MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY

EDUCATIONAL AND SCIENTIFIC PROGRAM

"Industrial Machinery Engineering"

The level of higher education: **The third (educational and scientific) level**

Degree of higher education: **Doctor of Philosophy**

Field of study: **13 Mechanical engineering**

Program subject area **133 "Industrial machinery engineering"**

«APPROVED»

Academic Council of Sumy NAU

protocol No. 13 of 24.03 2023

Head of the academic council

academician of the NAAS of Ukraine

_____V.I.Ladyka

Entered into force by Order No. 174-к of 31.03.23

Rector

academician of the NAAS of Ukraine

_____V.I.Ladyka

With changes approved by the Academic Council

protocol No. ___ of _____ 2023

Sumy – 2023

APPROVAL LETTER

of the educational and scientific program

"Industrial Machinery Engineering"

Level of higher education - third (educational and scientific)

The project team consist of:

Head of the project team:

Doctor of Technical Sciences, Professor of the Technical Service Department — **V.B. Tarelnyk**

Project team members:

Doctor of Technical Sciences, Professor of the Agroengineering Department — **V.M. Zubko**

Doctor of Technical Sciences, Professor of the Technical Service Department — **O.V. Radionov**

Candidate of Technical Sciences, Associate Professor of the Transport Technologies Department — **O.A. Sarzhanov**

Candidate of Technical Sciences, Associate Professor of the Technical Service Department — **M.Y. Dumanchuk**

Graduate student of the Department of Agricultural Engineering — **M.S. Shelest**

PREREQUISITE

Developed by the project team of specialty 133 "Industrial Engineering" of Sumy National Agrarian University as part of the project:

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Shelest Mykola Serhiyovych – Graduate student of the Department of Agricultural Engineering

Profile of the educational and scientific program in specialty 133 " Industrial machinery engineering "

1. General information	
Full name of the higher education institution and structural unit	Sumy National Agrarian University
Higher education level	The third (educational and scientific) level
Academic Degree	Philosophy Doctor degree
Field of study	13 Mechanical engineering
Subject area	133 "Industrial machinery engineering"
Official name of the academic program	Industrial machinery engineering
Educational qualifications	Doctor of Philosophy in Industrial Machinery Engineering
Diploma qualification	Academic Degree - Philosophy Doctor Field of study 13 Mechanical engineering Specialty- 133 Industrial Machinery Engineering Educational program "Industrial Machinery Engineering"
Type of diploma and educational program scope	unitary, 60 ECTS credits, (educational component ESP), study period 4 years
Restrictions as for forms of studying	None
Accreditation availability	Conditional accreditation: https://registry.naqa.gov.ua/#/op/37218
Cycle / Program level	8 level of the National Qualifications Framework, FQ-EHEA – 3 cycle, EQF LLL – 8 level
Prerequisites	Persons who have obtained a master's degree can apply for the Philosophy Doctor degree in subject area 133 Industrial Machinery Engineering. The program of professional entrance examinations for persons who have received the previous level of higher education in other specialties should include verification of the person's acquisition of competencies and learning outcomes defined by the standard of higher education in subject area 133 Industrial Machinery Engineering for the second (master's) level of higher education.
Language of instruction	Ukrainian, English

Length of the educational program	until 2025 (initiated in 2021).
Link of the permanent placement of the description	https://science.snau.edu.ua/aspirantura/
2. The educational-scientific program aim	
Training of highly qualified specialists capable of planning and implementing original scientific research, solving problems, expanding and reassessing knowledge in the subject area of industrial engineering, integrating their education and experience into professional activities and academic practice.	
3. Characteristics of the educational-scientific program	
Subject area (field of knowledge, specialty, specialization (if available))	Field of study 13 Mechanical engineering Subject area 133 "Industrial machinery engineering"
Orientation of the academic program	The educational and research program is focused on the development of research and teaching competencies, communication skills and responsibilities, and professional activities in the field of mechanical engineering in the specialty "Industrial Engineering". The EPP has an academic orientation. The educational and research program includes an educational and scientific component. The educational component of the program is 60 ECTS credits, of which 45 ECTS credits are compulsory courses for all cycles and 15 ECTS credits are elective courses. The scientific component of the program involves conducting your own research under the guidance of a supervisor(s) with the results presented in the form of a dissertation. This component of the program is not measured by ECTS credits, but is drawn up separately in the form of an individual plan of research work of a graduate student.
Object of study	Phenomena and processes that determine the formation of the researcher's worldview and competencies and enable scientific research of various types and structures of industrial products in the engineering industry.
Learning aims	Training of specialists in industrial engineering capable of solving problems in professional and/or research and innovation activities in the field of mechanical engineering, which involves a deep rethinking of existing and creation of new holistic knowledge and/or professional practice
Theoretical content	A set of tools, methods and techniques aimed at creating, operating and disposing of industrial engineering products.

