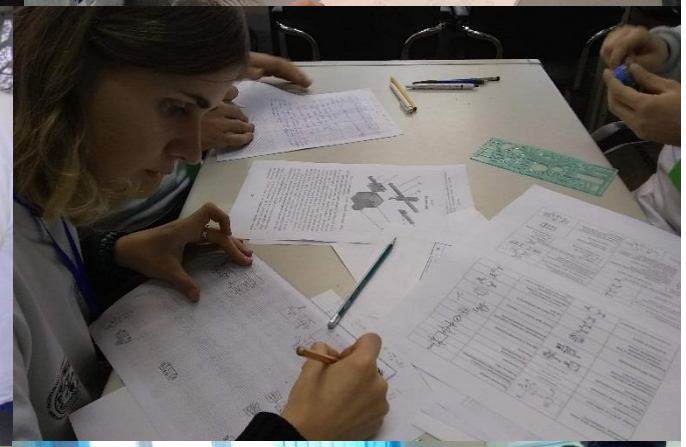
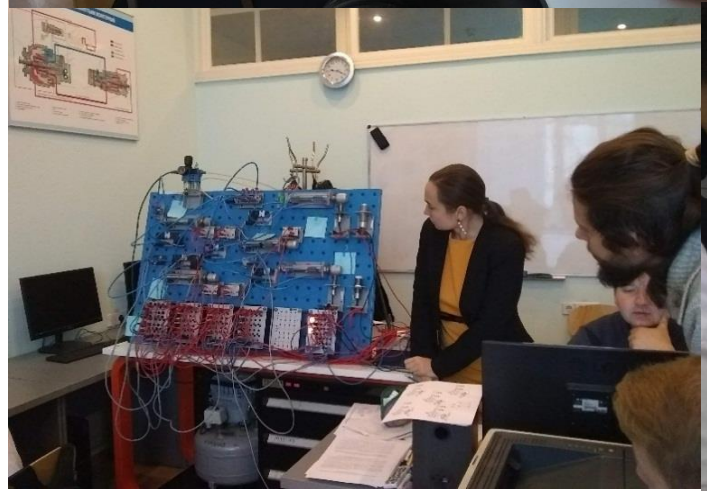
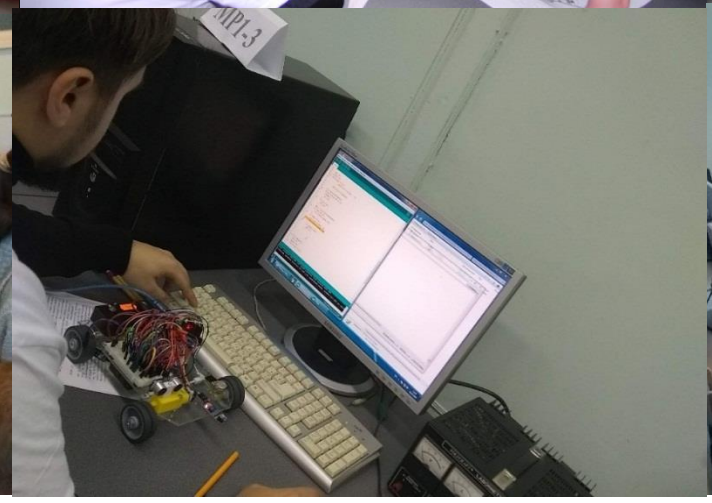
(modeling of physically heterogeneous systems, modeling of mechatronics and robotics Units, room 120-1)

Design and constructing mechatronic Units:

(CAD of mechatronic Units with hydraulic, pneumatic and mechanic components, room 299-5)

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4


Youtube: WorldSkills Ukraine
worldskills Ukraine
Всеукраїнський конкурс професійної майстерності "WORLDSKILLS UKRAINE" за компетенціями мехатроніка та мобільна робототехніка
21-25 листопада 2016 р., Київ, Україна


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PARTNER UNIVERSITIES

Otto von Guericke University Magdeburg (Germany)
Bialystok University of Technology (Poland)
Hof University of Applied Sciences (Germany)
Technical University Bergakademie Freiberg (Germany)
Technical University of Gabrovo (Bulgaria)
Politechnika Wroclawska (Poland)
Technical University Dresden (Germany)
Kharkiv Polytechnic Institute (Ukraine)
Odesa National Academy of Food Technologies (Ukraine)
Kharkiv Aviation University (Ukraine)
Lviv Polytechnic (Ukraine)
Vinnytsia Technical University (Ukraine)
Khmelnytsky Technical University (Ukraine)

