MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"Igor Sikorsky Kyiv Polytechnic Institute"

Approve
Head of the science board of
Igor Sikorsky Kyiv Polytechnic Institute

_____ M.Z. Zgurovsky
«___»_____20__ p.

EDUCATIONAL PROGRAMM

«Automated and robotic mechanical systems»

The 2nd (Master) educational degree

Specialty	**131 Applied machanics**
Branch of knowledge	**13 Mechanical engineering**
Qualification	**Master of Applied mechanics**

Approved by the Science Board of
University
on the «__»_____20__ p.
protocol № ___

Igor Sikorsky Kyiv Polytechnic Institute
Kyiv – 2018

INTRODUCTION

Developed by the work group:

Head of the work group
Uzunov Oleksandr Vasylyovych Doctor of tech. science, professor, professor of department of applied hydro-aeromechanics and mechatronics _____

Members of the work group:
Gubarev Oleksandr Pavlovych, Doctor of tech. science, professor, professor of department of the applied hydro-aeromechanics and mechatronics _____
Danylchenko Yuriy Mykhailovych Doctor of tech. science, professor, professor of the department of applied mechanics _____
Muraschenko Alyona Mykolayivna, PhD, assistant of the department of applied hydro-aeromechanics and mechatronics _____

Head of the department of applied hydro-aeromechanics and mechatronics
Luhovsky Oleksandr Phedorovych, Doctor of tech. science, professor _____
Head of the department of applied mechanics
Danylchenko Yuriy Mykhailovych Doctor of tech. science, professor _____

Head of the scientific methodical board of specialty
Bobyr Mykola Ivanovych
Doctor of tech. science, professor, Corresponding Member of the National Academy of Sciences of Ukraine, Director of Mechanical Engineering Institute _____

Head of the project group (Guarantor of the educational program)
Uzunov Oleksandr Vasylyovych Doctor of tech. science, professor, professor of department of applied hydro-aeromechanics and mechatronics _____

Educational program reviewed and approved by the Methodical board of university (Protocol № _9_ on the «_29_» _March_ 2018)

Head of the Methodical board
_____ Yu.I. Yakymenko

Science secretary of the Methodical board
_____ V.P. Golovenkin

CONTENT

1. Educational program curriculum

specialty 131 Applied mechanics
specializations:

"Mechatronic and robotic systems in mechanical engineering",
"Hydro-pneumo automatics and hydraulic and pneumatic machines",
"Automated logistics systems"

1 – General information	
Full names of the high educational institution and faculty	NATIONAL TECHNICAL UNIVERSITY OF UKRAINE "Igor Sikorsky Kyiv Polytechnic Institute", Mechanical Engineering Institute
Educational degree and qualification	Master degree Qualification – Master of Applied mechanics
QF for LLL	QF for LLL of Ukraine – Level 8
Official name of educational program	Automated and robotic mechanical systems
Type of diploma and educational program volume	Master Diploma, single, 120 credits, terms – 1 year and 9 months.
Existing accreditation	License AE №270199, license term: since 02.07.2013 till 01.07.2023
Precondition	Bachelor degree
Language	Ukrainian/English
Term of educational program	Till next accreditation
WEB-version of the educational program	http://weld.kpi.ua/op
2 – The aim of the educational program	
Training of the specialist, who can solve complex tasks and problems of applied mechanics and is able to professional development.	
3 – Educational program characteristics	
Subject area (branch of knowledge, specialty, specialization (-s), (if existing))	specialty 131 –Applied mechanics branch of knowledge 13 – Mechanical engineering, specializations: "Mechatronic and robotic systems in mechanical engineering", "Hydro-pneumo automatics and hydraulic and pneumatic machines", "Automated logistics systems"
Orientation of educational program	Educational and Scientific
Main focus of educational program and specialty	Special education in applied mechanics area Keywords: mechatronics, automation in mechanical engineering, hydro- and pneumo- automatic, logistics systems, robots and manipulators, hydraulic and pneumatic machines, Hoisting-and-transport machines
Features of program	without features
4 – Suitability of graduates for employment and further training	
Suitability for employment	Specialist is able to do professional work according to the classificatory of professions ДК 003:2010 in specialty
Further training/education	Graduates are able to continue education on the 3rd educational degree