Methods, techniques	Forecasting methods, theoretical and experimental methods of research of technical objects, methods of mathematical, physical and computer modeling of work processes of technological machines, digital technologies. Modern methods and technologies of organizational, information, marketing, and legal support of scientific research
Tools and equipment	Measuring complexes for studying the stress-strain state of ashing structures, computer-integrated measuring equipment and specialized software
The main focus of the program	The educational and scientific program is designed as an optimal combination of academic and professional requirements, which allows graduate students to develop the ability to justify the solution of problems in the field of Mechanical Engineering in the specialty "Industrial Machinery Engineering", plan and conduct research using modern research methodology, plan and implement research projects, collaborate with other researchers, including working in an interdisciplinary team, and transfer professional knowledge. The subject of scientific research is aimed at studying patterns in the field of industrial engineering and developing innovative scientific and practical foundations, methods and approaches to: - modeling, forecasting, optimization and calculation of work processes, machine and machine unit designs, as well as their complexes, operating modes and loads under various operating conditions; - Achieving the required tribotechnical properties of friction surfaces through hardening and coating and studying their tribological characteristics; - controlling the work processes of the units to ensure the required quality, efficiency and reliability of their operation; - patterns of equipment failures and the development of measures to prevent them, in particular through the effective use of advanced materials, technologies and equipment for strengthening, restoration and repair; - technologies and technical means for diagnosing, maintaining, restoring and repairing components and assemblies of machinery and equipment; - physical and mechanical properties of soils in order to develop the design, justify the parameters and modes of operation of the working bodies of agricultural machinery; - kinematic diagrams, design, dynamic and energy parameters, operating modes and loads of agricultural machines; - forecasting, changing technical parameters and ensuring the quality and reliability of agricultural machinery.
Features of the program	The ESP training model provides for professional training focused on the development of the applicant's competencies in accordance with the topic of his or her dissertation and research areas conducted by university researchers, combined with general training that involves the development of teamwork skills, academic writing, teaching

	competencies, and project management. At the same time, the professional training is implemented mainly in the elective component of the ESP, and the general training is mainly in the mandatory component of the program. This model allows students to develop social skills and combine their own research with the study of professional qualifications. The professional block of the ESP is designed to provide the applicant with the opportunity to study in-depth the issues related to the subject of his/her scientific research through the choice of relevant professional disciplines.
4. Graduates' eligibility to employment and further education	
Further studying	Obtaining a doctoral degree and additional qualifications in the adult education system.
Employment eligibility	Employment as research and teaching staff in research institutions and higher education institutions, as well as as highly qualified employees in research, design, development and engineering institutions and departments of enterprises. Possible positions according to the Classifier of professions DK 003:2010: Assistant (2310.2), associate professor (2310.1), professor (2310.1), director (head) of a small industrial enterprise (firm) (1312), director (head) of an organization (research, development, design) (1210.1), director (head) of a vocational educational institution (vocational school, vocational college, etc.) (1210.1), director (head, other manager) of an enterprise (1210.1), director (rector, head) of a higher educational institution (technical school, college, institute, academy, university, etc.) (1210.1), director of advanced training courses (1210.1), director of a research institute (1210.1), director of a training centre (1229.4), head (chief) of a department (research, design, engineering, etc.) (1237.2).) (1237.2), head of a department in a college (1229.4), head of a laboratory (research, production preparation) (1237.2), junior researcher (2213.1), researcher (2213.1).
5. Teaching and assessment	
Approaches to teaching and studying	Approaches to teaching and learning: - active learning (interactive teaching methods that provide a personality-oriented approach and the development of systemic, creative and strategic thinking; joint learning in interdisciplinary groups; "flipped classroom") - learning by teaching (pedagogical practice); - learning through research (including participation in budgetary and commercially contractual research works, participation in research projects); - Personalized Learning: individual consultations with academic advisors; selective professional disciplines)
Assessment system	***The educational component of the program.*** The system of assessment of learning outcomes in the disciplines of the educational and scientific program consists of current and final control.