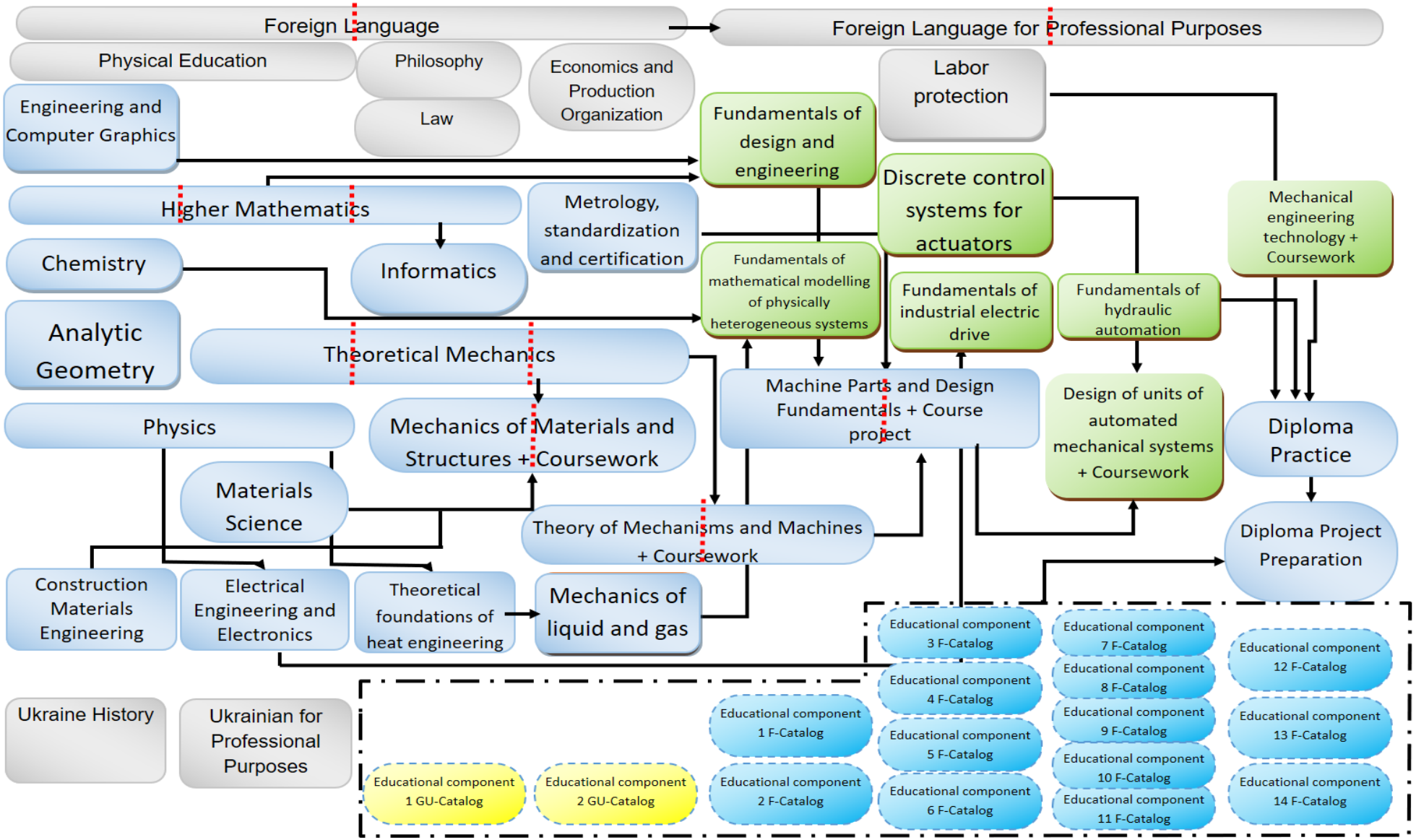
INDUSTRY PARTNERS

Aviation Scientific and Technical Complex “ANTONOV”
Institute of Hydromechanics of the National Academy of Sciences of Ukraine
NIKMAS Corporation
Design office Luch
Hydrosila Group
Kyiv Institute of Automation
Progrestech-Ukraine
Hydraulic Oil
FESTO (Ukraine office)
Bosch-Rexroth (Ukraine office)

Automated and Robotic Mechanical Systems

STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM

1 semester 2 semester 3 semester 4 semester 5 semester 6 semester 7 semester 8 semester



Components description (compulsory and optional)