5 – Teaching and evaluating	
Teaching and learning	Lectures, practices and seminars, computer practices and lab works, course projects and works, combined education technology, excursions, implementation of the master's thesis
Evaluating	Rating system, oral and written exams, tests etc.
6 – Competencies of the program	
Integral competence	Ability to solve complex tasks and problems of automation for engineering and similar technical objects or in studying process, that needs researching and/or innovating and is characterized by undetermined conditions and requirements.
General competencies (GC) (ЗК)	
GC 1	Ability to find, formulate and solve problems
GC 2	Ability to make informed decisions
GC 3	Skills of using information and communication technologies
GC 4	Ability to generate new ideas (creativity)
GC 5	Ability to develop and manage projects
GC 6	Ability to communicate with agents of other professional groups of different levels (with experts in other branches of knowledge/areas of business)
GC 7	Ability to speak foreign language
GC 8	Ability to learn and use modern knowledge
GC 9	Ability of abstract thinking, analyze and synthesis
GC 10	Ability to make researches at the required level
GC 11	Ability to search, process and analyze information from different sources
Professional competencies of specialty (PC) (ФК)	
PC 1	Special concept knowledge of the newest methods of develop and study design, machines and/or processes in mechanical engineering
PC 2	Ability of critical analyzing and predicting of operational parameters for new and existing mechanical designs, machines, materials and production processes in the engineering by using general knowledge and modern analytic and/or computing methods
PC 3	Ability to solve different engineering tasks, with understanding of invariance solutions, via using required methods and resources of the modern enginery and information technology
PC 4	Ability of critical comprehension of problems in studying, at professional and researching areas on the level of new achievements in engineering and at the edge of other sciences
PC 5	Ability to formulate a task and detect ways to solve problems through applied mechanics and similar subject areas, to use knowledge about methods of searching the optimal solution, taking into account conditions of insufficient information and contradictory requirements
PC 6	Ability to use required mathematical, scientific and technical methods, information technology and applied computer software to solve engineering and scientific tasks of applied mechanics
PC 7	Ability to describe, determine and simulate technical objects and processes, that based on knowledge and comprehension of mechanical theories and practices, also as on basic knowledge of similar sciences
PC 8	Ability to generate new ideas and inform new innovation projects and promote them on market
PC 9	Ability of self-employment and effective managing the group or department in solving production tasks, developing complex project, doing scientific researches, as a head. Charge in to develop professional knowledge and skills, and evaluation of strategical evolution of a team

PC 10	Ability to represent own conclusions, knowledge and explanations to specialists and non-specialists, in understandable form and without contradictions, also in educational process. Ability to understand other people's work, giving and receiving concreate instructions
PC 11	Ability to plan and do experimental studies, processing results of an experiment via modern information technology and microprocessor techniques, to explain results of experiments and simulations
Unit 1 (specialization "Mechatronic and robotic systems in mechanical engineering")	
PC 1.1	Ability to use basic concepts about different of approaches and tools for creating intelligent mechatronic and robotic systems
PC 1.2	Ability to use modern methods for design pneumatic, hydraulic, electrical and mechanical devices with different physical sources of operational signals
PC 1.3	Ability to use modern methods of the mechatronic and robotic engineering systems design
PC 1.4	Ability to make the structural and logical synthesis and to develop algorithms and control systems for multifunctional versatile mechatronic systems
PC 1.5	Ability to simulate and study pneumatic, hydraulic, electrical and mechanical devices and systems, as a part of multi-partition automated technical objects
PC 1.6	Ability to develop and innovate technical objects and raise efficiency of the production taking into account ISO and modern management methods
PC 1.7	Ability to evaluate efficiency of mechatronic devices and multi-functional automated systems via complex criterions and modern methods
PC 1.8	Ability to innovate by creating new mechatronic and robotic systems and their parts
Unit 2 (specialization "Hydro-pneumo automatics and hydraulic and pneumatic machines")	
PC 2.1	Ability to use basic concepts about different approaches and tools for creating hydraulic and pneumatic automated systems, machines and devices
PC 2.2	Ability to use modern methods of the hydraulic and pneumatic actuators design, also controlling and operational devices of hydraulic and pneumatic machines
PC 2.3	Ability to use modern methods of the hydraulic and pneumatic systems and aggregates design
PC 2.4	Ability to develop control systems for hydraulic and pneumatic actuators
PC 2.5	Ability to simulate and study hydraulic and pneumatic machines, devices and automated systems
PC 2.6	Ability to develop and innovate technical objects and raise efficiency of the production taking into account ISO and modern management methods
PC 2.7	Ability to evaluate efficiency of hydraulic and pneumatic machines and automated systems via complex criterions and modern methods
PC 2.8	Ability to innovate by creating new developments in hydro-pneumo automation area
Unit 3 (specialization "Automated logistics systems")	
PC 3.1	Ability to use basic concepts about different forms of the logistics systems functional structure and approaches and tools for the soft- and hardware of logistics processes creating
PC 3.2	Ability to use modern methods for the logistics systems automation of the motion of the materials flow, Hoisting-and-transport machines and mechanisms, also controlling and operational devices
PC 3.3	Ability to use modern methods of the systems "storage and transportation" , micro-systems design for engineering industries, municipal and domestic branches
PC 3.4	Ability to analyze outer and inner environments of logistics systems, to organize logistics processes, also to develop soft- and hardware for logistics processes
PC 3.5	Ability to simulate and study mechanical, electromechanical, hydraulic and mechatronic devices, as parts of automated logistics systems
PC 3.6	Ability to raise efficiency of the logistics systems functionality taking into account ISO and modern management methods
PC 3.7	Ability to evaluate efficiency of logistics processes, soft- and hardware of automated logistics systems via complex criterions and modern methods

