

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**

**NATIONAL TECHNICAL UNIVERSITY  
"KHARKIV POLYTECHNIC INSTITUTE"**

**APPROVED BY**

Rector of NTU "KhPI"

\_\_\_\_\_ Ye. Sokol

« \_\_\_\_ » \_\_\_\_\_ 2019

**EDUCATIONAL PROFESSIONAL PROGRAM**

**«SECTORAL ENGINEERING»**

**For First Higher Education Level**

**by Specialty 133 Sectoral Engineering**

**in Knowledge 13 Mechanical Engineering**

**Qualification: Bachelor of Sectoral Engineering**

**APPROVED BY THE ACADEMIC  
COUNCIL OF NTU "KHPI"**

**Chairman of the Academic Council**

\_\_\_\_\_ L. Tovazhnyansky

protocol № \_\_\_\_ from

« \_\_\_\_ » \_\_\_\_\_ 2019

**Kharkiv 2019.**

**AGREEMENT SHEET  
of educational-professional program**

Higher Education Level	First (bachelor)
Field of knowledge	13 Mechanical Engineering
Specialty	133 «Sectoral Engineering»
Qualification	Bachelor of Sectoral Engineering

**APPROVED**

Chairman of the support group for the specialty "Sectoral Engineering"

\_\_\_\_\_ D.Volontsevych

« \_\_\_\_ » \_\_\_\_\_ 2019

**RECOMMENDED**

by the Methodological Council of NTU "KhPI"

Deputy Chairman of the Methodological Council

\_\_\_\_\_ R. Mygushchenko

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Automobile and Tractor construction

\_\_\_\_\_ V. Samorodov

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Director of Education and Science Institute of Mechanical Engineering and Transport

\_\_\_\_\_ V. Iepifanov

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Information Technologies and Systems of Wheeled and Tracked Vehicles named after A.A. Morozov

\_\_\_\_\_ D.Volontsevych

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Hydraulic Machines

\_\_\_\_\_ M. Cherkashenko

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Lifting Transport Machines and Equipment

\_\_\_\_\_ V. Kovalenko

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Engineering Technology and Machine Tools

\_\_\_\_\_ A. Permiakov

« \_\_\_\_ » \_\_\_\_\_ 2019

**AGREED**

Head of the department of Chemical Engineering and Industrial Ecology

\_\_\_\_\_ V. Shaporev

« \_\_\_\_ » \_\_\_\_\_ 2019

**APPROVED AND INTRODUCED**

by the order of the Rector of the National Technical University "Kharkiv Polytechnic Institute" from « \_\_\_\_ » \_\_\_\_\_ 20\_\_\_\_, № \_\_\_\_\_.

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## FOREWORD

Developed by a working group of the Educational and Scientific Institute of Mechanical Engineering and Transport of the National Technical University "Kharkiv Polytechnic Institute" consisting of:

1. Doctor of Technical Sciences, Professor D. Volontsevych – Head of the department of Information Technologies and Systems of Wheeled and Tracked Vehicles named after A.A. Morozov, Chairman of the support group for the specialty "Sectoral Engineering".
2. Doctor of Technical Sciences, Professor V. Samorodov – Head of the department of Automobile and Tractor construction.
3. Doctor of Technical Sciences, Professor M. Cherkashenko – of Hydraulic Machines.
4. Candidate of Technical Sciences, Associate Professor V. Kovalenko – Head of the department of Lifting Transport Machines and Equipment.
5. Doctor of Technical Sciences, Professor A. Permiakov – Head of the department of Engineering Technology and Machine Tools.
6. Doctor of Technical Sciences, Professor V. Shaporev – Head of the department of Chemical Engineering and Industrial Ecology.

**1. PROFILE OF EDUCATIONAL AND PROFESSIONAL PROGRAM ON SPECIALTY  
133 "SECTORAL ENGINEERING"**

<b>1 – General information</b>	
<b>The full name of the higher education institution and structural unit</b>	National Technical University "Kharkiv Polytechnic Institute", Educational and Scientific Institute of Mechanical Engineering and Transport
<b>Higher education level and qualification title in original language</b>	Bachelor of Sectoral Engineering
<b>The official name of the educational program</b>	Educational and professional specialized program «Sectoral Engineering»
<b>Type of diploma and the volume of the educational program</b>	Bachelor's degree, single, 240 ECTS credits, 4 years
<b>Accreditation presence</b>	ND №2192175 from 01.07.2023
<b>Program cycle / level</b>	FQ-EHEA - first cycle, QF LLL - 6 level, IRC - 7 level
<b>Prerequisites</b>	Full secondary education
<b>Teaching language(s)</b>	Ukrainian / English
<b>The term of the educational program</b>	According to the validity of the certificate of accreditation
<b>Internet address of the permanent placement of the educational program description</b>	<a href="http://www.kpi.kharkov.ua/ukr/faculty/mit/">http://www.kpi.kharkov.ua/ukr/faculty/mit/</a>
<b>2 – The purpose of the educational program</b>	
Professional training of highly qualified specialists capable of solving complex specialized tasks and practical problems in the field of mechanical engineering, which are characterized by complexity and uncertainty of conditions.	
<b>3 – Characteristics of the educational program</b>	
<b>Subject area (area of knowledge, specialty, specialization)</b>	Area of knowledge: 13 – Mechanical engineering Specialty: 133 – Sectoral Engineering
<b>Orientation of the educational program</b>	Educational and professional applied. Oriented to the formation of the ability to carry out engineering activities regarding the full life cycle of products of sectoral engineering (development, implementation, commissioning, research, operation, repair and disposal), respectively, of these blocks of disciplines.
<b>The main focus of the educational program and specialization</b>	General education in the field of engineering and special education in accordance with the specified specializations (blocks of disciplines). Keywords: engineering, calculation, design, computer modeling, operation, maintenance, repair.
<b>Features of the program</b>	Project-oriented professional program on the standards of the international initiative CDIO, for the training of foreign citizens. Project training based on the sequence of implementation of integrated training and real projects. Dual training in basic enterprises. Mandatory carrying out pre-diploma practice at the enterprises of the engineering industry according to the selected block of disciplines.

