

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"



APPROVED BY
Rector of NTU "KhPI"

Yevhen SOKOL
05.05.2023 yr.

EDUCATIONAL-PROFESSIONAL PROGRAM
"Engineering Ecology"
Second (Master's) level of higher education

in the specialty
field of knowledge
qualification

101 Ecology
10 – Natural Sciences
Master of Ecology

APPROVED BY
ACADEMIC COUNCIL OF NTU "KhPI"
Chairman of the Academic Council

Leonid TOVAZHNYANSKY
Protocol №. 4
dated 05.05.2023 yr.

Kharkiv 2023

AGREEMENT SHEET

Educational-professional program "Engineering Ecology"

Second level of higher education (master's)

Field of knowledge 10 - Natural Sciences

Specialty 101 "Ecology"

Qualification Master of Ecology

APPROVED

By the working group of the program
"Engineering Ecology"

Guarantor of the educational program


Musii TSEITLIN

06.04.2023 year

RECOMMENDED

By the methodical council of NTU "KhPI"
Deputy chairman of the methodical council


Ruslan MIGUSHCHENKO

03.05.2023 year

AGREED

Head of the department of Chemical
Engineering and Environment Protection


Oleksiy SHESTOPALOV

06.04.2023 year

AGREED

Director of the Institute of Education and Science in
Mechanical Engineering and Transport


Vitaliy YEPYFANOV

27.04.2023 year

AGREED

Student (member of the working group of the
program) of the MIT-M122 group


Iryna Shcherbyna

06.04.2023 year

REVIEWERS:

Productive comments and feedback on the educational program project were received from:

1. Dmitro Samoilenko, DSc, prof Warsaw University of Technology.
2. Nataliia Vnukova, Head of Department of Ecology, Dr. Sci. (Engin.), Professor of Kharkiv National Automobile and Highway University
3. Shkop Andriy Oleksandrovich, candidate of technical science, director of Ekomash Scientific and Technical Center LLC.
4. Sergiy Pesin, CEO at Ekoton industrial end ESMIL Group, Ełk, Warmińsko-Mazurskie, Polska.
5. Prokaieva Hanna, head of the NGO "Center for Public and Media Initiatives"
6. Stadnik Veronika Yuriivna, graduate of the postgraduate course in the specialty 101 "Ecology", NTU "KhPI".
7. Shcholokova Olga Eduardivna, student of the MIT-M122a group, specialty 101 "Ecology", NTU "KhPI".

INTRODUCTION

Corresponds to the Higher Education Standard of the second (master's) level in the field of knowledge 10 - Natural Sciences, specialty 101 Ecology, approved and implemented by the order of the Ministry of Education and Science of Ukraine 04.10.2018 No. 1066.

Developed by the working group of the Educational Program "Engineering Ecology" Institute of Education and Science in Mechanical Engineering and Transport of the National Technical University "Kharkiv Polytechnic Institute" including:

Educational program guarantor

Tseitlin Musii, Doctor of Technical Sciences, Professor, Professor of the Department of Chemical Engineering and Environment Protection NTU "KhPI"

(full name, academic degree, academic title, position)

Members of the working group of the EP:

1. Bairachnyi Volodymyr, candidate of technical sciences, associate professor, professor of the Department of Chemical Engineering and Environment Protection NTU "KhPI"

(full name, academic degree, academic title, position)

2. Samoilenko Nataliia, candidate of technical sciences, associate professor, professor of the Department of Chemical Engineering and Environment Protection NTU "KhPI"

(full name, academic degree, academic title, position)

1. EDUCATIONAL PROGRAM PROFILE FOR THE SPECIALTY

1 - General Information	
Higher education institution and structural unit	National Technical University "Kharkiv Polytechnic Institute", Department of Chemical Engineering and Environment Protection
Degree and qualification name in the original language	Master's degree, Master's degree in Ecology
Official name of the educational program	Engineering ecology
Type of diploma and scope of educational program	Master's diploma, individual, 90 ECTS credits, training period – 1 year 4 months
Accreditation status	National Agency for Higher Education Quality Assurance. Ukraine. Certificate - ND No. 2192131. Valid until 01.07.2023
Cycle/level	Second (Master's) level of higher education; NKR Ukraine - 7th level; FQ-EHEA - second cycle; QF-LLL - 7th level
Prerequisites	Bachelor's degree
Language of instruction	Ukrainian / English language
Duration of educational program	According to certificate validity period, it is reviewed annually.
Link to permanent description of educational program	Department of Quality Assurance of Educational Activities of NTU "KhPI https://blogs.kpi.kharkov.ua/v2/quality/op-magistr-2023/
2 - Educational Program Goals	
<p>The goal of the educational program is to combine a high level of professional training with the formation of a student's scientific worldview and providing a broad perspective in the economic and professional fields related to ecology, environmental protection, and balanced use of natural resources through theoretical, practical training, and scientific research. Achieving this goal is based on principles of continuity and individualization of education, fundamental and holistic provision of knowledge, practical orientation and awareness of the place of acquired competencies, symbiosis of scientific and systemic approaches, and more.</p>	
3 - Characteristics of the educational program	