1. Descriptions of educational components

Discipline	Synthesis of discrete control systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Theoretical Mechanics", "Computer Science", "Physics", "Fundamentals of design and engineering"
What will be studied	Principles of construction and architecture of mechatronic systems of discrete action, elements of graph theory Automation of technological processes, separate functions and technical objects by means of mechatronics. Formal description of cyclic and closed processes in objects of discrete action, functional and system modules. Research and supplement system memory. Logical synthesis of systems by cyclic-modular approach. Assembly, testing and debugging of typical discrete control systems for mechatronics. Search for system errors, expanding the range of automated functions.
Why it is interesting / necessary to study	Mechatronics is the basis for the creation of intelligent machines, and the synthesis of control systems with open architecture is a prerequisite for the application of developments in the Industry 4.0 platform. It is impossible to automate the control of complex systems without understanding the physics of controlled processes, and the synthesis process is a means of transforming the structure of a complex physical and mechanical process into the logic of subordination of individual actions and functions, which is the main content of this discipline.
Why you can learn (learning outcomes)	Perform analysis of automation objects using conceptual models and principles of construction of cyclic and closed systems of discrete action. Cyclic-modular structure of system elements. Methods of synthesis, research, addition and minimization of discrete control systems of mechatronics. Principles of construction of PLC control algorithms.
How to use the acquired knowledge and skills (competencies)	Solve practical problems of automation by means of mechatronics. Develop schemes and control algorithms for automated mechanical systems. Select a modern element base of control systems, compile, debug and diagnose algorithms and control systems of mechatronics of typical systems.
Information support	Training and working programs of the discipline, RSD, lecture notes (electronic edition), textbook (electronic edition)
Form of classes	Lectures, laboratory classes, individual task
Semester control	Test

