

**THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
LVIV POLYTECHNIC NATIONAL UNIVERSITY**



**EDUCATION – SCIENTIFIC PROGRAM  
"Industrial machinery engineering"  
third (educational-scientific) level of higher education  
Field of study 13 Mechanical engineering  
Program Subject Area 133 Machine Building  
Doctor of Philosophy Degree**

Considered and approved  
Academic Council of the University  
( protocol № 74  
from «25» 05 2021 )

**LETTER OF AGREEMENT  
EDUCATION – SCIENTIFIC PROGRAM**

Level of higher education	the third (scientific and educational)
Field of study	13 Mechanical engineering
Program Subject Area	133 Machine Building
Qualification	Doctor of Philosophy Degree

**DEVELOPED AND APPROVED**

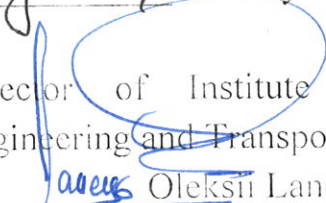
Scientific and methodical commission of  
specialty 133 Machine Building

Protocol № 2  
from « 11 » 02 2021

Head of the EMC of the specialty

 Zinoviy Stotsko

Director of Institute of Mechanical  
Engineering and Transport

 Oleksii Lanets  
« 15 » 02 2021

**RECOMMENDED**

Scientific and methodological council of  
the university

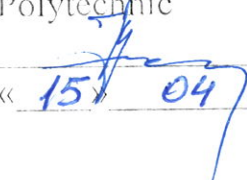
Protocol № 56  
from « 13 » 05 2021

The head of the SMC of the university

 Anatolii Zahorodnii

**AGREED**

Vice-rector for science  
works of the National University "Lviv  
Polytechnic"

 Ivan Demydov  
« 15 » 04 2021

Vice-rector for scientific and  
pedagogical work

 Oleh Davydchak  
« 12 » 05 2021

Head of educational and methodical  
department

 Valerii Sviridov  
« 12 » 05 2021

It was developed by the working group for ensuring the quality of the educational and scientific program, according to which the training of applicants at the third (educational and scientific) level of higher education in the specialty 133 " Machine Building " is carried out as part of:

<b>Head of the working group (guarantor):</b> Vasyl Dmytriv	D.Sc.Tech., professor, Head of Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University;
<b>Members:</b> Zinoviy Stotsko	D.Sc.Tech., professor, professor of Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University, Ukraine;
Orest Horbay	D.Sc.Tech., professor, professor of Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University, Ukraine;
Volodymyr Maystruk	Ph.D., Assoc. prof., of Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University;
Petro Yatsunskyi	Ph.D., Lecturer at the Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University;
Oleh Sahan	Postgraduate Student of Department of Machine Design and Automotive Engineering, Lviv Polytechnic National University;
Roman Kachmar	Chief engineer of the state enterprise "Lviv State Aviation Repair Plant".

Guarantor

D.Sc.Tech., professor Vasyl Dmytriv  
(scientific degree, academic title, full name)

Approved and put into effect by the Order of the Rector of the National University "Lviv Polytechnic" from « 1 » 06 2021 p. № 325-1-10

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# I. EDUCATIONAL COMPONENT OF THE EDUCATIONAL - SCIENTIFIC PROGRAM

## 1. Doctor of Philosophy program profile Field of study 13 *Mechanical engineering* Programme Subject Area 133 *Machine Building*