PC 3.8	Ability to innovate by creating new developments in the area of logistic implementation for technological processes
7 – Program results of studying	
KNOWLEDGE	
KN 1	knowledge about modern tendencies, approaches and methods of the typical and conceptual solves using and creating new engineering implementations for automated devices and systems, including new types of product, automated manufacturing, doing engineering researches and/or development and automation for operational, technological and logistical processes in engineering and for different technological objects
KN 2	knowledge of principle structure and functionality of CAD/CAE/CAM-systems, software for studying, simulation and analyzes of automation devices and systems in engineering
KN 3	knowledge and skills of using modern methods to find out optimal solutions and rational parameters for technical devices and automated systems via simulations, system analyzes, also in cases of insufficient information and contradictory requirements
KN 4	knowledge about methods to perform innovating tasks (qualification work, course project), ability to argue and assert results and implementations, also in public speaking
KN 5	knowledge about basics of organization and management of staff
KN 6	knowledge about architecture, function, soft- and hardware of computer aided control-measurement systems in engineering
KN 7	knowledge and comprehension of the basic structure of the manufacturing process
KN 8	knowledge about architecture, function, soft- and hardware of computer aided information and measurement systems for the mechanic systems and processes studying
KN 9	knowledge and comprehension of basic organization of the studying process
KN 10	knowledge, comprehension and practical using of the theory of the experiment, the planning methods of experimental studying and results verification, methods of analyzes of experimental data and creating simulations, based on it, also using new methods via modern information technologies
KN 11	knowledge about principles and methods for the modern automated intelligent systems, mechatronic and robotic devices design, practice experience in performing project documentation according to world standards
KN 12	knowledge about modern methods, approaches and algorithms of the automated control for operational, technological and logistical processes and acts in engineering complex and specialized technical objects
KN 13	knowledge about the automated mechanical systems and objects modernization, design, simulation and development of unusual and innovating mechanical, pneumatic, electrical automation devices
KN 14	knowledge about synthesis methods for the optimal structural solutions and determination of mechatronic and robotic system rational parameters via simulation, system analyzes, also in case of conditions of insufficient and contradictory information
KN 15	knowledge about approaches, methods and criterions to evaluate the multi-partition automated systems and devices efficiency and quality in variable and complicated operation modes
KN 16	knowledge about principles and methods of the hydraulic, pneumatic automated systems and devices design, the hydraulic and pneumatic machines (volumetric and dynamic types) design, practice experience in performing project documentation according to world standards
KN 17	knowledge about modern methods, approaches and technical solutions of the automated control systems design for the pneumatic, hydraulic systems and aggregates