<b>4 - Suitability of graduates for employment and further education</b>	
<b>Suitability for employment</b>	<p>Employment in enterprises of any legal form (commercial, non-commercial, state, municipal), in which graduates work as heads of technical services (departments) or performers of various services in primary positions:</p> <ul style="list-style-type: none"> <li>- technician technologist;</li> <li>- mechanic;</li> <li>- production mechanic;</li> <li>- equipment mechanic;</li> <li>- technician for the mechanization and repair of equipment;</li> <li>- technician for the mechanization of labor-intensive processes;</li> <li>- instructor in operational, technical and organizational issues;</li> <li>- statistician researcher;</li> <li>- the technician on adjustment and tests;</li> <li>- technician for the preparation of technical documentation;</li> <li>- technician inspector.</li> <li>- engineer of the design department;</li> <li>- engineer department chief mechanic;</li> <li>- technical department engineer;</li> <li>- foreman;</li> <li>- service center manager.</li> </ul>
<b>Further training</b>	<p>The possibility of continuing education at the next (master's) level of higher education in the relevant educational-professional or educational-scientific programs.</p> <p>The possibility of postgraduate education to obtain professional qualifications according to relevant professional standards.</p>
<b>5 – Teaching and Assessment</b>	
<b>Teaching and learning</b>	Lectures, laboratory and practical classes, scientific workshops, the implementation of educational and real-world projects (training projects), problem-oriented education and training on demand, student-centered training, dual learning, distance and blended learning, independent work and self-study, practice, qualification work preparation.
<b>Assessment</b>	Current and final control of knowledge (interviewing, control and individual tasks, testing, etc.), tests and exams (oral and written), protection of training and real projects on presentation, public protection of qualifying work.
<b>6 – Program competencies</b>	
<b>Integral competence</b>	The ability to solve specialized practical problems of sectoral engineering, which involve the use of certain theories and methods of mechanical engineering and have signs of complexity and uncertainty of conditions.
<b>General competencies</b>	GC-1. The ability to preserve and enhance moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and the

	<p>development of society, technique and technology, use different types and forms of motor activity for active recreation and maintaining a healthy lifestyle.</p> <p>GC-2. The ability to learn, acquire new knowledge, skills, including in a field other than professional.</p> <p>GC-3. Ability to apply professional knowledge and skills in practice.</p> <p>GC-4. The ability to flexibly adapt to real professional situations, to be creative, initiative.</p> <p>GC-5. The ability to critically evaluate and rethink the accumulated experience (own and someone else's), to analyze their professional and social activities.</p> <p>GC-6. Ability to solve problems in professional activity on the basis of analysis and synthesis.</p> <p>GC-7. Ability to work with information: to find, evaluate and use information from different sources, necessary for solving professional problems.</p> <p>GC-8. Ability to use basic knowledge in the field of exact, natural, social, humanitarian and economic sciences in a profession.</p> <p>GC-9. The ability to effectively build communication based on the goals and situation of communication.</p> <p>GC-10. The ability to carry out production activities in an international environment.</p> <p>GC-11. Ability to social and professional interaction and cooperation in a team.</p>
<p><b>Professional competencies of the specialty (defined by the draft standard of higher education in the specialty)</b></p>	<p>PC-1. The ability to apply analytical methods and computer software for solving engineering problems of sectoral engineering.</p> <p>PC-2. The ability to apply knowledge and understanding of fundamental scientific facts, concepts, theories, principles.</p> <p>PC-3. The ability to apply the appropriate quantitative mathematical, scientific and technical methods, as well as computer software for solving engineering problems of sectoral engineering.</p> <p>PC-4. Ability to use the requirements of industry, international standards and practices regarding the implementation of professional activities.</p> <p>PC-5. Ability to implement advanced engineering developments for practical results.</p> <p>PC-6. The ability to understand and solve the problem of modern production, aimed at meeting the needs of consumers.</p> <p>PC-7. The ability to determine the technical and economic efficiency of typical systems of sectoral engineering and their components based on the use of analytical methods.</p> <p>PC-8. Ability to demonstrate creative and innovative potential in project development.</p> <p>PC-9. Ability to use knowledge in the areas of commercial and economic activities.</p> <p>PC-10. The ability to understand and take into account social, ethical, economic and commercial constraints and risks in the process of implementing technical solutions.</p> <p>PC-11. Ability to develop plans and projects aimed at achieving the goal and focused on available resources.</p> <p>PC-12. Ability to use knowledge in solving problems of product quality improvement and its control.</p> <p>PC-13. Ability to determine areas of possible use of</p>