1 – General information	
1	2
Full name of the higher education institution and structural division	LVIV POLYTECHNIC NATIONAL UNIVERSITY
The full title of the qualification in the original language	Doctor of Philosophy in Mechanical Engineering by Specialty of Machine Building
The official name of the educational-scientific program	Machine Building
Type of diploma and scope of the educational program	Diploma of Doctor of Philosophy, single, 43 ECTS credits of the educational component of the educational and scientific program, the term of the educational component of the educational-scientific program is 2 years
Cycle/level	NRC Ukraine – 8 level, FQ-EHEA – third cycle, EQF-LLL – 8 level
Prerequisites	Level of higher education "Master"
Language(s) of instruction	Ukrainian language
Basic concepts and their definitions	The educational-scientific program uses the main concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" dated 07/01/2014 No. 1556-VII as amended, the Law of Ukraine "On Scientific and Scientific-Technical Activities" dated 11/26/2015 r. No. 848-VIII with amendments and additions, Procedure for the training of higher education applicants for the degree Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions), approved by Resolution of the Cabinet of Ministers No. 261 dated 23.03.2016
2 – The objective of educational program	
	To improve theoretical knowledge and practical abilities and skills in the field of Mechanical Engineering with the specialty "Industrial Mechanical Engineering", to develop philosophical and linguistic competences, to form universal skills of a researcher, sufficient for the conduct and successful completion of scientific research and further professional and scientific activities
3 - Characteristics of the educational program	
Subject area (field of knowledge, specialty)	Field of study 13 <i>Mechanical engineering</i> Program Subject Area 133 <i>Machine Building</i>
Orientation of the educational and scientific program	The educational - scientific program is based on normative provisions and the results of modern scientific research in the field of mechanical engineering, design methods, experimental studies, modeling, parametric optimization of structures, control of parameters and diagnostics to ensure the reliability of machines, which solve current problems and tasks in the field of mechanical engineering: design, calculations, manufacture, operation and repair of mechanisms and machines, creation of rational structures, improvement of the quality and efficiency of their work: development and improvement of manufacturing processes and technological equipment; research of dynamic processes in energy,

	technological, transport and other machines, devices and apparatuses, creation of methods for assessing their structural strength, durability and reliability at the stages of design, production and operation and directs the applicant to the solution of current tasks and problems in industrial mechanical engineering.
<b>The main focus of the educational and scientific program and specialization</b>	The educational - scientific program provides general scientific, professional, language competences and universal skills of the researcher, as well as in-depth knowledge in the chosen specialty. <b>Key words:</b> mechanical engineering, industrial mechanical engineering, English language, philosophy, methodology, pedagogy, scientific foundations, system analysis, machine design, dynamic processes, strength, planned experiment, modeling, diagnostics.
<b>Features of the program</b>	The educational component of the program is implemented during 4 semesters, with a duration of 43 credits and has disciplines in the corresponding 3 cycles that provide: language competences, universal skills of the researcher, knowledge in the chosen specialty, disciplines of the student's free choice.
<b>4 – Ability of graduates to employment and further education</b>	
<b>Suitability for employment</b>	Jobs in public and private higher education institutions, scientific and research institutions as teachers and researchers, in enterprises and organizations of various types of activities and forms of ownership in managerial positions.
<b>Further education</b>	Improvement of qualifications in research institutions, leading universities of Ukraine and abroad, scientific design and technological units of industrial enterprises of machine building and instrument building. Completion of the scientific program of the fourth (scientific) level of higher education to obtain the degree of Doctor of Science.
<b>5 – Teaching and assessment</b>	
<b>Teaching and learning</b>	A combination of lectures, practical classes, consultations, independent work on solving scientific and applied problems, consultations with teachers, preparation of the theoretical part of the PhD thesis.
<b>Assessment</b>	Written and oral exams, assessments and presentations of the results of dissertation research, defense of the dissertation with the participation of scientific and pedagogical workers from other universities and scientific institutions of the National Academy of Sciences of Ukraine.
<b>6 – Software competencies</b>	
<b>Integral competence (IC)</b>	The ability to solve complex scientific and applied problems and make decisions regarding the use of results in the practical activities of enterprises/institutions in the field of mechanical engineering, or in educational processes of universities and scientific programs of research institutes, which involves the application of theories and methods of designing machines and their manufacturing technologies and are characterized by complexity and uncertainty.
<b>General competences (GC)</b>	1. <i>Research ability.</i> The ability to form a systematic scientific outlook, professional ethics and a general cultural outlook. Ability to initiate and carry out (individually or in a scientific group) scientific research leading to new knowledge in industrial mechanical engineering of a quality that meets the requirements of reviewers at the national and international levels. Ability to search and analyze information from various scientific domestic and foreign sources. The ability to effectively use in scientific practice various theories in the field of scientific and applied research in the specialty "Industrial

Mechanical Engineering". The ability to solve scientific and applied problems and make appropriate informed decisions, to form new scientific ideas and topical problems in the field of mechanical engineering, to choose appropriate directions and appropriate methods for their implementation, taking into account the available resources. Ability to use information technologies and computer programs in the field of mechanical engineering (working with NMBD, forming reasonable references to literary sources, etc.).