KN 18	knowledge about modernization ways for hydraulic, pneumatic automated systems and devices, design and simulation of unusual and innovating hydraulic and pneumatic devices, machines and systems
KN 19	knowledge about physical processes in hydraulic and pneumatic devices, on which their working based, and modern methods of analyzes, simulation and design of optimal and rational hydraulic and pneumatic automated systems, taking into account operation modes and circumstances, in case of conditions of insufficient and contradictory information
KN 20	knowledge about approaches, methods and criterions to evaluate the efficiency and quality of hydraulic and pneumatic drive systems and machines
KN 21	knowledge about principles and methods of the logistics systems, devices for automated systems of the motion of the materials flow, Hoisting-and-transport machines and mechanisms design, controlling and operational devices, practice experience in performing project documentation according to world standards
KN 22	knowledge about modern methods, approaches and algorithms of the automated control for the logistics systems equipment in engineering industries, municipal and domestic branches
KN 23	knowledge about modernization ways for equipment of logistics systems, design and simulation of unusual and innovating mechanisms and devices for providing motion of the materials flow
KN 24	knowledge about physical processes in equipment of logistics systems, on which their working based, especially of Hoisting-and-transport machines and mechanisms, mechanical, electromechanical, hydraulic and mechatronic devices, economic methods of analyzes, simulation and optimization of logistics processes, taking into account operation modes and circumstances, different outer influences, also in case of conditions of insufficient and contradictory information
KN 25	knowledge about approaches, methods and criterions to evaluate the efficiency and quality of functionality of logistics systems and their soft- and hardware
SKILLS	
SK 1	skills in development, design, simulation and studying devices, mechanisms, automated mechanical systems on the design stage via modern computer systems
SK 2	skills in argumentation and evaluation of innovational projects, knowing of promotion methods on the market, capability to make econometric and scientifically evaluation and to evaluate efficiency of the practice tasks solution
SK 3	skills in checking non-contradictory of control systems of the quality to world standards
SK 4	skills in development and performing project documentation, control systems and algorithms of modern mechatronic systems according to standard obligators, including, innovational technical solutions
SK 5	skills in complectation, assembling, adjustment and commissioning mechatronic and robotic systems, that consist of mechanical, hydraulic, pneumatic electrical parts with complex control and functional algorithms
SK 6	skills in upgrading automation level in existing objects by modernizing and re-engineering mechanical systems within methods of mechatronic, robotic and artificial intellect
SK 7	skills in performing design and project documentation of operational, control, measuring and supporting devices and energetic aggregates of hydro-pneumo automatics according to requirement, including optimized and innovational technical solutions
SK 8	skills in complectation, assembling, adjustment and commissioning pneumatic and hydraulic machines and hydro-pneumo automatics systems of technical objects, taking into account operational modes and circumstances
SK 9	skills in upgrading automation level in existing objects by modernizing and re-engineering hydro-pneumo automatic systems, optimizing operational modes and complement, using innovational technical solutions and methods