	<p>engineering knowledge.</p> <p>PC-14. The ability to apply a systematic approach to solving engineering problems.</p> <p>PC-15. Ability to use knowledge in order to choose construction materials, equipment, processes.</p> <p>PC-16. The ability to demonstrate an understanding of the requirements for engineering activities in relation to ensuring rapid and continuous development.</p>
<b>Professional competences by discipline blocks (defined by the university)</b>	
<b>133.01 – Automobiles and tractors</b>	<p>PCB.01-1. The ability to analyze the current state of development of the automotive and tractor engineering industries, to own the principles of functioning of cars, tractors and special equipment based on them.</p> <p>PCB.01-2. The ability to analyze the design and principles of functioning of the units and systems of automobiles and tractors, to determine their structure and composition.</p> <p>PCB.01-3. The ability to use methods for analyzing and calculating the structures of automobiles and tractors, to evaluate the mechanical strength of designed structures, to design components and systems for automobiles and tractors, to use computer-aided design systems.</p> <p>PCB.01-4. The ability to develop technological processes for the production of standard parts and the assembly of automobile units and tractors.</p> <p>PCB.01-5. The ability to calculate and apply electric, hydraulic and pneumatic drives in automobiles and tractors.</p> <p>PCB.01-6. The ability to use optimization methods in the calculations of structures and elements of automobiles and tractors.</p> <p>PCB.01-7. The ability to design new and modernize the existing modern running gear, suspension and transmissions of automobiles and tractors.</p> <p>PCB.01-8. Ability to use mathematical methods for modeling workflows in the elements of automobiles and tractors.</p>
<b>133.02 – Automated design of all terrain vehicles</b>	<p>PCB.02-1. The ability to analyze the design and principles of operation of aggregates and systems of all terrain vehicles (ATV), to determine their structure and composition.</p> <p>PCB.02-2. The ability to calculate and apply electric, hydraulic and pneumatic drives, electrical, electromechanical and electronic equipment in ATV.</p> <p>PCB.02-3. The ability to use the methods of analysis and calculations of the construction of ATV, to assess the mechanical strength of the designed structures, including using automated design systems.</p> <p>PCB.02-4. The ability to design and modernize nodes and systems of ATV.</p> <p>PCB.02-5. The ability to develop the main types of technological processes for manufacturing parts and assembling units of ATV.</p> <p>PCB.02-6. Ability to use numerical methods and optimization basics when calculating structures and elements of ATV.</p> <p>PCB.02-7. Ability to carry out the organization of</p>

	<p>operation, maintenance and repair of ATV. PCB.02-8. Ability to use mathematical methods for modeling workflows in ATV.</p>
<p><b>133.03 – Machines and mechanisms of oil and gas industry</b></p>	<p>PCB.03-1. The ability to own the main types of equipment, technology and equipment regarding the production, transportation and storage of hydrocarbons. PCB.03-2. The ability to determine the main characteristics of the field for its further development. PCB.03-3. The ability to analyze the laws of viscous fluid flow and drilling fluids, to be able to evaluate the influence of the parameters of a drilling fluid on its characteristics. PCB.03-4. The ability to choose pumping and hydraulic equipment according to operational characteristics, analyze hydraulic circuits and design volumetric hydraulic drives according to them. PCB.03-5. The ability to design machinery and equipment related to the drilling, extraction and transportation of oil and gas. PCB.03-6. The ability to develop tooling and technological processes for the manufacture of parts, devices and other technological equipment that is used for drilling, production and transportation of oil and gas. PCB.03-7. The ability to design mechanical and hydraulic equipment for pumping hydrocarbons. PCB.03-8. The ability to calculate and design structures and elements of hydraulic machines of wide use.</p>
<p><b>133.04 – Lifting-and-Shifting, road, construction, land reclamation machines and equipment</b></p>	<p>PCB.04-1. An idea of the place and role of Lifting-and-Shifting, transport, road, construction, land reclamation machines and equipment in the socio-economic development of Ukraine and the World; own the modern state of technology in this area and the trends of its development; navigate in professional terminology and be able to use it in professional activities. PCB.04-2. Possession of the skills to develop and use design and working technical documentation using application software packages in the design of materials handling, road, construction, land reclamation machines and equipment, taking into account their design features. PCB.04-3. The ability to select and apply hardware and software to automate Lifting-and-Shifting, road, construction, reclamation machines and equipment, analyze the results and build the appropriate conclusions. PCB.04-4. The ability to compose, design, use the methods of analysis and calculations of the mechanical strength of metal Lifting-and-Shifting, road, construction, reclamation machines and equipment PCB.04-5. The ability to develop technological processes for the manufacture and assembly of Lifting-and-Shifting, road, construction, land reclamation machines and equipment. PCB.04-6. The ability to calculate, design and operate the systems of hydraulic and pneumatic actuators in Lifting-and-Shifting, road, construction, land reclamation machines and equipment. PCB.04-7. The ability to develop the technology of functioning of warehouse complexes and to carry out the selection of technical equipment for its implementation.</p>



	<p>PCB.04-8. The ability to organization of operation, maintenance and repair of hoisting, transportation, road, construction, land reclamation machines and equipment, taking into account the special requirements for the safety of their operation.</p>
<p><b>133.05 – Equipment for Food, Processing and Chemical Production</b></p>	<p>PCB.05-1. The ability to calculate thermodynamic potentials, equilibrium in homogeneous and heterogeneous systems, equilibrium chemical reactions; knowledge of the methodology for solving scientific and technical issues related to the transformation of energy in chemical processes; the ability to analyze the physical nature of the basic processes that occur in the equipment.</p> <p>PCB.05-2. Possession of engineering methods and skills of calculations and design of devices, where the main processes of chemical technology take place, typical elements of technological schemes of chemical production and their interrelations; the ability to analyze the technological schemes of chemical production, to classify them by type or kind.</p> <p>PCB.05-3. Possession of the basic requirements for structural materials in chemical process equipment; understanding of the technological basis of processing of construction materials by pressure, cutting, welding, etc .; possession of skills for the development of technological processes of manufacturing parts for a given release program with all the basic calculations; knowledge of the theory of strength calculation of thin-walled shells and their practical application.</p> <p>PCB.05-4. Способность различать виды и типы монтажных работ на производствах, документацию относительно их внедрения, владение навыками расчетов типового монтажного оборудования в зависимости от типа работ на химическом предприятии, умение компоновать оборудование и проводить монтажную проработку проекта.</p> <p>PCB.05-5. The ability to analyze the technological schemes of food production, classify them by type or kind; possession of the skills of calculating typical elements of technological schemes of food production and their interconnections; the ability to select basic samples and a range of food quality indicators.</p> <p>PCB.05-6. The ability to provide recommendations on the use of protective equipment for process equipment in accordance with the operating conditions in order to preserve durability and reliability, ensuring safe operation.</p> <p>PCB.05-7. The ability to make calculations and use of hydraulic and pneumatic drives in the chemical, construction and food industries.</p> <p>PCB.05-8. Knowledge of basic principles, objectives and terminology of standardization and certification.</p>
<p><b>133.08 – Automated and robotic technological complexes in mechanical engineering</b></p>	<p>PCB.08-1. The ability to use methods and technical means to measure the basic parameters of automated technological objects and systems of mechanical engineering.</p> <p>PCB.08-2. The ability to perform kinematic analysis of automated machine tools, to make kinematic schemes of</p>