2. *Group work.* Ability to work in a scientific group, understanding responsibility for work results, taking into account budget costs and personal commitments. Present the results of research and innovation to colleagues.
3. *Creativity.* The ability to produce new scientific and scientific-applied ideas, to show creativity, the ability to system thinking when achieving scientific goals.
4. *Communication skills.* Ability to communicate effectively with special and general audiences, to present complex information in a convenient and understandable manner orally and in writing, using appropriate technical vocabulary and methods. Ability to communicate with colleagues in the field of mechanical engineering about scientific advances, both at the general level and at the level of a scientist professional.
5. *International outlook.* Acquisition of language competences sufficient to present and discuss the scientific results of work in a foreign language in oral and written form. Ability to work in an international group, respect national and cultural traditions, ways of working of other group members.
6. *Management skills.* Acquiring the competence of effective management of scientific projects, drawing up proposals for financing scientific developments. Ability to work under time and resource constraints, and to motivate and manage others to achieve goals. Ability to demonstrate a significant range of management skills, methods, tools, practices that are relevant to the field of study. The ability to analyze and synthesize, which allows you to formulate conclusions for various types of complex management tasks, plan, analyze, control and evaluate your own work and the work of others. The ability to effectively use in practice various theories in the management of science and in the field of business administration. Acquiring skills in covering the results of scientific work in Ukrainian and foreign languages using modern information technologies.
7. *Teaching abilities.* Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (working with VNS, Microsoft Teams, Zoom, etc.). Competence to teach undergraduate students in practical and laboratory classes.
8. *Ethical obligations.* Demonstrate commitment to ethical obligations and ethical conduct in scientific research. Ability to demonstrate awareness of equal opportunities and gender issues. Correct understanding and respect for multiculturalism and diversity.
9. *Critical and self-critical abilities.* Participate in critical dialogue, conduct and initiate complex social processes in one's professional field. The ability to be critical and self-critical in order to understand

	<p>factors that have a positive or negative impact on communication, and the ability to identify and take into account these factors in specific communication situations.</p> <p>10. <i>Social skills</i>. The ability to learn, to perceive the acquired knowledge in the subject area and to integrate it with the existing knowledge. Ability to plan and manage time. The ability to act with social responsibility and civic consciousness. Determination and perseverance in the performance of the assigned tasks and responsibility for the quality of the work performed. Orientation to the protection and preservation of the natural environment. The ability to adapt and work in new situations, evaluate and maintain the quality of work performed, motivate people and move towards a common goal.</p>
<p><b>Special (professional) competences (SC)</b></p>	<p>1. <i>Research abilities</i>. Acquisition of meaningful knowledge of industrial mechanical engineering, in particular assimilation of the basic concepts of the development of mechanical engineering, understanding of theoretical and practical problems facing modern mechanical engineering, the history of development and the current state of scientific research in this field. Ability to carry out original research in mechanical engineering and achieve scientific results that create new knowledge, with special attention to current tasks/problems and using the latest scientific methods. Possess knowledge in the field of mechanical engineering and fundamental sciences, necessary for mastering disciplines that provide knowledge in the chosen specialty and disciplines of the graduate student's free choice.</p> <p>2. <i>Technological abilities</i>. Competence in the use of scientific equipment and technologies related to mechanical engineering. The ability to develop technological documentation in the field of mechanical engineering during the implementation of the development of machines and mechanisms in the relevant areas of mechanical engineering. Ability to master generally accepted technical terminology in mechanical engineering, including in a foreign language in accordance with the State Standards of Ukraine and ISO standards.</p> <p>3. <i>Design skills</i>. Competence in the design of machines and equipment of the relevant industries and the construction of experimental installations in general. To have scientific concepts, theories and methods necessary for understanding the principles of creating equipment in the relevant branch of mechanical engineering.</p> <p>4. <i>Data analysis skills</i>. The ability to analyze the data of theoretical and experimental studies conducted in the relevant field of mechanical engineering, which may require the use of appropriate computing resources. Acquisition of intellectual property rights registration skills.</p> <p>5. <i>Criticism and evaluation skills</i>. Ability to interpret experimental results and participate in discussions with experienced mechanical scientists regarding the scientific significance and potential implications of the results obtained.</p> <p>6. <i>Teaching abilities</i>. The ability to organize scientific and pedagogical activities in the relevant branch of mechanical engineering. The ability to apply scientific and pedagogical knowledge and practical skills to solve scientific and applied</p>