Discipline	Hydro- and pneumatic engines of mechatronic systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Theoretical Mechanics", "Computer Science", "Physics", "Fundamentals of design and engineering"
What will be studied	The principle of operation of various three-dimensional machines (manual, gear, gerotor, screw, plate, axial and radial piston, which are used in mechatronic systems). Features of their design and operation in different modes of operation, because mechatronic systems must be very flexible.
Why it is interesting / necessary to study	Understanding the principle of operation of a three-dimensional machine, allows you to competently, reasonably select, if necessary, compose or develop, one of the main components of the hydraulic system
Why you can learn (learning outcomes)	Clearly understand the possibilities and areas of application of different in design and initial parameters of hydraulic and pneumatic machines. Understanding the functional significance of any pump or motor component for any mechatronic system. Ability to select the required type of hydraulic and pneumatic machines for specific parameters and tasks. Calculation of the main parameters of hydraulic and pneumatic machines. In my own experience to evaluate the operation of hydraulic and pneumatic machines in different modes of operation of the mechatronic system.
How to use the acquired knowledge and skills (competencies)	Acquired theoretical knowledge makes it possible to easily understand the work of any hydraulic system. Identify possible faults and predict its operation. The practical experience gained through close cooperation with the HIDRAVLIK Line company gives skills of work with the hydraulic equipment of any complexity.
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition)
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Logical synthesis of control algorithms
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Theoretical Mechanics", "Computer Science", "Physics", "Fundamentals of design and engineering"
What will be studied	Principles of construction of systems and algorithms of control of mechatronics objects on the basis of PLC. Logical synthesis of control algorithms using algorithmic languages STL, LD, ST. Consideration of the type of devices in control algorithms. Memory elements, timers, counters and subroutines in control algorithms Assembly, testing and debugging of typical control algorithms for mechatronics systems. Search for system errors, expanding the range of automated functions.
Why it is interesting / necessary to study	Logical synthesis is a tool for transforming developer knowledge into algorithms for the operation and management of an automated object. The use of controllers and distributed systems instead of hardware controls is indispensable for the automation of mechanical systems. The cyclic-modular approach allows to build mechatronic systems with open architecture, ja suitable for qualitative and quantitative modernization, which is the main content of the discipline.
Why you can learn (learning outcomes)	Perform a logical synthesis of algorithms for the operation of typical cyclic systems of mechatronics Conclude typical control algorithms for mechatronic systems based on algorithmic languages STL, LD, ST Take into account the technical means of executive, control and monitoring devices in the control algorithms of mechatronics
How to use the acquired knowledge and skills (competencies)	Develop typical control algorithms for practical automation problems by means of mechatronics Develop schemes of control systems using PLC, select the element base, compile, debug and diagnose control algorithms
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition)
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Electric-hydraulic drive of mechatronic systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Hydro-pneumatic motors of mechatronic systems", "Mechanics of materials and structures", "Synthesis of discrete control systems", "Fundamentals of design and engineering"
What will be studied	Design and calculation of the main parameters of hydraulic drives. Design and principle of operation of elements of hydraulic systems. Hydraulic systems for industry machinery. Electrical control of hydraulic elements. Sensors and sensors of hydraulic systems.
Why it is interesting / necessary to study	The hydraulic drive is widely used in heavy-duty automated industrial lines, mobile construction equipment and works. Understanding the operation of the hydraulic drive system and its management is necessary, both at the level of the individual hydraulic apparatus and as a whole.
Why you can learn (learning outcomes)	Fundamentals of design of hydraulic devices. Calculation and selection of power drives for hydraulic systems. Calculation of hydraulic lines and selection of electrohydraulic equipment of mechatronic systems.
How to use the acquired knowledge and skills (competencies)	Design of mechatronic systems based on hydraulic drive. Creation of technical proposals and projects. Registration of design documentation.
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition), textbook on laboratory workshops (electronic edition).
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Electropneumatic drive
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Hydro-pneumatic motors of mechatronic systems", "Mechanics of materials and structures", "Synthesis of discrete control systems", "Fundamentals of design and engineering"
What will be studied	Principles of operation of electric control systems for pneumatic actuators. Automation of production processes and technical facilities by means of electropneumatic automation. Formal description of pneumatic actuators and study of static and dynamic characteristics. Troubleshooting of system and hardware nature, modernization of control systems.
Why it is interesting / necessary to study	A large number of enterprises, especially in the food and pharmaceutical industries, use as the main type of drive is a pneumatic drive with electric control. High-quality operation and maintenance of such systems requires highly qualified personnel.
Why you can learn (learning outcomes)	Basic principles of construction and use of standard solutions of electric control systems for pneumatic drives. Methods of development, research, addition of electric control systems for pneumatic actuators. Approaches to equipment selection, assembly, commissioning, modernization and troubleshooting
How to use the acquired knowledge and skills (competencies)	Solve practical problems of automation of technical objects by creating electrical control systems for pneumatic drives Develop circuit solutions and documentation for electrical control systems for pneumatic actuators using Electropneumatic controls Select the element base of control systems Assemble, set up and diagnose pneumatic drive control systems and put them into operation
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition), textbook on laboratory workshops (electronic edition).
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Proportional hydraulics
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired during the study of disciplines "Electrical Engineering and Electronics", "Fundamentals of Electronics", "Electric Hydro Drive of Mechatronic Systems", "Electric Drive of Mechatronic Systems", "Synthesis of Discrete Control Systems for Actuators"
What will be studied	Development and construction of hydraulic circuits based on proportional hydraulics devices. Types and principle of construction of structures of hydraulic devices with proportional control. Performance characteristics and operating parameters of valves with proportional control. Practical issues of application of drives with proportional control. Designs and principle of operation of hydraulic servos, areas of application of servos.
Why it is interesting / necessary to study	The development and modernization of the hydraulic drive is also associated with full or partial automation of work processes. The use of proportional hydraulics allows you to expand the functionality of the hydraulic drive, reduce the number of equipment and add automated control, including from the controller. That is why a modern engineer needs basic knowledge of the design features of hydraulic devices with proportional control, the ability to create schemes based on proportional hydraulics and practical skills to adjust the parameters of the system.
Why you can learn (learning outcomes)	To carry out development and calculations of designs of hydraulic devices with proportional control and the hydraulic drives constructed on their basis. Know the methods of design and modernization of hydraulic control systems. Acquire practical skills in creating, commissioning, operation and modernization of mechatronic systems based on proportional control hydraulic devices.
How to use the acquired knowledge and skills (competencies)	To carry out assembly, adjustment and diagnostics of the mechatronic system with proportional devices in its composition and put it into operation. Improve the degree and quality of existing facilities by upgrading the control system and / or hardware using innovative approaches to the development of mechatronic systems.
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition), textbook, guidelines for laboratory work
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Mathematical modeling and design of physically heterogeneous systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired during the study of disciplines "Electrohydro-drive of mechatronic systems", "Electropneumatic drive", "Physics", "Fundamentals of design and engineering", "Fundamentals of mathematical modeling of physically heterogeneous systems"
What will be studied	The process of designing physically heterogeneous continuous systems, such as aircraft control system, automatic ejection system, etc. Functional approach to the analysis of technical systems. Elemental composition of physically heterogeneous systems for different purposes. Ways to represent elements and systems in the design process. Static and dynamic characteristics of elements and systems and methods of their determination. The principle of construction of mathematical descriptions of elements and systems for modeling their output. Development of computer programs for modeling the action of elements and systems. Computer programs for building mathematical models. Principles of computer experiments for verification of models of elements and systems and research of their characteristics.
Why it is interesting / necessary to study	Understanding the structure of complex technical systems with physically heterogeneous components is not easy, but if you learn to look at them accordingly, they become clear. Understanding is the key to solving various engineering problems of analysis and synthesis of such systems.
Why you can learn (learning outcomes)	The basic principles of the structure of physically heterogeneous systems and the principle of their analysis. Methods for determining the characteristics of elements and systems. Methods of constructing mathematical descriptions and mathematical models for modeling static and dynamic processes. The use of specialized programs for building mathematical models and modeling. Methods of model verification and evaluation of system characteristics
How to use the acquired knowledge and skills (competencies)	Analyze the composition and action of physically heterogeneous systems to diagnose, identify and eliminate problems. Develop new technical solutions, develop mathematical models and model the operation of elements and technical systems. Identify the characteristics of elements and systems and ways to improve them
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition), textbook, guidelines for laboratory work
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