	<p>mechanisms that perform the main and auxiliary movements for shaping the surfaces of parts by the method of cutting.</p> <p>PCB.08-3. The ability to design manufacturing processes for the manufacture of parts using automated process control systems.</p> <p>PCB.08-4. Ability to use methods and technical means for the development of technological processes of automated engineering production.</p> <p>PCB.08-5. The ability to apply basic knowledge of microprocessor technology, develop and calculate circuits of automated electric drives of technological systems of mechanical engineering, determine the composition of their equipment and calculate the modes of their operation.</p> <p>PCB.08-6. Fluency in basic knowledge and practical skills in the field of modern information technologies, programming skills and work in computer networks, the ability to apply in professional activities the hardware and software of computer networks and telecommunications.</p> <p>PCB.08-7. The ability to design the process of machining parts, develop control programs for CNC machines, develop the structure and the necessary types of support for flexible manufacturing systems for mechanical processing of engineering products.</p> <p>PCB.08-8. The ability to acquire skills in working with automated systems for designing various geometric objects and mechanisms that are used in the design of process equipment.</p>
<p><b>133.09 – Mechatronic vehicle systems</b></p>	<p>PCB.09-1. The ability to analyze the design and principles of operation of units and vehicle systems, to determine their structure and composition.</p> <p>PCB.09-2. The ability to calculate and apply electric, hydraulic and pneumatic drives, electrical, electromechanical and electronic equipment in vehicles.</p> <p>PCB.09-3. The ability to use the basic laws of the theory of systems and the theory of selection of optimal variants of the schemes of process control systems in aggregates and vehicle systems.</p> <p>PCB.09-4. Possession of the element base of modern electronic products, knowledge of the development of microelectronics and microprocessor technology in vehicles.</p> <p>PCB.09-5. The ability to perform the installation of components of control systems and to monitor the quality of these works.</p> <p>PCB.09-6. The ability to use numerical methods and optimization basics during the analysis and synthesis of microprocessor control systems for vehicles, aggregates and automatic control systems.</p> <p>PCB.09-7. The ability to determine and analyze the technical and operational parameters of vehicles, their mechanisms, systems, units and components.</p> <p>PCB.09-8. Ability to use mathematical methods for modeling workflows in basic systems and control systems in vehicles.</p>

## 7 – Program learning outcomes

**Program learning outcomes in the specialty  
(defined by the draft standard of higher  
education in the specialty)**

- LO-1. The ability to demonstrate knowledge and understanding of the fundamentals of basic and engineering sciences that underlie sectoral engineering.
- LO-2. The ability to demonstrate knowledge of mechanics and engineering and outline the prospects for their development.
- LO-3. The ability to demonstrate knowledge and understanding of microprocessor technology, automatic control systems of objects and processes of sectoral engineering.
- LO-4. The ability to set and solve engineering problems of sectoral engineering using appropriate design and experimental methods.
- LO-5. Ability to use the knowledge gained in the analysis of engineering objects, processes and methods.
- LO-6. Ability to work with the main sources of technical information, in particular, in a foreign language.
- LO-7. Ability to experiment and analyze data.
- LO-8. The ability to demonstrate understanding and ability to apply design methods and calculations of typical components and mechanisms according to the task, including on the basis of computer-aided design systems.
- LO-9. The ability to choose and apply the right equipment, tools and methods.
- LO-10. The ability to combine theory and practice to solve an engineering problem.
- LO-11. Ability to demonstrate professional knowledge and skills.
- LO-12. The ability to understand the problems of labor protection and provide for the social consequences of the implementation of technical specifications.
- LO-13. The ability to apply technical control tools for estimating the parameters of objects and processes in sectoral engineering.
- LO-14. The ability to demonstrate an understanding of the structure and services of enterprises of sectoral engineering.
- LO-15. Ability to design, prepare production and operate products using automatic life cycle support systems.
- LO-16. The ability to successfully communicate with the engineering community, in particular, in a foreign language.
- LO-17. The ability to understand the need to learn independently throughout life.
- LO-18. The ability to use knowledge in solving the problem of improving product quality.
- LO-19. The ability to solve complex specialized tasks and practical problems in a particular area of professional activity or in the learning process, which involves the application of certain theories and methods of the relevant science and is characterized by complexity and uncertainty of conditions.