	<p>problems in the field of mechanical engineering. The ability to identify, classify and describe work related to scientific and pedagogical activities in the relevant field of mechanical engineering by using analytical methods and methods of modeling machines, their elements and production processes in the relevant industry.</p> <p>7. <i>Management skills.</i> Ability to establish cause-and-effect relationships, analyze and summarize external and internal management information to plan, organize, motivate employees and control the activities of subordinates working in the field of mechanical engineering.</p> <p>8. <i>Social skills.</i> Have knowledge of the basics of labor protection, industrial sanitation and fire safety in the organization of production. The ability to understand and take into account social, ecological, ethical, economic aspects that influence the formation of current and perspective decisions. Carefully research and understand social norms and relationships within your specific field of education and take action to change them. Ability to conduct business communications, knowledge and understanding of the scientific specialty to determine the structure of scientific research in the field of mechanical engineering.</p>
<p><b>7 –Program learning outcomes</b></p>	
<p><b>Knowledge (KN)</b></p>	<ol style="list-style-type: none"> <li>1. The ability to demonstrate meaningful knowledge of the relevant field of mechanical engineering and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, own scientific outlook and moral and cultural values, which will provide an opportunity to critically analyze the situation in the field of mechanical engineering.</li> <li>2. The ability to demonstrate in-depth knowledge and understanding of the classical and modern methodological and methodological base of research in the selected field of scientific research for the successful organization and conduct of scientific research in the relevant field of mechanical engineering, successful public defense of their results at scientific seminars and specialized scientific councils;</li> <li>3. Ability to demonstrate sufficient knowledge of a foreign language, necessary for oral and written presentation of the results of scientific research, conducting professional scientific dialogue, full understanding of English-language scientific texts.</li> <li>4. The ability to demonstrate knowledge and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, one's own scientific outlook and moral and cultural values.</li> <li>5. Ability to independently conduct scientific research and make decisions. The ability to plan and set research objectives, choose methods of experimental work, interpret and present the results of scientific research, give practical recommendations for their implementation in production.</li> <li>6. The ability to evaluate the technological system for its modeling and simulation as an object of research; to be able to choose appropriate methods of research and modeling, principles of building models; apply the obtained models for process and equipment design; determination of optimal process schemes and equipment operation modes; optimize management of production</li> </ol>



	<p>processes.</p> <p>7. Knowledge of failure models that are used to describe mechanical devices and systems of basic reliability indicators; ways of ensuring reliability indicators. Ability to calculate probabilistic characteristics of failure models for individual elements of mechanical devices and systems; calculate reliability indicators for non-renewable and renewable mechanical devices and systems; select the required type of backup and the number of backup elements.</p> <p>8. Ability to choose methods and means of technical control of parameters of technological machines; the ability to assess measurement accuracy; knowledge of the procedure for identifying reliable information about the object, which includes mathematical and (or) logical processing of control results; the ability to analyze the influence of the main parameters of the elements on the functional indicators of the equipment.</p> <p>9. The ability to competently and reasonably use mathematical apparatus to solve industry problems;</p> <p>10. The ability to use a variety of peripheral devices, methods and methods of effective use of information system hardware to solve practical problems.</p> <p>11. The ability to demonstrate in-depth knowledge of historical and modern trends, scientific development and practical experience in the development of mechatronic control systems of aggregates and car systems based on the analysis of the used conceptual, methodological and methodical principles.</p>
<p><b>Skill</b></p>	<p>1. The ability to conduct scientific research on the basis of identifying current scientific problems, defining goals and objectives, forming and critically analyzing the information base, substantiating research materials and formulating author's conclusions and proposals.</p> <p>2. The ability to apply knowledge and understanding to solve problems of synthesis and analysis of elements and systems characteristic of the chosen field of scientific research.</p> <p>3. The ability to integrate and apply acquired knowledge from various interdisciplinary fields in the process of solving theoretical and applied tasks in a specific area of research.</p> <p>4. The ability to conduct a scientific conversation and discussion in Ukrainian and a foreign language at an appropriate professional level, to present the results of scientific research in oral and written form, to organize and conduct training sessions.</p> <p>5. The ability to use modern information and communication tools and technologies to ensure effective scientific and professional communications.</p> <p>6. The ability to conduct a scientific conversation and discussion in Ukrainian and a foreign language at an appropriate professional level, to present the results of scientific research in oral and written form, to organize and conduct training sessions.</p> <p>7. The ability to conduct scientific research and implement scientific projects based on the identification of current scientific problems, definition of goals and objectives, formation and critical analysis of the information base, substantiation and commercialization of research results, formulation of author's conclusions and proposals.</p> <p>8. The ability to use well-known packages of applied mathematical programs for conducting scientific research, solving and analyzing</p>