Discipline	Computer modeling of mechatronics and robotics systems
Educational level	First (bachelor's)
Course	3
ECTS Credits	4 ECTS credits
Language of instruction	Ukrainian, English
Departmen	Applied hydroaeromechanics and mechatronics
Requirements for the beginning of the study	Successful mastering of knowledge and skills acquired in the study of disciplines "Higher Mathematics", "Physics", "Fundamentals of Mathematical Modeling and Design of Physically Heterogeneous Systems", "Electropneumatic Drive", "Electrohydro-Drive of Mechatronic Systems", "Fundamentals of Design and Engineering"
What will be studied	Basic concepts and characteristics of mathematical methods of modeling; Basic equations characterizing physically heterogeneous systems hydraulic, pneumatic, mechanical, electrical, etc.; Analysis of some generalized mathematical models of mechanical, hydraulic, pneumatic systems and processes, basics of mathematical modeling of physically heterogeneous systems and modules, theoretical positions of approaches to mathematical modeling of physically heterogeneous systems and processes; synthesis, methods and mechanisms (stages) of construction of mathematical models; the physical nature of the phenomena and processes occurring in technical facilities.
Why it is interesting / necessary to study	Ability to numerically assess the effectiveness of physically diverse systems, using complex criteria and modern methods of construction and systems engineering, to solve specific practical problems of the machine-building complex. Mathematical modelling is one of the main stages in the development, testing, research and design of modern modules of the machine-building complex.
Why you can learn (learning outcomes)	Formation of mathematical models that make it possible to conduct physical and mathematical modeling; Build, develop, test and research mathematical models of mechatronics and robotics systems, taking into account the modes and conditions of their operation using innovative approaches to mathematical modeling and software packages. ability to increase the degree and quality of existing objects by modernizing mechatronics and robotics systems using innovative approaches to mathematical modeling and software packages. ability to subuse
How to use the acquired knowledge and skills (competencies)	Improve the quality of existing facilities by modernizing and reengineering physically diverse systems, optimize the use of innovative technical solutions and approaches.
Information support	Curriculum and working programs of the discipline, RSD, lecture notes (electronic edition), textbook, guidelines for laboratory work
Form of classes	Lectures, laboratory classes, independent work, individual task
Semester control	Test

CONTINGENT OF STUDENTS

1-T YEAR OF STUDY:	**56 STUDENTS**	**(3 ACADEMIC GROUPS)**
2-ND YEAR OF STUDY:	**45 STUDENTS**	**(3 ACADEMIC GROUPS)**
3-RD YEAR OF STUDY:	**42 STUDENTS**	**(3 ACADEMIC GROUPS)**
4-TH YEAR OF STUDY:	**31 STUDENTS**	**(3 ACADEMIC GROUPS)**

THEMES OF DIPLOMA PROJECTS

Hydroficated baling press for recyclable materials **(***Gordiyenko Vitaliy***)**

Mixer for preparation of cutting fluid *(Poltoliarna Tetiana)*

Hydrodrive of mobile crane-manipulator *(Samusenko Mykola)*

Internal combustion engine fuel injector cleaning system (*Santashov Oleksiy)*

Automated hydraulic drive of sheet bending press *(Botsman Maxim)*

Development of an automated hydraulic deep draw module *(Kostiuchenko Ivan)*

Hydraulic drive with proportional control for the forklift *(Cherevko Danilo)*

Modernization of an Automation Control System for a Seed Packaging Line *(Dgabura Yana)*