<p>Subject area (field of knowledge, specialty, specialization)</p>	<p>Field of knowledge: 10 - Natural Sciences Specialty: 101 - "Ecology" Object of study: structure and functional components of ecosystems of different levels and origins; anthropogenic impact on the environment and optimization of natural resource use. Learning objectives: formation of a complex of knowledge, skills and abilities in higher education students for application in professional activities in the field of ecology, environmental protection and balanced natural resource use. Theoretical content of the subject area: concepts, principles and concepts of natural sciences, modern ecology and their use for environmental protection, balanced natural resource use and sustainable development. Methods, techniques and technologies: the student must master the methods of collecting, processing and interpreting the results of ecological research. Tools and equipment: machinery, equipment and software necessary for natural, laboratory and distance research of the structure and properties of ecological systems of different levels and origins.</p>
<p>Orientation of the educational program</p>	<p>Vocational education</p>
<p>Main focus of the educational program and specialization</p>	<p>Key words: ecology, natural sciences, ecological systems, environment, anthropogenic impact, environmental protection, balanced nature use, environmental protection technologies, resource conservation, greening of production, clean technologies, sustainable development Emphasis is placed on acquiring skills and knowledge in ecology, environmental protection and balanced nature management. The structure of the program involves dynamic and interactive learning. The program offers a comprehensive approach to solving modern environmental problems at the local, regional and national levels. The disciplines and modules of the program are based on theoretical knowledge that is closely related to practical skills. The program allows students to acquire the necessary skills in the field of</p>

	environmental protection and nature balanced as well as in sustainable development.
Program features	The peculiarities of the second educational level program "Engineering Ecology" are that it involves scientific methods in-depth study of developing engineering environmental protection complexes to minimize anthropogenic environment impact, and trains masters who are able not only to apply modern methods of greening industrial production, but also to develop new low-waste and energy-saving technologies, which are based on science and technology modern achievements.
4 - Employability and further education of graduates	
Employability	<p>Scientific and teaching activity in the field of ecology. Scientific, administrative and managerial activities in educational and state institutions.</p> <p>Positions according to the Ukrainian Classifier: (SC 003: 2010):</p> <ul style="list-style-type: none"> • 1237. 223908 1 Head of the Department of Environmental Protection; • 1412 Natural resource manager; • 2149. 222364 1 Environmental protection engineer; • 2149.222209 1 Research engineer • 2211.2 Ecologist; • 2211.2 Environmental expert; • 2213.2 Engineer of natural ecosystems reproduction; • 2213.2 Engineer of water resources use; • 2213.2 Engineer of natural ecosystems protection; • 2213.2 Environmental engineer; • 2411.2. Environmental auditor; • 3211 Environmental technician; • 3439 State inspector of technogenic and ecological supervision; • 3439 Nature management organizer; • 3439 Engineer-inspector; • 3449 Inspector for nature reserve fund protection <p>According to the Professional Standard "Ecologist", approved and put into effect by the order of the Ministry of Economy of</p>

	Ukraine from May 4, 2022 No. 1111-22: <ul style="list-style-type: none"> • ecologist; • ecologist - II category; • ecologist - 1st category; • leading ecologist.
Further education	Education in Ukrainian and foreign universities to obtain a Doctor of Philosophy degree. Acquisition of additional qualifications in the system of postgraduate education. Educational programs, research grants and scholarships that include additional scientific and educational components.
5 - Teaching and assessment	
Teaching and learning	Student-centered learning, problem-oriented learning, distance learning in the Office 365 system, self-learning, learning through laboratory practice, research-based learning, dual learning; internship / practice; on-the-job training (industrial practice). Teaching methods depend on the form of education (full-time, part-time, distance learning). Teaching is conducted in the form of lectures, multimedia lectures, interactive lectures, seminars, practical classes, laboratory work. Independent work with the possibility of consultations with the teacher on individual educational components, individual classes, group project work is also provided.
Assessment	Rating system of assessment, oral and written exams, testing.
6 - Program competencies	
Integral competence	The ability to solve complex specialized tasks and solve practical problems in the field of ecology, environmental protection and balanced natural resource use in the implementation of professional activities, or in the process of learning, which involves the application of basic theories and methods of environmental sciences, and characterized by complexity and uncertainty of conditions and requirements.
General competencies (defined by the higher education)	GC-1. The ability to learn and master modern knowledge. GC-2. The ability to make informed decisions. GC-3. The ability to generate new ideas. GC-4. Competence to develop and manage projects.