	The current knowledge control is conducted orally (questioning based on the results of the material studied). The final control of knowledge is in the form of written and oral exams, tests. During the current and final control in the process of assessing the disciplines that provide professional training, the scientific articles prepared by the applicant and published in collections included in professional publications and/or publications indexed in international scientometric databases (Scopus, Web of Science) are taken into account. ***Scientific component of the program.*** Evaluation of the scientific activity of applicants is carried out in accordance with the scientific plan of the graduate student through: - intermediate attestations of the postgraduate student in the form of an annual report on the implementation of the individual plan; - participation in the department's seminars and conferences; - reviewing scientific papers; - recommendations of the supervisor; - preparation, presentation and defense of a dissertation.
Monitoring form of PhD student (applicant) learning achievements	**The educational component of the program.** The final assessment of the educational components of the control of the applicant's learning progress is carried out in the form: - exam - based on the results of studying the mandatory components of the educational program of the cycle of general scientific training, the cycle of research training, the cycle of language training, and the cycle of special (professional) training; - credit - based on the results of studying all other educational components provided for in the curriculum. **Scientific component of the program.** The scientific component of the ESP provides for the current certification of postgraduate students at a meeting of the department twice a year. The purpose of the intermediate certification is to assess the level of implementation of the individual plan, provide support and feedback to the applicant. The purpose of the final certification is to establish the compliance of the level of educational and scientific training of graduate students with the requirements of the Doctor of Philosophy degree program in the specialty 133 "Industrial Engineering" and ends with a public defense of the thesis. The dissertation is defended in public at a meeting of the Specialized Academic Council. A prerequisite for admission to the dissertation defense, subject to the successful completion of the individual research plan, is the testing of research results and main conclusions at scientific conferences and their publication in professional scientific journals in accordance with the current requirements.

6. Program competences	
Integral competence	The ability to solve problems in the field of professional and/or research and innovation activities in the field of mechanical engineering, which involves a deep rethinking of existing and creation of new holistic knowledge and/or professional practice.
General competences	GC 1. Ability to think abstractly, analyze and synthesis GC 2. Ability to search, process and analyze information from various sources, generate new ideas and solve complex problems of industrial engineering. GC 3. Ability to work in an international context. GC 4. Ability to solve problems in the field of industrial engineering on the basis of a systematic scientific outlook and general cultural outlook, in compliance with the principles of academic integrity. GC 5. Ability to use information and communication technologies..
Special (professional, subject) competences	SC 1. Ability to perform original research, achieve scientific results that create new knowledge in mechanical engineering and related interdisciplinary areas and can be published in leading scientific journals in mechanical engineering and related fields. SC 2. Ability to present and discuss the results of scientific research and/or innovative developments orally and in writing in Ukrainian and English (or other) languages, deep understanding of English (or other foreign language) scientific texts in the field of mechanical engineering. SC 3. Ability to critically analyze, evaluate and synthesizes new and complex ideas in the field of industrial engineering and related interdisciplinary issues. SC 4. Ability to continuous self-development and self-improvement. SC 5. Ability to carry out research and teaching activities in higher education. SC 6. Ability to generate new ideas for the development of the theory and practice of industrial engineering, to identify, formulate and solve research problems, evaluate and ensure the quality of research. SC 7. Ability to substantiate, plan and execute a research project to identify and solve a scientific task or problem of industrial engineering. SC 8. Ability to solve problems of system engineering with creation of innovative technical objects of industrial engineering and their operation.
Program learning outcomes **Upon completion of the educational program, the applicant will be able to:**	
PLO 1. To have conceptual and methodological knowledge in mechanical engineering and on the verge of subject areas, as well as research skills sufficient to conduct scientific and applied research at the level of the latest world achievements in the relevant field, to obtain new knowledge and/or to implement innovations. PLO 2. Freely present and discuss with specialists and non-specialists research results, scientific and applied problems of mechanical engineering in the state and foreign languages, publish research results in scientific publications in leading international scientific journals.	