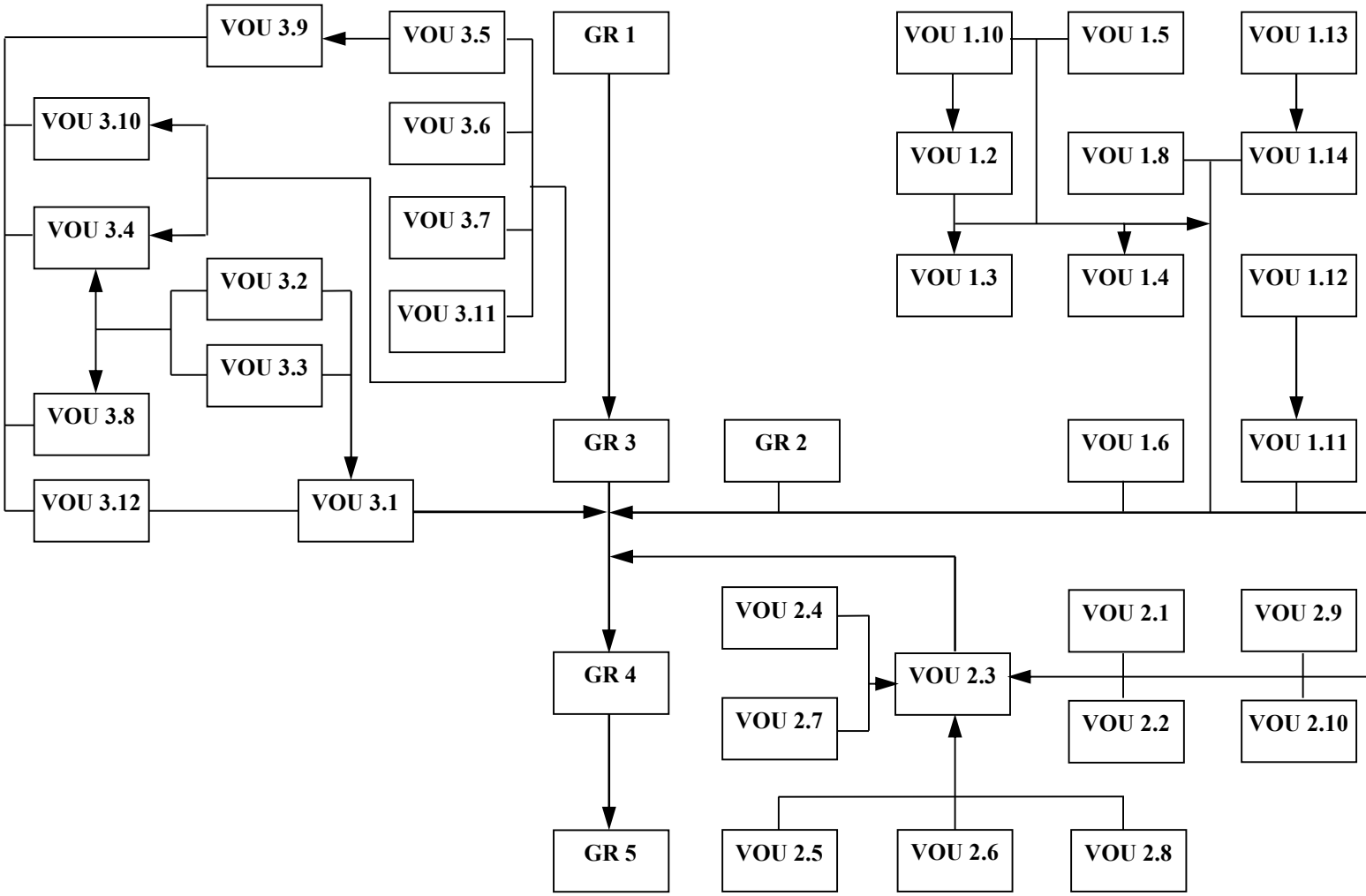
SK 10	skills in performing design and project documentation of operational, control, measuring and supporting equipment of logistics systems according to requirement, including optimized and innovational technical solutions
SK 11	skills in complectation, assembling, adjustment and commissioning pneumatic and hydraulic machines and hydro-pneumo automatic systems of technical objects, especially Hoisting-and-transport machines and mechanisms and mechanical, electromechanical, hydraulic, mechatronic devices and other technical objects, taking into account operational modes and circumstances
SK 12	skills in upgrading automation level in existing objects by modernizing and re-engineering logistics systems, optimizing operational modes and complement, using innovational technical solutions and methods
8 – Resource providing of the program realization	
Staff	According to requirements to the staff of providing education in high education institution on required level (appendix 12 of License circumstances), approved by Resolution of Cabinet of Ministers of Ukraine, 30.12.2015 №1187
Equipment	According to technical requirements to the equipment of providing education in high education institution on required level (appendix 13 of License circumstances), approved by Resolution of Cabinet of Ministers of Ukraine, 30.12.2015 №1187
Information and teaching materials	According to technical requirements to information and teaching materials of providing education in high education institution on required level (appendices 14 and 15 of License circumstances), approved by Resolution of Cabinet of Ministers of Ukraine, 30.12.2015 №1187
9 – Academic mobility	
National credit mobility	Possibility to make agreements of academic mobility and programs of the double-diplomas
International credit mobility	Agreements of double-diplomas with: Otto von Guericke University, Magdeburg, Germany
High education for foreign students	Teaching in foreign language: English