<b>Program learning outcomes in blocks of disciplines (defined by the university)</b>	
<b>133.01 – Automobiles and tractors</b>	<p>LOB.01-1. To be able to analyze the current state of development of the automotive and tractor field of mechanical engineering, know the principles of functioning of cars, tractors and special equipment based on them.</p> <p>LOB.01-2. To be able to analyze the structures and principles of functioning of the units and systems of automobiles and tractors, to determine their structure and composition.</p> <p>LOB.01-3. Demonstrate the skills of using methods for analyzing and calculating automobiles and tractor designs, assessing the mechanical strength of engineered structures, designing automobiles and tractor units and systems, using computer-aided design systems.</p> <p>LOB.01-4. To be able to develop technological processes for the production of standard parts and the assembly of automobile and tractors units.</p> <p>LOB.01-5. Demonstrate the skills of calculating and applying electric, hydraulic and pneumatic drives in automobiles and tractors.</p> <p>LOB.01-6. To be able to use optimization methods when calculating the structures and elements of automobiles and tractors.</p> <p>LOB.01-7. Have skills in designing new and modernizing existing chassis, suspension and transmission of automobiles and tractors.</p> <p>LOB.01-8. To be able to use mathematical methods for modeling workflows in the elements of automobiles and tractors.</p>
<b>133.02 – Automated design of all terrain vehicles</b>	<p>LOB.02-1. To be able to analyze the structures and principles of functioning of the aggregates and systems of all terrain vehicles (ATV), to determine their structure and composition.</p> <p>LOB.02-2. To be able to calculate and apply electric, hydraulic and pneumatic drives, electrical, electromechanical and electronic equipment in ATV.</p> <p>LOB.02-3. Know and be able to use the methods of analysis and calculations of the construction of ATV, to assess the mechanical strength of the designed structures, including using automated design systems.</p> <p>LOB.02-4. To be able to design and upgrade components and systems of ATV.</p> <p>LOB.02-5. To know and be able to develop the main types of technological processes for manufacturing parts and assembling units of ATV.</p> <p>LOB.02-6. To know and be able to use numerical methods and optimization basics when calculating structures and elements of ATV.</p> <p>LOB.02-7. Know the basic principles and be able to carry out the organization of operation, maintenance and repair of ATV.</p> <p>LOB.02-8. Know and be able to use mathematical methods for modeling workflows in ATV systems.</p>

<p><b>133.03 – Machines and mechanisms of oil and gas industry</b></p>	<p>LOB.03-1. Know the main types of technique, technology and equipment regarding the production, transportation and storage of hydrocarbons.</p> <p>LOB.03-2. To be able to determine the main characteristics of the field for its further development.</p> <p>LOB.03-3. Know and be able to analyze the laws of viscous fluid flow and drilling fluids, and be able to evaluate the influence of the parameters of a drilling fluid on its characteristics.</p> <p>LOB.03-4. To be able to choose pumping and hydraulic equipment according to operational characteristics, analyze hydraulic circuits and design volumetric hydraulic actuators according to them.</p> <p>LOB.03-5. To be able to design machinery and equipment related to the drilling, extraction and transportation of oil and gas.</p> <p>LOB.03-6. To be able to develop tooling and technological processes for the manufacture of parts, devices and other technological equipment that is used for drilling, production and transportation of oil and gas.</p> <p>LOB.03-7. Know the basic principles and be able to design mechanical and hydraulic equipment for pumping hydrocarbons.</p> <p>LOB.03-8. Know the basic principles and be able to calculate and develop structures and elements of hydraulic machines of wide use.</p>
<p><b>133.04 – Lifting-and-Shifting, road, construction, land reclamation machines and equipment</b></p>	<p>LOB.04-1. Understand the place and the role of Lifting-and-Shifting, road, construction, land-reclamation machines and equipment in the socio-economic development of Ukraine and the World; own the modern state of technology in this area and the trends of its development; navigate in professional terminology and be able to use it in professional activities.</p> <p>LOB.04-2. To have the skills to develop and use design and working technical documentation using application software packages in the design of Lifting-and-Shifting, road, construction, land reclamation machines and equipment, taking into account their design features.</p> <p>LOB.04-3. To be able to select and apply hardware and software to automate Lifting-and-Shifting, road, construction, land reclamation machines and equipment, analyze the results and build appropriate conclusions.</p> <p>LOB.04-4. Know the basic principles and be able to compose, design, use methods of analysis and calculations of the mechanical strength of metal structures of Lifting-and-Shifting, road, construction, land reclamation machines and equipment.</p> <p>LOB.04-5. Know the basic principles and be able to develop technological processes for the manufacture and assembly of Lifting-and-Shifting, road, construction, land reclamation machines and equipment.</p> <p>LOB.04-6. Know the basic principles and be able to calculate, design and operate the systems of hydraulic and pneumatic drives in Lifting-and-Shifting, road, construction, land reclamation machines and equipment.</p> <p>LOB.04-7. To be able to develop the technology of functioning of warehouse complexes and to carry out the selection of technical equipment for its implementation.</p>