PLO 3. Formulate and test hypotheses; use appropriate evidence, in particular, the results of theoretical analysis, experimental studies and mathematical and/or computer modeling, available literature data to support conclusions. PLO 4. Develop and investigate conceptual, mathematical and computer models of processes and systems, effectively use them to obtain new knowledge and/or create innovative products in mechanical engineering and related interdisciplinary areas. PLO 5. To apply modern tools and technologies for searching, processing and analyzing information, in particular, statistical methods for analyzing large and/or complex data, specialized databases and information systems. PLO 6. To develop and implement scientific and/or innovative engineering projects that make it possible to rethink existing and create new holistic knowledge and/or professional practice and solve significant scientific and technological problems of mechanical engineering in compliance with the norms of academic ethics and taking into account social, economic, environmental and legal aspects. PLO 7. To be able to plan and carry out experimental and/or theoretical research in industrial engineering and related interdisciplinary areas using modern tools and in compliance with professional and academic ethics, to critically analyse the results of own research and the results of other researchers in the context of the whole range of modern knowledge on the problem under study. PLO 8. Apply the general principles and methods of mathematics, natural and technical sciences, as well as modern methods and tools, digital technologies and specialized software to conduct research in mechanical engineering. PLO 9. To have a deep understanding of the general principles and methods of mechanical engineering and research methodology, to apply them in their own research in the field of industrial engineering and in teaching practice. PLO 10. Organize and carry out the educational process in the field of industrial engineering, its scientific, educational, methodological and regulatory support, develop and teach special disciplines in higher education institutions. PLO 11. To ensure the creation, operation and disposal of industrial engineering products through the use of effective system engineering PLO 12. Carry out reengineering to improve the operational characteristics of machines, equipment, complexes, production lines using safe technological and energy-efficient methods.

7. Forms of certification of higher education applicants	
Forms of certification of higher education applicants	The certification is carried out in the form of a public defense of the dissertation of the Philosophy Doctor, provided that the applicant fulfils his/her individual curriculum and research plan
Requirements to the qualification work	A dissertation for the degree of Philosophy Doctor is an independent detailed study that proposes a solution to a complex problem in the field of industrial engineering or on its border with other specialties, the results of which have scientific novelty, theoretical and practical significance. The dissertation must not contain academic plagiarism, falsification, or fabrication. The dissertation must be posted on the website of a higher education institution (research institution)

Public defense requirements	The dissertation is defended openly at a meeting of the Specialized Academic Council. A prerequisite for defending a dissertation is the testing of research results and main conclusions at scientific conferences and their publication in professional scientific journals in accordance with the current requirements.
8. Resource support for program implementation	
Staffing	The scientific and pedagogical staff of the ONP meets the requirements of the License Conditions and the current legislation of Ukraine. The academic staff involved in the implementation of the educational and research program are employees of Sumy NAU with relevant scientific and academic experience, involved in the implementation of scientific and educational projects. 100% of academic staff involved in teaching disciplines have academic degrees and academic titles. Advanced training and internships for academic staff are provided at least once every five years.
Logistics	The provision of classrooms, computer workstations, and multimedia equipment meets the needs. To implement the educational and scientific program, there are educational and scientific laboratories of the faculty, including inter-faculty laboratories: "Precision Agriculture", "Electron Microscopy", "Ecology", "Chemistry Laboratory" and a branch of the department of TRIZ LTD.
Informative and methodical support	Use of the collection of scientific libraries of higher education institutions of the city of Sumy, the Vernadsky National Library of Ukraine, Internet resources and copyright developments of the academic staff of SNAU. Applicants are provided with free and remote access to the Scopus and WoS databases.
9. Academic mobility	
National credit mobility	National individual academic mobility is implemented within the framework of agreements on the establishment of scientific and educational relations to meet the needs of education and science development: NSC IMESG, Poltava State Agrarian Academy and others/
International credit mobility	On the basis of bilateral agreements between Sumy NAU and higher education institutions of foreign partner countries, in particular, cooperation agreements with Weihenstephan-Triesdorf University of Applied Sciences (Germany), Wrocław University of Environmental and Life Sciences (Poland), the Kielce University of Technology (Poland), Czech University of Life Sciences Prague (Czech Republic), University of Natural Sciences in Warsaw (Poland), University of Life Sciences in Lublin (Poland) and Henan Institute of Science and Technology (China).