2. Educational program components

Code e/s	Educational program components (subjects, practice, qualification works)	Credits	Examination
1	2	3	4
1. General training			
Required components (GR)			
ЗО 1	Patenting and Intellectual Property	3	final test
GR 2	Mathematical Simulation of systems and processes	4	final test
GR 3	Scientific Work on the Topic of Master's Thesis	7,5	final test
GR 4	Pre-diploma Practice	9	final test
GR 5	Master's Thesis Implementation	21	graduation
Optional components (GO)			
ЗВ 1	Subject on Sustainable Development Problems	2	final test
GO 2	Pedagogy Subject	2	final test
GO 3	Management Subject	3	final test
GO 4	Workshop on Scientific Communication in Foreign Language	4,5	final test
2. Vocational training			
Optional components			
Optional unit 1 (specialization "Mechatronic and robotic systems in mechanical engineering")			
ПВБ 1.1 (VOU 1)	Multifunctional Mechatronic Systems in Energy Intensive Processes	4	exam
VOU 1.2	Electro-Hydraulic Control Systems in Mechatronics	7,5	exam
VOU 1.3	Design of Intelligent Mechatronic Systems	7	final test
VOU 1.4	Electro-Pneumatic Control Systems	4	exam
VOU 1.5	Electro-Pneumatic Automation	2,5	final test
VOU 1.6	Modeling and Research of Mechatronic Objects	2,5	final test
VOU 1.7	Logic Control for Mechatronic Systems	5	exam
VOU 1.8	Modular Production Systems	5	exam
VOU 1.9	Flexible Mechatronic Systems	6,5	exam
VOU 1.10	Multifunctional Actuators Subject	4	exam
VOU 1.11	Re-Engineering Subject	3,5	final test
VOU 1.12	Automation Means Subject	3,5	final test
VOU 1.13	Executional Mechatronic Devices Subject	3	exam
VOU 1.14	Simulation of Multi-element Technical Systems Subject	6	exam
Optional unit 2 (specialization "Hydro-pneumo automatics and hydraulic and pneumatic machines")			
VOU 2.1	Pneumo automatics	4	exam
VOU 2.2	Features of Hydraulic Control Systems Design	3,5	final test
VOU 2.3	Hydraulic Control Systems	7,5	exam
VOU 2.4	Design of Hydraulic and Pneumatic Machines	5	final test
VOU 2.5	Impeller Hydro-Dynamic Transmissions	4,5	exam
VOU 2.6	Production Technology of Hydro-Pneumo-Machines	2,5	final test
VOU 2.7	Compressors	3	exam
VOU 2.8	PLC Programming for Hydraulic and Pneumatic Drive Systems	4	exam
VOU 2.9	Fundamentals of Lubrication Theory	3,5	final test
VOU 2.10	Mathematical Methods for Drive Systems Analysis	7	exam
VOU 2.11	Computer Aided Design Subject	4,5	exam

1	2	3	4
VOU 2.12	Production Technology Subject	3	final test
VOU 2.13	Operation of Drive Systems	3	final test
VOU 2.14	Features of Working Fluids Subject	3	exam
VOU 2.15	Control System Subject	6	exam
Optional unit 3 (specialization "Automated logistics systems")			
VOU 3.1	Modern Design Methods	4	exam
VOU 3.2	Mathematical methods and modelling in Logistics	3	final test
VOU 3.3	Information Systems and Technologies in Logistics	4	final test
VOU 3.4	Logistics Systems Design	11,5	exam
VOU 3.5	Micro-processing Control of Mechatronic Modules and Systems	7,5	exam
VOU 3.6	Diagnostics and Industrial Safety of Hoisting-and-Transport Machines	7	exam
VOU 3.7	Hoisting-and-Transport Machines Dynamics	6	exam
VOU 3.8	Logistics Processes Optimization	3	final test
VOU 3.9	Automation of Storage-and-Transport Systems Subject	4	exam
VOU 3.10	Resource-Saving Technologies in logistics Systems Subjects	6	final test
VOU 3.11	Reliability of Logistics Equipment Subject	4	exam
VOU 3.12	Experimental Researching Methods Subject	4	exam
…			
Total in General Training:		**56**	
Total in Vocational Training:		**64**	
Total of Required Components:		**44,5**	
Total of Optional Components:		**75,5**	
Including Students Choice:		**30**	
TOTAL IN EDUCATIONAL PROGRAM		**120**	

3. Educational program structural-and-logic diagram



4. Form of Students Graduation

Students Graduation Examination, according to Educational Program of Specialty 131 Applied Mechanics, is a public speaking and presentation of the qualification work and finishes with receiving standard form document Diploma of Master Degree in Applied Mechanics and one of specializations: “Mechatronic and robotic systems in mechanical engineering”, “Hydro-pneumo automatics and hydraulic and pneumatic machines”, “Automated logistics systems”.

Graduation Examination is public and visitable.