	<p>LOB.04-8. Know the basic principles and be able to carry out the organization of operation, maintenance and repair of Lifting-and-Shifting, road, construction, land reclamation machines and equipment, taking into account the special requirements for the safety of their operation.</p>
<p><b>133.05 – Equipment for Food, Processing and Chemical Production</b></p>	<p>LOB.05-1. Know the basic methods and be able to carry out calculations of thermodynamic potentials, equilibrium in homogeneous and heterogeneous systems, equilibrium chemical reactions; master the method of solving scientific and technical issues related to the transformation of energy in chemical processes, the ability to analyze the physical nature of the basic processes that occur in equipment.</p> <p>LOB.05-2. Know and possess engineering techniques and skills of calculations and design of devices where the main processes of chemical technology take place, typical elements of technological schemes of chemical production and their interrelations, be able to analyze technological schemes of chemical production, classify them by type or type.</p> <p>LOB.05-3. Possess the basic requirements for structural materials in chemical process equipment; understand the technological basics of processing construction materials by pressure, cutting, welding, etc.; have skills in the development of technological processes of manufacturing parts for a given release program with all the basic calculations; know the theory of strength calculation of thin-walled shells and their practical application.</p> <p>LOB.05-4. To be able to distinguish between the types and kinds of installation work on the production, documentation on their implementation; have skills in calculating standard installation equipment, depending on the type of work in a chemical plant; be able to assemble the equipment and carry out the assembly study of the project.</p> <p>LOB.05-5. Know the basic principles and be able to analyze the technological schemes of food production; classify them by type or kind; have skills in calculating standard elements of technological schemes of food production and their interrelations; be able to make a choice of base samples and a nomenclature of food quality indicators.</p> <p>LOB.05-6. Be able to provide recommendations on the use of protective equipment for process equipment according to the operating conditions in order to preserve durability, reliability and ensure safe operation.</p> <p>LOB.05-7. Know the basic methods and be able to calculate and use hydraulic and pneumatic actuators in the chemical, construction and food industry.</p> <p>LOB.05-8. Know the basic principles, objectives and terminology of standardization and certification.</p>

**133.08 – Automated and robotic technological complexes in mechanical engineering**

- LOB.08-1. To be able to use methods and technical means for measuring the basic parameters of automated technological objects and systems of mechanical engineering.
- LOB.08-2. Know the ways and be able to perform kinematic analysis of automated metal-cutting machine tools, make kinematic diagrams of mechanisms that perform the main and auxiliary movements for shaping the surfaces of parts by the cutting method.
- LOB.08-3. Know the principles and be able to design technological processes for manufacturing parts using automated process control systems.
- LOB.08-4. To know and be able to use methods and technical means for the development of technological processes of automated engineering production.
- LOB.08-5. To be able to apply basic knowledge of microprocessor technology, to develop and calculate circuits of automated electric drives of technological systems of mechanical engineering, to determine the composition of their equipment and to calculate the modes of their operation.
- LOB.08-6. Freely possess basic knowledge and practical skills in the field of modern information technologies, programming skills and work in computer networks, be able to use in professional activity the hardware and software of computer networks and telecommunications.
- LOB.08-7. To be able to design parts processing, develop control programs for CNC machines, develop the structure and the necessary types of support for flexible production systems for the mechanical processing of engineering products.
- LOB.08-8. Have skills to work with automated systems for designing various geometric objects and mechanisms that are used in the design of process equipment.

**133.09 – Mechatronic vehicle systems**

- LOB.02-1. To be able to analyze the structures and know the principles of functioning of the units and systems of vehicles, to determine their structure and composition.
- LOB.02-2. To be able to calculate and apply electric, hydraulic and pneumatic drives, electrical, electromechanical and electronic equipment in vehicles.
- LOB.02-3. To know and be able to use the basic laws of the theory of systems and the theory of the selection of optimal variants of the schemes of process control systems in aggregates and vehicle systems.
- LOB.02-4. To possess the element base of modern electronic products, to know the development of microelectronics and microprocessor technology in vehicles.
- LOB.02-5. To be able to carry out the installation of components of control systems and carry out quality control of these works.
- LOB.02-6. Know and be able to use numerical methods and the basics of optimization during the analysis and synthesis of microprocessor-based vehicle control systems, aggregates and automatic control systems.
- LOB.02-7. To be able to determine and analyze the

	<p>technical and operational parameters of vehicles, their mechanisms, systems, units and components.</p> <p>LOB.02-8. Know and be able to use mathematical methods for modeling workflows in basic systems and control systems in vehicles.</p>
<b>8 – Resource support for the implementation of the program</b>	
<b>Staffing support</b>	<p>The program meets the personnel requirements for ensuring the conduct of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Ukrainian Cabinet of Ministers "On approval of the licensing conditions for the educational activities of educational institutions" dated December 30, 2015 No. 1187, Appendix 12).</p>
<b>Material and technical support</b>	<p>The program meets the requirements regarding the material and technical support of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Ukrainian Cabinet of Ministers "On approval of the licensing conditions for the educational activities of educational institutions" dated December 30, 2015 No. 1187, Appendix 12).</p>
<b>Informational, educational-and-methodological support</b>	<p>The program meets the requirements for Informational, educational-and-methodological support of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Ukrainian Cabinet of Ministers "On approval of the licensing conditions for the educational activities of educational institutions" dated December 30, 2015 No. 1187, Appendix 12).</p>
<b>9 – Academic mobility</b>	
<b>National Credit Mobility</b>	<p>On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and the leading technical universities of Ukraine.</p>
<b>International Credit Mobility</b>	<p>On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and educational institutions of higher education of foreign partner countries.</p>
<b>Training foreign applicants for higher education</b>	<p>Education is possible after studying the course of the Ukrainian language.</p>