2. List of educational-scientific program components and their logical

2.1. List of ESP components

Code	Components of the academic program (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Form of final control
1. Compulsory components of ESP			
CC1	Philosophy of Science	4,0	exam
CC2	Contemporary computer technologies in science	3,0	exam
CC3	Communications in Scientific Area	3,0	credit
CC4	Methodology of Conducting Scientific Research	3,0	credit
CC5	Tribotechnics	3,0	exam
CC6	Modeling and planning a scientific experiment in engineering	3,0	credit
CC7	Registration of Intellectual Property Rights	3,0	credit
CC8	Design and Delivery of Course Unit	3,0	exam
CC9	Ukrainian Language	3,0	exam
CC10	Scientific Projects Management	3,0	exam
CC11	English in Professional Area	4,0	credit, exam
CC12	Organization of Preparation of Scientific Publications and Thesis Writing	3,0	exam
CC13	Pedagogical Practice	4,0	credit
CC14	Innovative technological solutions in industrial machinery engineering	3,0	exam
	Total	**45,0**	
2. Optional components of AP *			
OC1	Vocational optional discipline 1	5,0	exam
OC2	Vocational optional discipline 2	5,0	exam
OC3	Vocational optional discipline 3	5,0	exam
	Total	**15,0**	
TOTAL VOLUME OF THE ESP		**60,0**	

List of professional optional disciplines: OC1-OC3

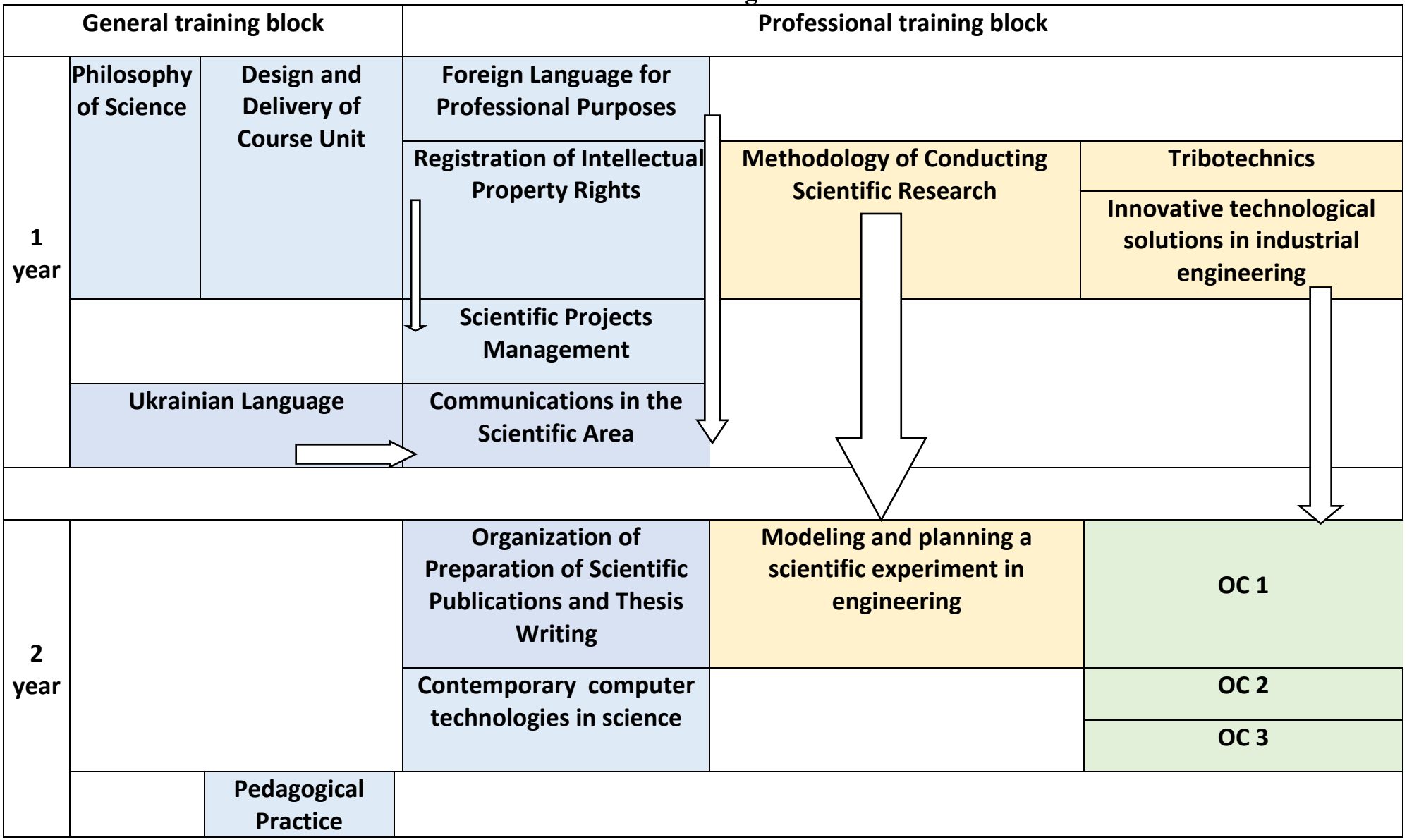
1. Efficiency of using sensors and controllers in support of experimental research
2. Advanced surface engineering technologies
3. Quality management methodology in mechanical engineering
4. Scientific and methodological foundations of quality assurance of mechanized agricultural technologies
5. Digital platforms in engineering research
6. Synthesis of rational technological solutions
7. Methodology of strengthening effects on the working surfaces of machine parts by concentrated energy sources.
8. Scientific substantiation of the use of CAD/CAM/CAE systems in agricultural engineering.
9. Testing of auto-tractor equipment
10. Qualimetry of tractor tests