	<p>scientific problems in the field.</p> <p>9. The ability to apply the acquired knowledge from various subject areas of industrial mechanical engineering to formulate and justify new theoretical provisions and practical recommendations in the investigated issues of scientific research.</p> <p>10. The ability to correctly choose theoretically justified and empirically verified simplifications of dynamic and static processes in aggregates and systems of wheeled vehicles for the correct application of methodologies and tools of scientific research.</p> <p>11. The ability to integrate and apply the acquired knowledge from various interdisciplinary fields in the process of solving theoretical and applied tasks in a specific area of research on the problems of wheeled and tracked vehicles.</p> <p>12. The ability to apply the acquired knowledge to formulate and substantiate new theoretical propositions and practical recommendations in a specific area of research.</p> <p>13. The ability to develop logical and justified sequences, systems, mechanisms, models, etc. for specific objects of research, their practical implementation in industrial mechanical engineering.</p>
<b>Communication (COM)</b>	<p>1. The ability to communicate in business scientific and professional language, to use different speech styles, communication methods and techniques, to demonstrate a wide scientific and professional vocabulary.</p> <p>2. The ability to use modern information and communication tools and technologies to ensure effective scientific and professional communications.</p>
<b>Autonomy and responsibility (A&amp;R)</b>	<p>1. Ability to adapt to new conditions, make decisions independently and initiate original research and innovation complex projects;</p> <p>2. The ability to realize the need for lifelong learning in order to deepen acquired and acquire new professional knowledge;</p> <p>3. The ability to take responsibility for the work performed and achieve the set goal in compliance with the requirements of professional ethics.</p> <p>4. Ability to demonstrate understanding of basic environmental principles, occupational health and safety, and their application.</p>

<b>8 – Resource support for program implementation</b>	
<b>Specific characteristics of personnel software</b>	100% of the teaching staff involved in teaching the cycle of disciplines that provide special (professional) competences of a graduate student in the specialty 133 "Industrial Mechanical Engineering" have relevant scientific degrees and academic titles.
<b>Specific characteristics of material and technical support</b>	Use of modern application programs: software complexes Autodesk AutoCAD and Autodesk Inventor, Delcam PowerSolution, ASCON COMPASS for designing, manufacturing and control of machine parts and technological equipment; Scilab for mathematical, engineering and scientific calculations; ALD RAM Commander for building failure trees and calculating machine reliability indicators; Microsoft Visio for data analysis and graphical representation.
<b>Specific characteristics of informational and methodological support</b>	The use of the virtual learning environment of the National University "Lviv Polytechnic" and author's theoretical and scientific-applied developments of the scientific and pedagogical staff of the university and other universities and research institutes.
<b>9 – Academic mobility</b>	

(Регламентується Постановою КМУ №579 «Про затвердження Положення про порядок реалізації права на академічну мобільність» від 12 серпня 2015 року)

<b>National credit mobility</b>	On the basis of bilateral agreements between Lviv Polytechnic National University and universities of Ukraine.
<b>International credit mobility</b>	Within the EU Erasmus+ program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries.
<b>Education of foreign students of higher education</b>	Possible.

**2. Distribution of content  
of the educational component of the educational - scientific program  
by component groups and preparation cycles**