## 2. LIST OF EDUCATIONAL PROGRAM COMPONENTS

Code	Components of the educational program (discipline, projects / work, practice, qualification work)	Number of ECTS credits	Final control form
1	2	3	4
<b>MANDATORY COMPONENTS OF THE EDUCATIONAL PROGRAM</b>			
<b>1. The cycle of general training</b>			
GT.1	History and Culture of Ukraine	4,0	Exam
GT.2	Vocational Language	10,0	Test (1), Exam (2)
GT.3	Foreign Language	8,0	Tests (2, 3, 7, 8)
GT.4	Ukrainian as a foreign language	9,0	Tests (3, 4), Exam (5)
GT.5	Higher Mathematics	19,0	Exams ( 1-4)
GT.6	Physics	13,0	Exams ( 1-3)
GT.7	Chemistry	4,0	Exam
GT	Physical Education	12,0	Tests ( 1-6)
<b>2. The cycle of professional and practical training</b>			
<b>2.1. Professional training for the specialty</b>			
PT 1	Fundamentals of Occupational Safety and Health	3,0	Exam
PT 2	Enterprise Economy	3,0	Test
PT 3	Descriptive Geometry, Engineering and Computer Graphics	6,0	Exam (1), Test (2)
PT 4	Theoretical Mechanics	7,0	Exam (3), Tests (4)
PT 5	Heat Engineering	4,0	Exam
PT 6	Theory of Mechanisms and Machines	7,0	Test (4), Exam (5)
PT 7	Strength of Materials	8,0	Exams ( 5-6)
PT 8	Machine Parts	7,0	Test (5), Exam (6)
PT 9	Interchangeability, Standardization and Technical Measurements in Mechanical Engineering	4,0	Exam
PT 10	Applied Materials	3,0	Test
PT 11	Electrical Engineering, Electronics and Microprocessor Technology	4,0	Exam
PT 12	Technology of Construction Materials	3,0	Test
<b>2.2. Practical training</b>			
	Practice	6	Test
	Preparation of qualification work (QW)	6	Protection of the QW
<b>Total Mandatory Components</b>		<b>150</b>	

Code	Components of the educational program (discipline, projects / work, practice, qualification work)	Number of ECTS credits	Final control form
1	2	3	4
<b>3. SELECTIVE COMPONENTS OF THE EDUCATIONAL PROGRAM (BY BLOCKS)</b>			
<b>Discipline block 01 "Automobiles and Tractors"</b>			
SB1.1	Introduction to the Profession	3,0	Test
SB1.2	Modern Information Technology in Automotive Engineering	10,0	Exams (1, 3)
SB1.3	The Construction of Automobiles and Tractors and their Analysis	12,0	Exams (3, 4)
SB1.4	Computer-aided Design Systems in Automotive and Tractor Engineering	6,0	Exam
SB1.5	Theory and Design of Automobiles and Tractors	12,0	Exams (5, 6)
SB1.6	Technological Basis of Engineering	4,0	Exam
SB1.7	Production Technology of Automobiles and Tractors	5,0	Exam
SB1.8	Hydraulics	4,0	Exam
SB1.9	Basics of the Construction Optimization of Automobiles and Tractors	6,0	Exam
SB1.10	Automated Design of Automobiles and Tractors Systems	3,0	Test
SB1.11	Oscillations and Vibration Protection of Automobiles and Tractors	5,5	Exam
SB1.12	Theory of Continuously Variable and Hybrid Transmissions of Automobiles and Tractors	3,0	Exam
SB1.13	Mathematical Models and Automated Analysis of Automobile and Tractor Systems	4,5	Exam
<b>Discipline block 02 "Automated Design of All Terrain Vehicles"</b>			
SB2.1	Introduction to the Profession	3,0	Test
SB2.2	Computer Science and Programming Basics	10,0	Exams (1, 3)
SB2.3	Constructions of All Terrain Vehicles (ATV)	12,0	Exams (3, 4)
SB2.4	Numerical Methods and Optimization Basics	6,0	Exam
SB2.5	Theory of ATV	6,0	Exam
SB2.6	CAD systems	11,0	Exams (5, 6)
SB2.7	Technological Basis of Engineering	4,0	Exam
SB2.8	Hydraulics	4,0	Exam
SB2.9	Special Questions of the ATV Theory	6,0	Exam
SB2.10	Basics of ATV Automation	3,0	Test
SB2.11	Design and Calculation of ATV	5,5	Exam
SB2.12	Technical Operation, Maintenance and Repair Basics for ATV	3,0	Exam
SB2.13	Systems of ATV	4,5	Exam
<b>Discipline block 03 "Machines and Mechanisms of Oil and Gas Industry"</b>			
SB3.1	Introduction to the Profession	3,0	Test
SB3.2	Information Technologies and Programming	10,0	Exams (1, 3)
SB3.3	Hydraulics, Hydraulic and Pneumatic Drives	6,0	Exam
SB3.4	Fundamentals of Underground Hydraulics and Filtration Theory	6,0	Exam
SB3.5	Mechanics of Viscous Fluid and Drilling Fluids	6,0	Exam