5.1 The Matching Matrix of program competences to educational program components

***(specialization** "Mechatronic and robotic systems in mechanical engineering")*

	GR 1	GR 2	GR 3	GR 4	GR 5	GO 1	GO 2	GO 3	GO 4	VOU 1.1	VOU 1.2	VOU 1.3	VOU 1.4	VOU 1.5	VOU 1.6	VOU 1.7	VOU 1.8	VOU 1.9	VOU 1.10	VOU 1.11	VOU 1.12	VOU 1.13	VOU 1.14
GC 1			+	+								+			+	+		+		+	+		
GC 2			+		+					+		+					+			+		+	
GC 3		+			+							+			+								+
GC 4	+		+		+	+				+	+		+	+					+			+	
GC 5						+		+		+		+						+		+			
GC 6				+			+		+														
GC 7									+														
GC 8	+						+			+													
GC 9			+	+	+					+						+							+
GC 10			+	+	+										+								
GC 11	+								+	+			+		+								
PC 1	+									+		+			+				+	+		+	
PC 2		+									+		+	+	+	+					+	+	
PC 3		+								+		+			+					+			+
PC 4			+	+	+																		
PC 5			+		+	+				+		+				+				+			
PC 6		+	+							+		+			+								+
PC 7		+								+				+			+	+			+		+
PC 8	+							+	+														
PC 9			+	+			+	+															
PC 10					+		+	+	+														
PC 11		+			+					+					+								+
PC 1.1										+		+									+		
PC 1.2										+	+	+	+	+		+					+	+	
PC 1.3										+	+	+	+	+		+					+	+	
PC 1.4																+	+	+					
PC 1.5													+		+	+							+
PC 1.6										+	+	+		+	+	+	+	+		+	+		
PC 1.7										+					+				+				+
PC 1.8											+	+	+	+			+	+	+	+	+	+	

5.2 The Matching Matrix of program competences to educational program components

***(specialization** "Hydro-pneumo automatics and hydraulic and pneumatic machines")*

	GR1	GR2	GR3	GR4	GR5	GO1	GO2	GO3	GO4	VOU 2.1	VOU 2.2	VOU 2.3	VOU 2.4	VOU 2.5	VOU 2.6	VOU 2.7	VOU 2.8	VOU 2.9	VOU 2.10	VOU 2.11	VOU 2.12	VOU 2.13	VOU 2.14	VOU 2.15
GC 1			+	+						+	+		+		+				+			+	+	
GC 2			+		+						+		+						+					+
GC 3		+			+												+		+					+
GC 4	+		+		+	+				+		+	+							+				
GC 5						+		+			+		+									+		
GC 6				+			+		+															
GC 7									+															
GC 8	+						+				+					+								
GC 9			+	+	+									+				+	+					
GC 10			+	+	+											+			+		+			
GC 11	+								+	+									+			+		
PC 1	+										+		+		+			+						
PC 2		+								+		+		+		+			+					
PC 3		+									+								+					
PC 4			+	+	+																			
PC 5			+		+	+					+		+			+							+	
PC 6		+	+										+						+					
PC 7		+									+						+			+				+
PC 8	+							+	+															
PC 9			+	+			+	+																
PC 10					+		+	+	+															
PC 11		+			+									+		+		+			+	+		
PC 2.1										+	+	+		+			+	+			+			+
PC 2.2										+	+	+	+	+		+					+	+		
PC 2.3										+	+	+	+	+		+					+	+		
PC 2.4																+	+	+						+
PC 2.5													+		+	+							+	
PC 2.6										+	+	+		+	+	+	+	+		+	+			
PC 2.7										+					+				+				+	
PC 2.8											+	+	+	+			+	+	+	+	+	+		

5.3 The Matching Matrix of program competences to educational program components

***(specialization** "Automated logistics systems")*

	GR1	GR2	GR3	GR4	GR5	GO1	GO2	GO3	GO4	VOU 3.1	VOU 3.2	VOU 3.3	VOU 3.4	VOU 3.5	VOU 3.6	VOU 3.7	VOU 3.8	VOU 3.9	VOU 3.10	VOU 3.11	VOU 3.12
GC 1			+										+	+	+	+	+	+	+	+	+
GC 2			+		+								+				+		+		+
GC 3					+					+		+	+	+		+	+				
GC 4			+		+	+							+					+	+		
GC 5								+					+					+			
GC 6				+			+		+		+	+	+	+							
GC 7									+												
GC 8							+			+	+	+	+	+	+	+	+	+	+	+	+
GC 9			+	+	+					+	+		+	+			+				
GC 10			+	+	+											+				+	+
GC 11	+								+	+	+	+	+	+	+	+	+	+	+	+	+
PC 1	+									+			+		+	+	+	+		+	+
PC 2		+											+		+	+	+		+	+	
PC 3		+								+		+					+				
PC 4			+	+	+										+						+
PC 5			+		+											+	+			+	+
PC 6		+	+							+		+				+				+	+
PC 7		+											+	+		+	+		+	+	
PC 8								+	+		+		+					+	+		
PC 9			+				+						+								+
PC 10					+				+				+					+			+
PC 11		+								+				+		+				+	+
PC 3.1												+	+	+				+	+		
PC 3.2										+		+	+	+				+	+		
PC 3.3													+					+	+		
PC 3.4										+	+	+	+	+			+	+			
PC 3.5										+				+	+	+	+	+	+	+	
PC 3.6													+				+				
PC 3.7													+	+		+	+		+	+	
PC 3.8													+					+	+		