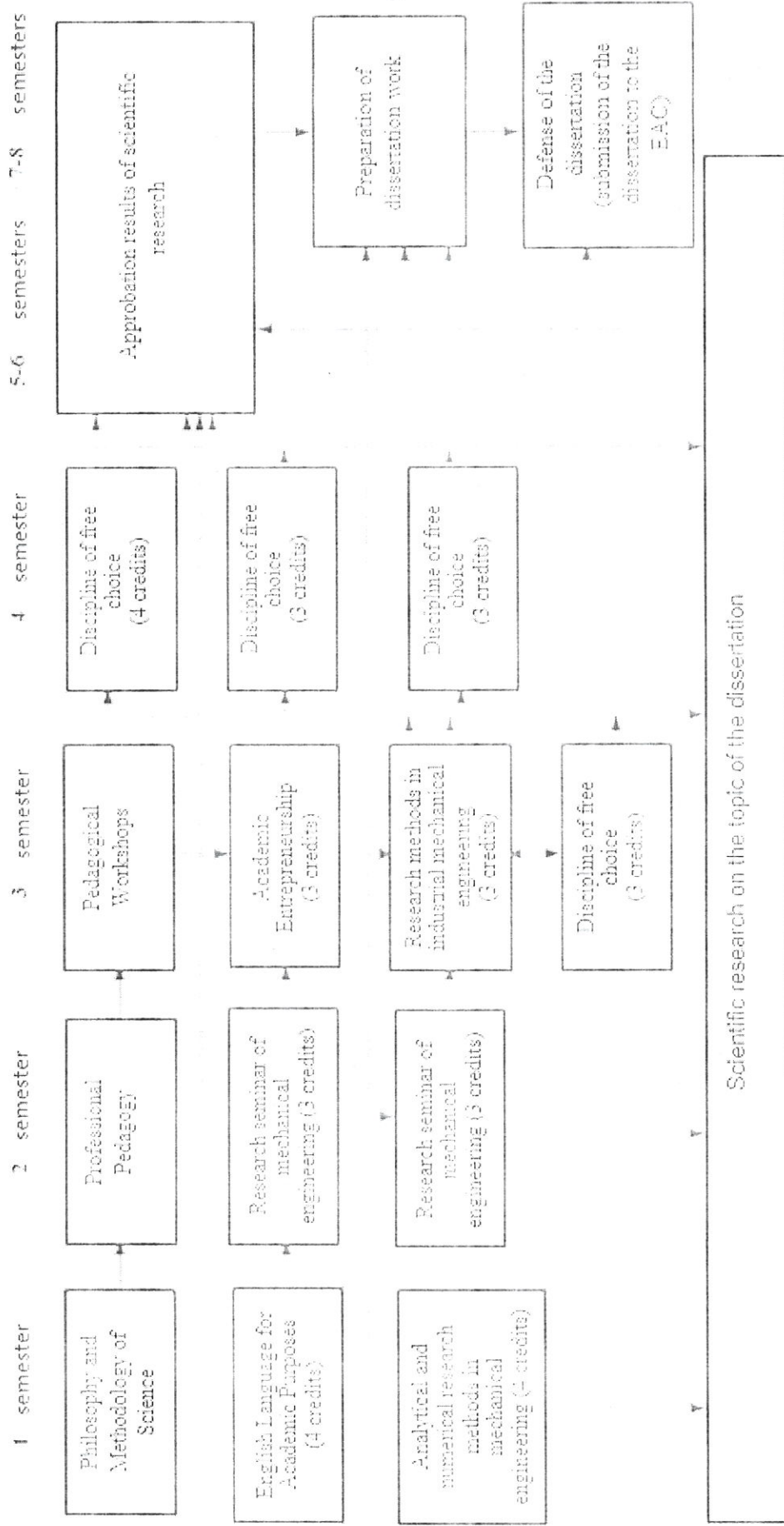
№ п/п	Training cycle	The amount of study load of a graduate student (credits / %)		
		Mandatory components of the educational component	Elective components of the educational component	In total for the entire term teaching
1	Cycle of disciplines that form general scientific competences and universal skills of the researcher	21 / 49	3 / 7	24 / 56
2	Cycle of disciplines forming professional competences	10 / 23	6 / 14	16 / 37
3.	Cycle of subjects of free choice of a graduate student:	-	-	
3.1	at the choice of the graduate student		3 / 7	3 / 7
<b>Total for the all period of study</b>		<b>31 / 72</b>	<b>12 / 28</b>	<b>43 / 100</b>