1	2	3	4
SB3.6	Fundamentals of the Theory of Hydraulic Machines Workflow	6,0	Exam
SB3.7	Technological Basis of Engineering	10,0	Exams (6, 7)
SB3.8	Machines and Equipment for Drilling Oil and Gas Wells	4,0	Exam
SB3.9	Machines and Equipment for Oil and other Hydrocarbons Mining	8,0	Exams (7, 8)
SB3.10	Hydraulic Engines and Transmissions	9,0	Exam (7), test (8)
SB3.11	Hydraulic and Pneumatic Superchargers	5,5	Exam
SB3.12	Hydraulic Machines Designing	4,5	Exam
<b>Discipline block 04 "Lifting-and-Shifting, Road, Building, Land-Reclamation Machines and Equipment"</b>			
SB4.1	Introduction to the Profession	3,0	Test
SB4.2	Calculations and Modeling in Lifting-and-Shifting Machines (LSM)	10,0	Exams (1, 3)
SB4.3	Design Technology of LSM	5,0	Exam
SB4.4	Design and Modeling of LSM	12,0	Exams (4, 5)
SB4.5	SMART-Technologies of LSM and Build-and-Road Machines (BRM)	6,0	Exam
SB4.6	Manufacturing Technology of LSM and BRM	11,0	Exams (6, 7)
SB4.7	Metalwares of LSM	4,0	Exam
SB4.8	Lifting Machines	6,0	Exam
SB4.9	Hydraulic Drive of LSM and BRM	4,0	Exam
SB4.10	Certification and Standardization of LSM	3,0	Test
SB4.11	BRM	5,5	Exam
SB4.12	Technical Equipment of Storage Systems	3,0	Exam
SB4.13	Operation, Maintenance, Diagnostics and Repairing of LSM	4,5	Exam
<b>Discipline block 05 "Equipment for Food, Processing and Chemical Production"</b>			
SB5.1	Introduction to the Profession	3,0	Test
SB5.2	Computer Science	5,0	Exam
SB5.3	Bases of CAD	6,0	Exam
SB5.4	Hydraulics, Hydraulic and Pneumatic Actuator	5,0	Test
SB5.5	Bases of thermodynamics	6,0	Exam
SB5.6	Processes and Apparatuses of Chemical Technology	12,0	Test (4), Exam (5)
SB5.7	Technological Equipments of Chemical Production	6,0	Exam
SB5.8	Technological Basis of Engineering	4,0	Exam
SB5.9	Designing Industrial Objects Using CAD	6,0	Exam
SB5.10	Technological Equipments of Processing and Food Production	6,0	Exam
SB5.11	Installation, Operation and Machine Maintenance	3,0	Test
SB5.12	Equipment Calculation and Designing in Processing and Food Industrials	5,0	Exam
SB5.13	Anti-corrosive Protection of Equipment	3,5	Exam
SB5.14	Reactors and Apparatuses Designing Theory in Processing, Food and Chemical Industrials	4,5	Exam
SB5.15	Safety of Food and Foodstuffs	3,0	Test

1	2	3	4
<b>Discipline block 08 " Automated and Robotic Technological Complexes in Mechanical Engineering"</b>			
SB8.1	Introduction to the Profession	3,0	Test
SB8.2	Informatics	5,0	Exam
SB8.3	Computer Technologies in engineering	5,0	Exam
SB8.4	Microprocessor and Software Automation	6,0	Exam
SB8.5	Process Measurements and Instrumentation	6,0	Exam
SB8.6	Fundamentals of Computer-aided Design Systems (CAD)	6,0	Exam
SB8.7	Automated Metal Cutting Equipment	6,0	Exams (5, 6)
SB8.8	Technological Basis of Engineering	4,0	Exam
SB8.9	Automation Control Systems of Technological processes	4,0	Exam
SB8.10	Technology of Aided Engineering Production	6,0	Exam
SB8.11	Automatic Electric Drives	5,0	Exam
SB8.12	Industrial networks	3,5	Test
SB8.13	Programming of Machining with NC-machining Technique	4,5	Exam
SB8.14	Flexible Automated Manufacturing	3,5	Exam
SB8.15	Computer-aided Design of Technological Processes	4,5	Exam
<b>Discipline block 09 "Mechatronic Systems of Vehicles"</b>			
SB9.1	Introduction to the Profession	3,0	Test
SB9.2	Computer Engineering and Algorithmic Languages	10,0	Exams (1, 3)
SB9.3	Vehicle Structures	6,0	Exam
SB9.4	Components of Mechatronic Systems	12,0	Exams (4, 5)
SB9.5	Theoretical Foundations of Electrical Engineering	6,0	Exam
SB9.6	Theory of Vehicles	6,0	Exam
SB9.7	Technological Basis of Engineering	4,0	Exam
SB9.8	Design and Calculation of Vehicles	5,0	Exam
SB9.9	Hydraulics	4,0	Exam
SB9.10	Simulation of Mechatronic Systems for Vehicles	6,0	Exam
SB9.11	Basics of Automation for Vehicles	3,0	Test
SB9.12	Development Tools of Mechatronic Systems	5,5	Exam
SB9.13	Installation and Commissioning of Electrotechnical Devices	3,0	Exam
SB9.14	Electrical Equipment of Vehicles	4,5	Exam
<b>4. SELECTIVE COMPONENTS OF THE EDUCATIONAL PROGRAM (STUDENT SELECTION)</b>			
SS1	Discipline 1	4,0	Test
SS2	Discipline 2	4,0	Test
SS3	Discipline 3	4,0	Test
<b>Total Selective Components</b>		<b>90</b>	
<b>TOTAL VOLUME OF EDUCATIONAL PROGRAM</b>		<b>240</b>	

### 3. DISTRIBUTION OF THE CONTENT OF THE EDUCATIONAL PROGRAM BY GROUPS OF COMPONENTS AND CYCLES OF TRAINING

№	Training Cycle	The volume of study load for the applicant of higher education (credits / %)		
		Mandatory Components of the Educational Program	Selective Components of the Educational Program	Total for the Entire Period of Study
1	2	3	4	5
1	Cycle of general training	<b>76/31,7</b>	<b>0/0</b>	<b>76/31,7</b>
2	Cycle of professional and practical training	<b>62/25,8</b>	<b>102/42,5</b>	<b>164/68,3</b>
Total for the Entire Period of Study		<b>138/57,5</b>	<b>102/42,5</b>	<b>240/ 100</b>

### 4. FORM OF ATTESTATION OF HIGHER EDUCATION APPLICANTS

Attestation of graduates of the educational program of the specialty 133 “Sectoral engineering” is carried out in the form of protection of qualification undergraduate work and ends with the issuance of a standard document on awarding a bachelor's degree with qualification assignment: “Bachelor of Sectoral Engineering”.

The attestation is carried out openly and publicly.