System for the artificial rehabilitation heart *(Sytniuk Georg)*

Mobile device for ultrasonic cavitational disinfection of liquids *(Bagdasarian David)*

Hydraulic Manipulator with Automated Trajectory Movement *(Fedotov Yevgen)*

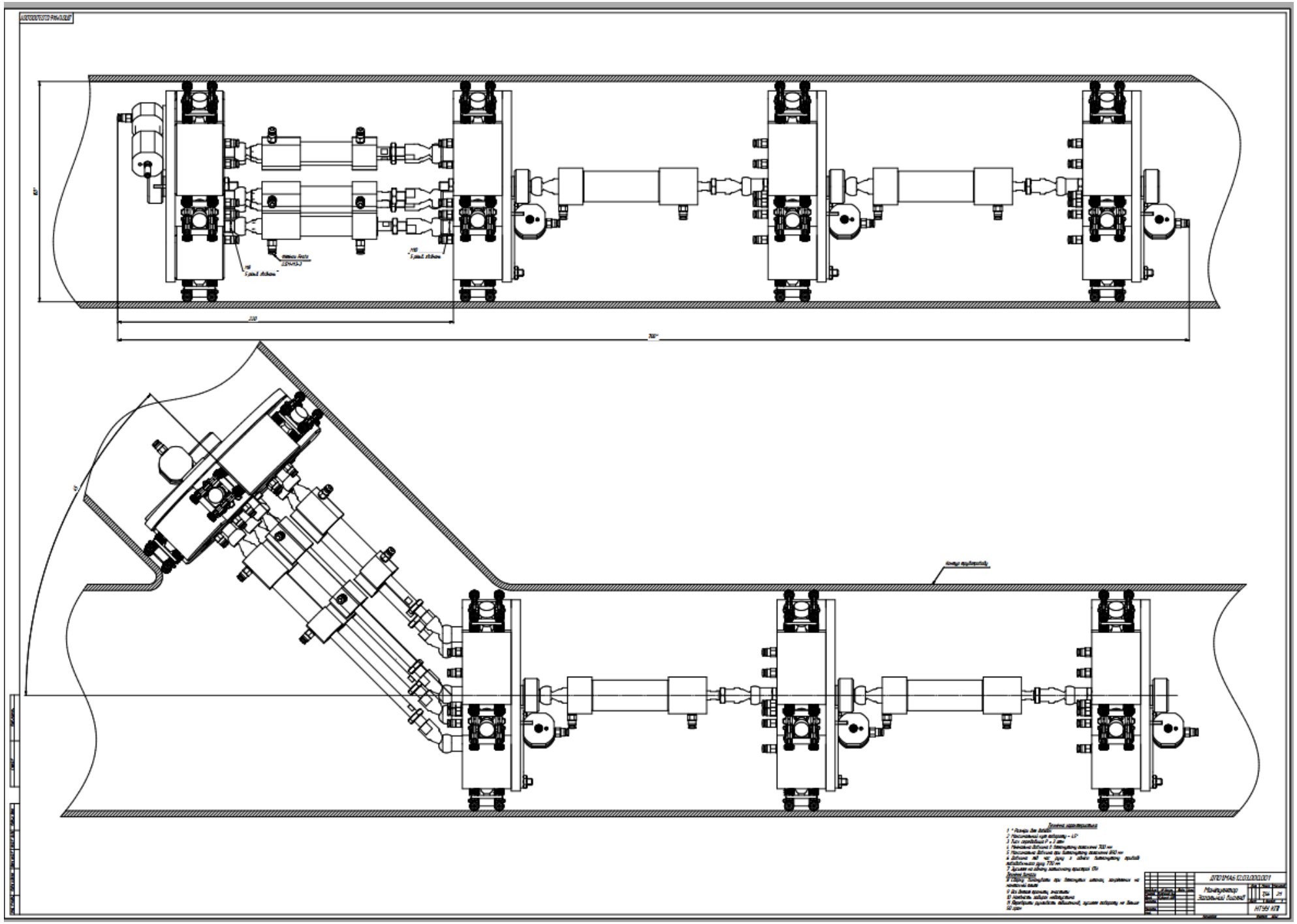
Modernization of hydraulic system of pallet changer PAL-TRANSFER *(KHarchenko Ilya)*