### 3. List of components of the educational component of the educational and scientific program

Discipline code	The educational component of the educational - scientific program	Semester	Sem. Control		Scope of work				Distribution by types of classes (hours)		
			Exam	Test	Cred.	Hours			Lectures	Laboratory	Practical
					ECTS	Total	Aud. work.	Indiv. work.			
1	2	3	4	5	6	7	8	9	10	11	12
<b>Mandatory components of the educational component</b>											
<i>Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>											
OK 1.1	Philosophy and Methodology of Science	1	1		3	90	30	60	15		15
OK 1.2	English Language For Academic Purposes, part 1	1		1	4	120	60	60			60
OK 1.3	English Language For Academic Purposes, part 2	1	1		4	120	60	60			60
OK 1.4	Professional Pedagogy	2		1	3	90	30	60	15		15
OK 1.5	Academic Entrepreneurship	3		1	4	120	30	90	15		15
OK 1.6	Pedagogical Workshops	3		1	3	90	30	60			30
<b>Total per cycle</b>					21	630	240	390			
<i>Cycle of disciplines forming professional competences</i>											
OK 2.1	Analytical and numerical research methods in mechanical engineering	1	1		4	120	30	90	15		15
OK 2.2	Research seminar in the field of mechanical engineering	2		1	3	90	30	60			30
OK 2.3	Research methods in industrial mechanical engineering	3		1	3	90	30	60			30
<b>Total per cycle</b>					10	300	90	210			
<b>Elective components of the educational component</b>											
<i>Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>											
BB 1.1	Business Foreign Language	3		1	3	90	30	60			30
BB 1.2	Psychology of Creativity and Invention	3		1	3	90	30	60	15		15
BB 1.3	Management of Scientific Projects	3		1	3	90	30	60	15		15
BB 1.4	Technology of Processing Grant Applications and Patents	3		1	3	90	30	60	15		15
BB 1.5	Rhetoric	3		1	3	90	30	60			30
BB 1.6	Modern inventions in research activities	3		1	3	90	30	60	15		15
BB 1.7	Open scientific practices	3		1	3	90	30	60			30
BB 1.8	Academic integrity and quality of education	3		1	3	90	30	60			30
BB 1.9	Methodology of preparation of scientific publications	3		1	3	90	30	60	15		15
BB 1.10	Quality of higher education (formation of internal quality assurance systems)	3		1	3	90	30	60			30
<b>Total per cycle</b>					3	90	30	60			

<i>Cycle of disciplines forming professional competences</i>											
ББ 2.1	Dynamics and reliability of machines	4	1		3	90	30	60	15		15
ББ 2.2	Dynamics of wheeled and tracked machines	4	1		3	90	30	60	15		15
ББ 2.3	Schematics of control systems	4	1		3	90	30	60	15		15
ББ 2.4	Applied theory of optimal processes and parametric optimization of wheeled and tracked machines	4	1		3	90	30	60	15		15
ББ 2.5	Modeling of processes and systems of mechanics	4	1		3	90	30	60	15		15
ББ 2.6	Experimental research on stand and road research wheeled and tracked vehicles .	4	1		3	90	30	60	15		15
ББ 2.7	Methodological and Mathematical Software of Scientific Research	4	1		3	90	30	60	15		15
ББ 2.8	Transfer of technologies and research results in the industrials machinery engineering	4	1		3	90	30	60	15		15
ББ 2.9	Methodology of control and measurement of machine parameters	4	1		3	90	30	60	15		15
<b>Total per cycle</b>					6	180	60	120			
<i>Discipline of the graduate student's free choice</i>											
ББ 3.1	Discipline of free choice	4		1	3	90	30	60	15		15
<b>Total per cycle</b>					3	90	30	60			
<b>IN GENERAL</b>					43	1290	450	840			

4. STRUCTURAL-LOGICAL SCHEME OF THE THIRD (SCIENTIFIC-EDUCATIONAL) LEVEL OF HIGHER EDUCATION IN THE SPECIALTY  
 133 " MACHINE BUILDING "



## 5. MATRIX SUITABILITY OF SOFTWARE COMPETENCES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	ИИТ	ЗК1	ЗК2	ЗК3	ЗК4	ЗК5	ЗК6	ЗК7	ЗК8	ЗК9	ЗК10	ФК1	ФК2	ФК3	ФК4	ФК5	ФК6	ФК7	ФК8
OK 1.1	•	•							•	•	•	•							•
OK 1.2					•	•	•						•						
OK 1.3					•	•	•						•						
OK 1.4			•		•			•	•		•					•	•		
OK 1.5							•								•			•	
OK 1.6			•		•			•		•	•					•	•		
OK 2.1												•			•				
OK 2.2	•											•			•	•			
OK 2.3	•											•	•	•	•				
BB 1.1					•	•	•						•						
BB 1.2		•		•	•					•									
BB 1.3							•								•			•	
BB 1.4		•													•				
BB 1.5			•	•	•			•									•		
BB 1.6			•				•								•			•	
BB 1.7	•	•		•	•							•							
BB 1.8								•	•							•			•
BB 1.9		•		•	•					•		•			•				
BB 1.10		•					•	•		•						•	•	•	
BB 2.1	•											•	•		•		•		
BB 2.2	•											•	•	•	•		•		
BB 2.3	•											•	•		•		•		
BB 2.4	•											•	•		•		•		
BB 2.5	•											•	•	•	•		•		
BB 2.6	•											•	•	•	•		•		
BB 2.7	•											•		•	•		•		
BB 2.8	•											•				•	•		
BB 2.9	•											•	•	•	•		•		
BB 3.1	•											•	•	•	•		•		