* A higher education applicant (postgraduate student) chooses 3 (three) out of 10 (ten) elective courses from the list.

2.2. Structural and logical scheme of ESP

Applicants for higher education have the right to choose disciplines within the limits provided by the relevant educational program and working curriculum, in the amount of not less than 25 percent of the total number of ECTS credits provided for this level of higher education.

2.2. Structural and logical scheme of ESP



List of normative documents on which the standard of higher education is based

1. Law of Ukraine of 01.07.2014 № 1556-VII "On higher education" [available at: http://zakon4.rada.gov.ua/laws/show/1556-18].
2. Law of Ukraine of 05.09.2017 № 2145-VIII) "On education". – [available at: http://zakon5.rada.gov.ua/laws/show/2145-19].
3. Resolution of the Cabinet of Ministers of Ukraine of 23.11.2011 № 1341 "On approval of the National Qualifications Framework" [available at: http://zakon4.rada.gov.ua/laws/show/1341-2011-п].
4. Resolution of the Cabinet of Ministers of Ukraine of March 23, 2016 № 261 "On approval of the Procedure for training applicants for higher education for the degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions)" [available at: https://zakon.rada.gov.ua/laws/show/261-2016-%D0%BF#Text].
5. Guidelines for the development of higher education standards. Order of the Ministry of Education and Science of Ukraine of 13.07.2020 No. 918: [available at: https://zakon.rada.gov.ua/rada/show/v0918729-20#Text].
6. Order of the Ministry of Education and Science of Ukraine of 06.11.2015 No. 1151 "On the peculiarities of introducing the list of branches of knowledge and specialties in which higher education applicants are trained." [available at: http://zakon.rada.gov.ua/laws/show/z1460-15#n36].
7. Resolution of the Cabinet of Ministers of Ukraine of 30.12.2015 № 1187 "On approval of the License conditions for educational activities of educational institutions" [available at: http://zakon4.rada.gov.ua/laws/show/1187-2015-п].
8. Professional standard for the group of professions "Teachers of higher education institutions". Order of the Ministry for Development of Economy, Trade and Agriculture of Ukraine dated 23.03.2021 No. 610: [available at: https://mon.gov.ua/storage/app/media/pto/standarty/2021/03/25/Standart%20na%20hrupu%20profesiy_Vykladachi%20zakladiv%20vyshchoyi%20osvity_25.03.pdf].
9. Standard of higher education of the third (educational and scientific) level, Doctor of Philosophy degree) in the field of mechanical engineering, speciality 133 Industrial Engineering. Order of the Ministry of Education and Science of Ukraine dated 30.05.2022 No. 503. [available at: https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/2022/ 06/23/133-Haluzeve.mashynobuduvannya.dok.filosofiyi-503-30.05.22.pdf].