6.1 The Matrix of providing program educational results via educational program components

***(specialization** "Mechatronic and robotic systems in mechanical engineering")*

	GR 1	GR 2	GR 3	GR 4	GR 5	GO 1	GO 2	GO 3	GO 4	VOU 1.1	VOU 1.2	VOU 1.3	VOU 1.4	VOU 1.5	VOU 1.6	VOU 1.7	VOU 1.8	VOU 1.9	VOU 1.10	VOU 1.11	VOU 1.12	VOU 1.13	VOU 1.14
KN 1	+		+		+			+	+	+		+					+	+	+				
KN 2		+	+		+					+		+			+				+				+
KN 3		+	+	+	+				+	+					+		+	+					+
KN 4			+	+	+						+	+											
KN 5						+	+	+															
KN 6										+							+						
KN 7								+										+		+	+		
KN 8			+	+	+					+								+					
KN 9			+	+	+																		
KN 10		+	+	+	+				+						+								
KN 11											+	+		+				+				+	
KN 12													+			+	+	+			+		
KN 13									+		+			+									
KN 14															+								+
KN 15									+	+					+				+	+			
…																							
SK 1		+	+	+	+							+			+	+	+						+
SK 2					+		+	+	+		+	+						+					
SK 3	+			+	+	+			+		+	+											
SK 4											+	+				+	+				+	+	
SK 5				+								+	+	+			+	+			+		
SK 6					+					+			+		+				+	+		+	+
…																							

6.2 The Matrix of providing program educational results via educational program components

***(specialization** "Hydro-pneumo automatics and hydraulic and pneumatic machines")*

	GR1	GR2	GR3	GR4	GR5	GO1	GO2	GO3	GO4	VOU 2.1	VOU 2.2	VOU 2.3	VOU 2.4	VOU 2.5	VOU 2.6	VOU 2.7	VOU 2.8	VOU 2.9	VOU 2.10	VOU 2.11	VOU 2.12	VOU 2.13	VOU 2.14	VOU 2.15
KN 1	+		+		+			+	+		+		+		+	+					+	+		
KN 2		+	+		+						+		+				+		+	+				
KN 3		+	+	+	+				+								+		+				+	
KN 4			+	+	+							+	+											
KN 5						+	+	+																
KN 6														+		+								
KN 7								+							+						+			
KN 8			+	+	+											+								
KN 9			+	+	+																			
KN 10		+	+	+	+				+										+					
…																								
KN 16										+	+		+	+		+				+				
KN 17												+					+							+
KN 18										+				+		+		+						
KN 19																			+					
KN 20											+		+									+	+	
SK 1		+			+						+		+						+	+				
SK 2					+		+	+			+		+											
SK 3	+				+	+						+	+		+									
…																								
SK 7											+	+	+			+		+		+	+			+
SK 8										+		+		+		+					+	+		
SK 9					+					+		+			+		+		+				+	+

6.3 The Matrix of providing program educational results via educational program components

***(specialization** "Automated logistics systems")*

	GR 1	GR 2	GR 3	GR 6	GR 7	GO 1	GO 2	GO 3	GO 4	VOU 3.1	VOU 3.2	VOU 3.3	VOU 3.4	VOU 3.5	VOU 3.6	VOU 3.7	VOU 3.8	VOU 3.9	VOU 3.10	VOU 3.11	VOU 3.12
KN 1	+		+		+			+	+				+	+		+	+	+			
KN 2		+	+		+					+	+	+			+		+				
KN 3		+	+	+	+				+		+					+	+			+	
KN 4			+	+	+								+	+	+						
KN 5						+	+	+					+								
KN 6										+		+			+						
KN 7								+					+					+			
KN 8			+	+	+					+		+			+						+
KN 9			+	+	+																+
KN 10		+	+	+	+				+							+				+	+
KN 21													+					+			
KN 22										+				+							
KN 23													+			+		+	+	+	
KN 24										+			+		+		+	+			
KN 25											+		+				+	+	+		
SK 1		+			+					+		+									
SK 2					+		+	+					+				+				
SK 3	+				+	+							+								
SK 10										+			+	+							
SK 11													+	+	+			+	+		
SK 12													+	+		+	+	+	+	+	