6. MATRIX OF PROVIDING PROGRAM LEARNING OUTCOMES BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	3H1	3H2	3H3	3H4	3H5	3H6	3P7	3P8	3P9	3H10	3H11	3H12	VM1	VM2	VM3	VM4	VM5	VM6	VM7	VM8	VM9	VM10	VM11	VM12	VM13	KOM1	KOM2	VI1	VI2	VI3	VI4						
OK 1.1	•											•																									
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## II. SCIENTIFIC COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

The scientific component of the educational-scientific program involves the postgraduate student conducting his own scientific research under the guidance of one or two academic supervisors and the preparation of his results in the form of a dissertation.

The dissertation for obtaining the degree of Doctor of Philosophy is an independent detailed study that offers a solution to the current scientific and applied task in the specialty 133 "Machine Building", the results of which are characterized by scientific novelty and practical value and are published in relevant publications.

The scientific component of the educational-scientific program is drawn up in the form of an individual plan of scientific work of a postgraduate student and is an integral part of the postgraduate study plan.

An integral part of the scientific component of the postgraduate educational and scientific program is the preparation and publication of scientific articles, speeches at scientific conferences, scientific professional seminars, round tables, and symposia.

### **Topics of scientific research in specialty 133 "Machine Building" (by types):**

- justification and optimization of structural and technological parameters of technological equipment and machines for various industries;
- research and modeling of improving the technical level and quality of technological equipment, improving its operational characteristics (productivity, energy intensity, material intensity, vibro-acoustic, radio interference, etc.) for various branches of mechanical engineering;
- modeling and substantiation of the parameters of the interaction of the working bodies of the technological equipment of machines with the working environment for various industries;
- dynamics and parametric optimization of the power drive and systems of machines and equipment for various industries;
- justification and modeling of parameters and systems of technological equipment with its adaptation to modern software complexes;
- active and passive safety of machines and equipment of various industries;
- dynamics and energy of all-wheel drive wheeled and tracked vehicles;
- alternative power drives of machines and equipment of various industries;
- stability and controllability of wheeled vehicles;
- modeling, research and automation of technological processes and the functioning of equipment of various industries;
- mathematical modeling of the reliability of technical systems;
- development of automated design of technological equipment

### III. CERTIFICATION OF GRADUATE STUDENTS

Attestation of higher education holders of the scientific degree doctor of philosophy is carried out by a specialized scientific council, permanently active or formed for a one-time defense, on the basis of a public defense of a scientific work in the form of a dissertation.

A mandatory condition for admission to the defense is the successful completion by the graduate student of his individual study plan and a mandatory plagiarism check.

Candidates of higher education for the scientific degree of Doctor of Philosophy defend their dissertations, as a rule, in a permanent specialized academic council for the relevant specialty, which functions in the higher educational institution where the graduate student was trained. The academic council of the higher NU "Lviv Polytechnic" also has the right to submit to the National Agency for Quality Assurance of Higher Education documents for accreditation of a specialized academic council formed for a one-time defense, or to apply to another higher educational institution where a permanent specialized academic council operates council from the relevant specialty.

The volume of the main text of the dissertation of higher education holders of the degree Doctor of Philosophy in the specialty 13 «Machine Building» set in the amount of 4.0-5.0 author 's sheets .

### IV. COMPLIANCE WITH THE STANDARDS OF ACADEMIC INTEGRITY

Academic supervisors and postgraduate students are obliged to strictly adhere to the established norms of academic integrity in accordance with the "Regulations on academic integrity at Lviv Polytechnic National University" (approved by the protocol of the Academic Council of Lviv Polytechnic National University No. 35 dated 09/08/2017)

All results of scientific research that are being prepared for publication are subject to a mandatory check for plagiarism. The issue of the regulation of measures to guarantee academic integrity is regulated by the Order on the Lviv Polytechnic National University 223-10 dated 24.10.2017. Publications of graduate students during the preparation of dissertations for submission to the specialized academic council also undergo an additional verification process in accordance with the Order on the Lviv Polytechnic National University 551-1-10 dated October 18, 2018.

At the meetings of the profiling departments of the "Industrial Mechanical Engineering" specialty, issues of ensuring academic integrity must be considered at least once a year.