Information sources

1. National Glossary 2014 [available at: http://ihed.org.ua/images /biblioteka/glossariy_Visha_osvita_2014_tempus-office.pdf.
2. Standards and guidelines for quality assurance in the European Higher Education Area (ESG), 2015 [available at:

https://www.britishcouncil.org.ua/sites/default/files/standards-and-guidelines_for_qa_in_the_ehea_2015.pdf].

3. Tuning project materials [available at: unideusto.org/tuningeu/images/stories/documents/ General_Brochure_Ukrainian_version.pdf].

4. Development of educational programmes: methodological recommendations [available at: http://ihed.org.ua/images/biblioteka/rozroblennya_osv_program_2014_tempus-office.pdf].

5. Development of the system of quality assurance in higher education in Ukraine: information and analytical review [available at: http://ihed.org.ua/images/biblioteka/ Rozvitok_sisitemi_zabesp_yakosti_VO_UA_2015.pdf].

6. ISCED 2011 [available at: http://www.uis.unesco.org/education/documents/isced-2011-en.pdf].

7. ISCED-F 2013 [available at: http://www.uis.unesco.org/Education/Documents/ isced-fields-of-education-training-2013.pdf].

8. TUNING (to get acquainted with special (professional) competences and examples of standards) [available at: http://www.unideusto.org/tuningeu/].

9. National Classifier of Ukraine: "Classifier of Professions" SC 003: 2010DC 003: 2010 [available at: http://www.dk003.com/].

Table 1

Matrix of correspondence between the competences defined by the ONP and the NQF descriptors

Classification of competencies according to NQF	Knowledge **Kn1.** Conceptual and methodological knowledge in the field or on the verge of fields of knowledge or professional activity	Skills **Sk1.** Specialized skills and methods necessary to solve significant problems in the field of professional activity, science and/or innovation, to expand and reassess existing knowledge and professional practice **Sk2.** Initiate, plan, implement and adjust a coherent process of rigorous scientific research in accordance with appropriate academic integrity **Sk3.** Critically analyze, evaluate and synthesis new and complex ideas	Communication **C1.** Free communication on issues related to the field of scientific and expert knowledge with colleagues, the wider scientific community, and society as a whole **C2.** Use of academic Ukrainian and foreign languages in professional activities and research	Autonomy and responsibility **AR1**. Demonstration of significant credibility, innovation, high degree of independence, academic and professional integrity, and a sustained commitment to the development of new ideas or processes in advanced professional and scholarly contexts **AR2.** Ability to continuously develop and improve oneself
Integral competences				
IC1	Kn1	Sk1, Sk2, Sk3	C1, C2	AR1, AR2
General competencies				
GC1	Kn1	Sk1	C1	AR2
GC2			C2	AR1
GC3		Sk3		AR1
GC4	Kn1	Sk2	C1	AR2
GC5		Sk1	C1, C2	AR1
Special (vocational) competencies				
SC1		Sk1	C2	AR2
SC2		Sk2		AR1
SC3	Kn1	Sk1, Sk3		
SC4		Sk1		
SC5		Sk1, Sk2, Sk3	C1	AR2
SC6		Sk1, Sk2, Sk3	C1	AR1
SC7	Kn1	Sk1, Sk2,	C1, C2	AR1
SC8		Sk1, Sk2,		AR1

Table 2

Matrix of correspondence between the learning outcomes and competences defined by the PLO

Program learning outcomes	Competences												
	General competences					Special (professional) competences							
	GC1	GC2	GC3	GC4	GC5	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
PLO1	X	X							X	X		X	X
PLO2				X	X	X				X			
PLO3								X			X	X	
PLO4	X									X			
PLO5			X		X			X	X				
PLO6		X		X		X	X			X			X
PLO7				X					X			X	X
PLO8	X				X		X						
PLO9		X				X						X	
PLO10			X					X			X		
PLO11	X			X				X			X		X
PLO12	X			X	X	X		X					

Table 3

Matrix of ensuring the program learning outcomes (PLO) with the relevant components of the educational and scientific program

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CC1			X			X	X	X				
CC2			X	X	X			X				
CC3		X					X			X		
CC4	X				X		X	X	X			
CC5	X		X	X					X		X	X
CC6	X		X	X		X		X				
CC7					X	X						
CC8									X	X		
CC9		X										
CC10						X	X					
CC11		X										
CC12		X										
CC13										X		
CC14	X		X	X					X		X	X