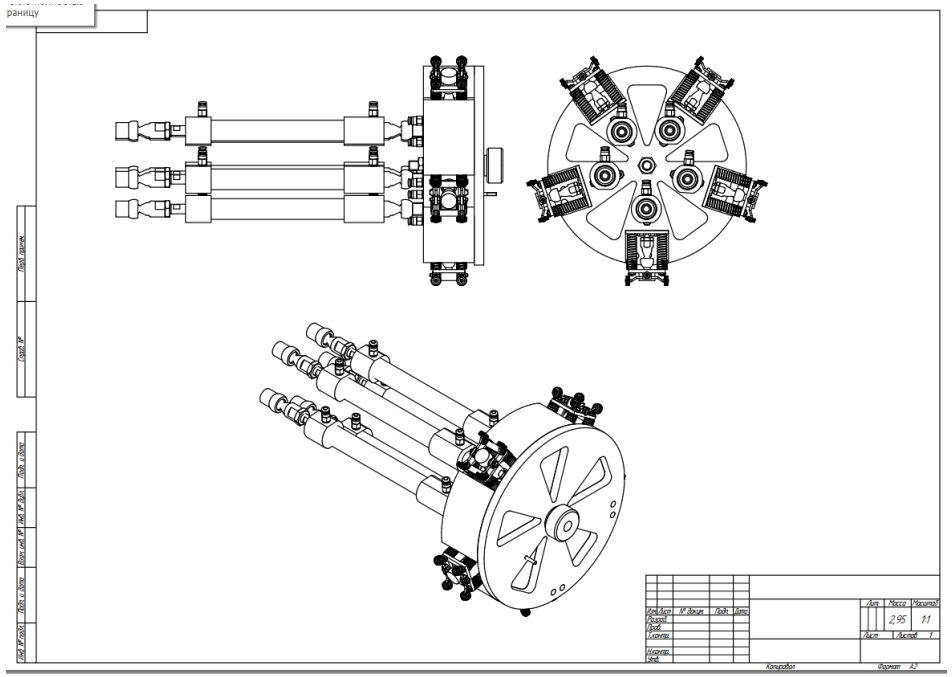
Diploma Project: Golichenko Katerina

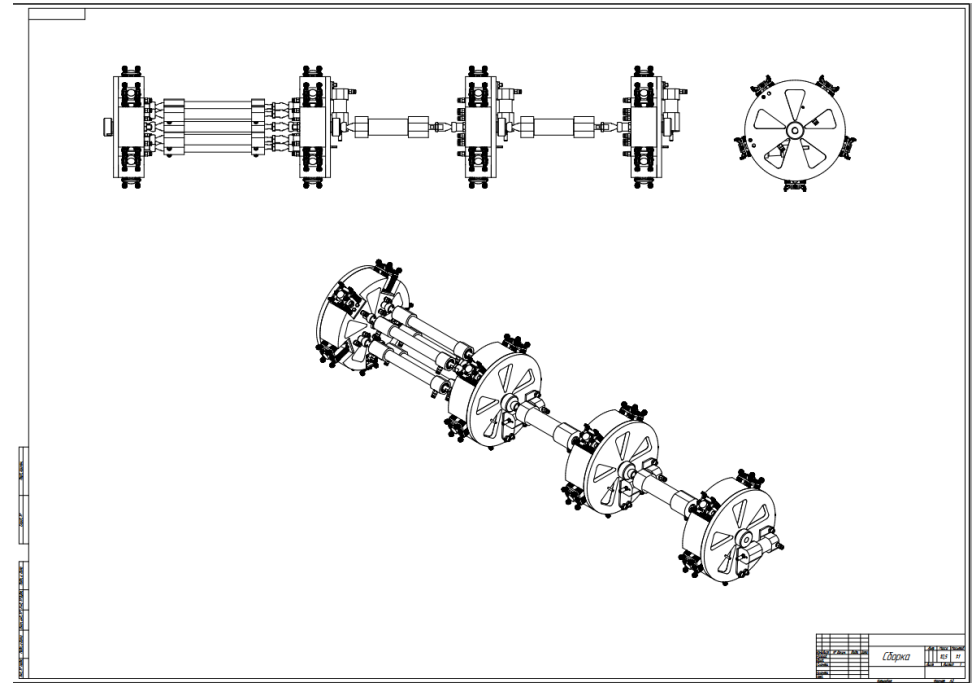
Pneumo-mechanical manipulator for checking the condition of medium diameter gas pipelines

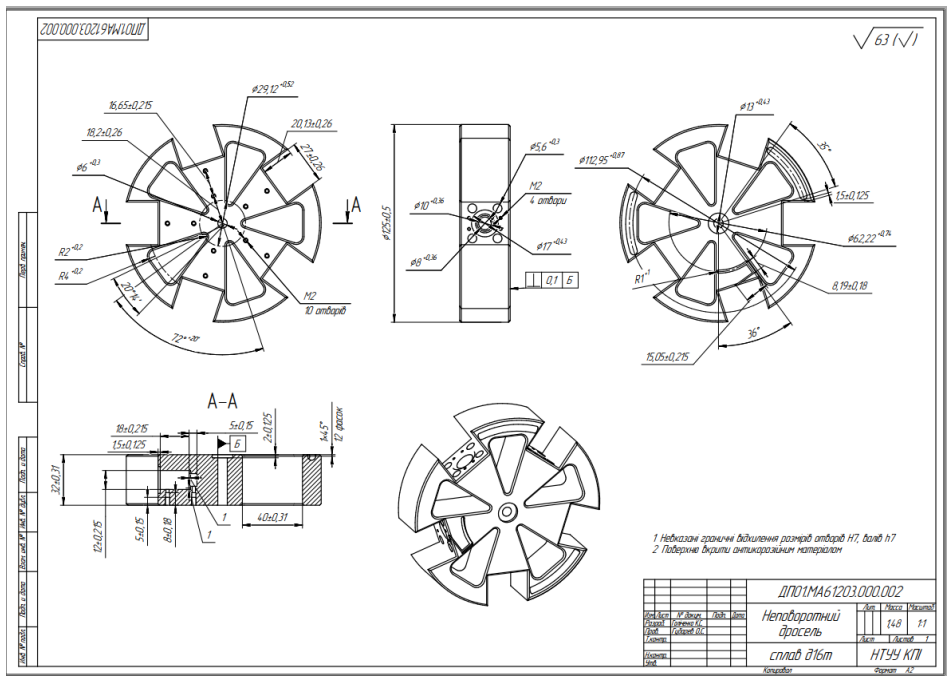
D = 150mm, **p = 0,3 ... 0,4 MPa,**

V = 1,2 ... 1,4 m/s, $S_{pipe}/S_{man} > 2$





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A–A
1. Невказані граничні відхилення розмірів отворів H7, валів h7.
2. Поверхня вкрити антикорозійним матеріалом
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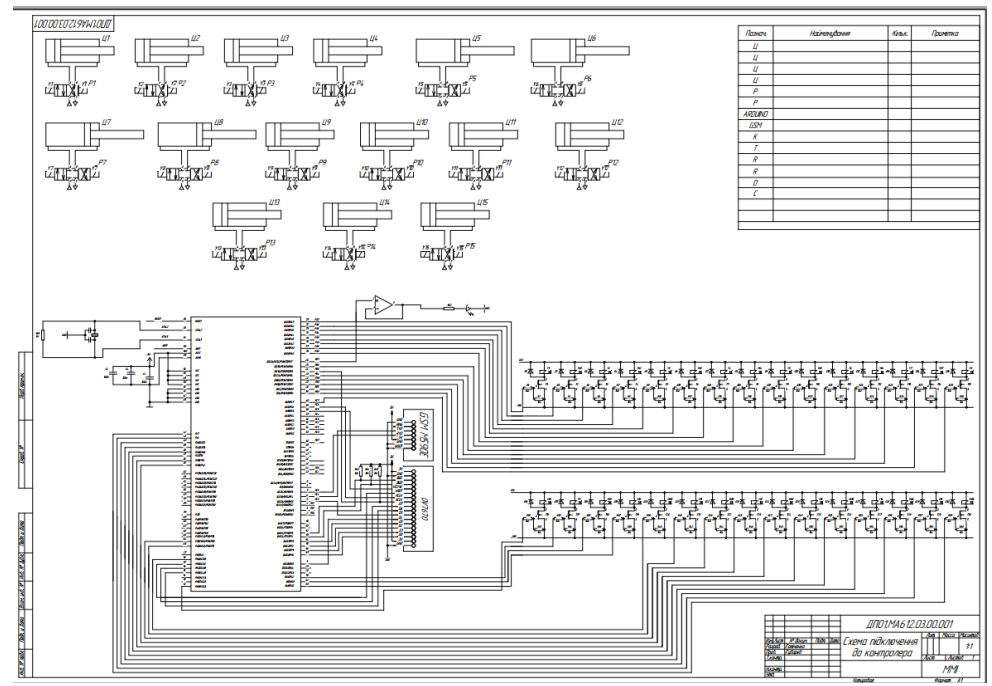
Неповоротний дросель
сплав Д16т
НТУУ КПІ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Позиц.
Найменування
Кільк.
Примітка
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Схема підключення до контролера
МР4