standard of the specialty)	<p>GC-5. Competence to communicate in a foreign language.</p> <p>GC-6. Competence to search, process, and analyze information from various sources.</p> <p>GC-7. Competence to motivate people and work towards a common goal.</p>
Special (professional) competencies of the specialty (defined by the higher education standard of the specialty)	<p>SC-1. Awareness of the latest achievements necessary for research and/or innovation in the field of ecology, environmental protection, and sustainable use of natural resources.</p> <p>SC-2. Ability to apply interdisciplinary approaches in critically analyzing ecological problems.</p> <p>SC-3. Ability to use principles, methods, and organizational procedures of research and/or innovation activities.</p> <p>SC-4. Ability to apply new approaches to analyzing and predicting complex phenomena, and critically evaluating problems in professional activities.</p> <p>SC-5. Ability to present knowledge and personal conclusions to both experts and non-experts.</p> <p>SC-6. Ability to manage the strategic development of a team in the process of professional activity in the field of ecology, environmental protection, and balanced nature management.</p> <p>SC-7. Ability to organize work related to the assessment of the environmental status, environmental protection and nature management optimization, in conditions of incomplete information and conflicting requirements.</p> <p>SC-8. Ability for self-education and professional development based on innovative approaches in the field of ecology, environmental protection, and balanced nature management.</p> <p>SC-9. Ability to independently develop ecological projects through the creative application of existing and generating new ideas.</p> <p>SC-10. Ability to assess the level of negative impact of natural and anthropogenic factors of ecological danger on the environment and human.</p>
7 - Learning outcomes	
Results of education in the specialty	RE-1. Know and understand the fundamental and applied aspects of environmental sciences.

<p>(defined by the higher education standard of the specialty)</p>	<p>RE-2. Be able to use conceptual ecological patterns in professional activities.</p> <p>RE-3. Know the basic concepts of natural science, sustainable development, and scientific methodology at the level of the latest achievements.</p> <p>RE-4. Know legal and ethical norms for evaluating professional activities, developing and implementing socially significant environmental projects under conflicting requirements.</p> <p>RE-5. Demonstrate the ability to organize collective activities and implement complex nature conservation projects, taking into account available resources and time constraints.</p> <p>RE-6. Know the latest methods and tools of environmental research, including methods and tools of mathematical and geoinformational modeling.</p> <p>RE-7. Be able to communicate in a foreign language in scientific, production, and socio-economic spheres of activity.</p> <p>RE-8. Be able to clearly and unambiguously convey professional knowledge, own reasoning, and conclusions to specialists and the general public.</p> <p>RE-9. Know the principles of personnel and resource management, basic approaches to decision-making under incomplete/insufficient information and conflicting requirements.</p> <p>RE-10. Demonstrate awareness of the latest principles and methods of environmental protection.</p> <p>RE-11. Be able to use modern information resources on ecology, nature use, and environmental protection.</p> <p>RE-12. Be able to evaluate landscape and biological diversity and analyze the consequences of anthropogenic impact on natural environments.</p> <p>RE-13. Be able to evaluate the potential impact of technological objects and economic activities on the environment.</p> <p>RE-14. Apply new approaches to develop decision-making strategies under complex unpredictable conditions.</p> <p>RE-15. Evaluate environmental risks under conditions of</p>
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	<p>insufficient information and conflicting requirements.</p> <p>RE-16. Choose the optimal management and/or nature use strategy depending on environmental conditions.</p> <p>RE-17. Critically analyze theories, principles, methods, and concepts from different subject areas to solve practical problems and ecological issues.</p> <p>RE-18. Be able to use modern methods of information processing and interpretation in innovative activities.</p> <p>RE-19. Be able to independently plan the implementation of innovative tasks and formulate conclusions based on their results.</p> <p>RE-20. Have knowledge of the basics of ecological engineering design and environmental impact assessment.</p>
8 - Resource Provision for Program Implementation	
Staffing	Meets the licensing requirements for educational activities approved by the resolution of the Cabinet of Ministers of Ukraine of December 30, 2015, No. 1187. (with changes introduced in accordance with Resolution of the CM No. 365 from 03.24.2021. Appendix 15-16).
Material and technical support	Meets the technological requirements for material and technical support of educational activities in the field of higher education in accordance with the requirements of the License Conditions approved by the Resolution of the Cabinet of Ministers of Ukraine from December 30, 2015, No. 1187.
Information and educational-methodical support	<p>Information about educational and professional programs, educational, scientific and educational activities carried out by the structural units of the university within this bachelor's program, is available through the official website of the NTU "KhPI": https://www.kpi.kharkov.ua/ukr/ and the [graduating Department of Chemical engineering and Environment Protection](https://www.kpi.kharkov.ua/rus/department/himichna-tehnika-ta-promislova-ekologiya/):</p> <p>https://www.kpi.kharkov.ua/rus/department/himichna-tehnika-ta-promislova-ekologiya/. Educational materials and textbooks, scientific publications (articles) of the department staff are available at:</p> <p>http://repository.kpi.kharkov.ua/handle/KhPI-Press/7479. All</p>

	<p>electronic resources are available to readers through the website of the scientific and technical library of NTU "KhPI": http://library.kpi.kharkov.ua/.</p> <p>Meets the technological requirements for material and technical support of educational activities in higher education, in accordance with the License Conditions approved by the Cabinet of Ministers of Ukraine on December 30, 2015, No. 1187.</p> <p>The program is fully provided with educational and methodological complexes for all components (academic disciplines, practices), the availability of which is presented in the modular environment of the educational process of the university.</p> <p>For each educational component of the program, students are provided with the necessary basic educational materials (textbooks, educational and methodological manuals and developments) and are accompanied by additional scientific and scientific and technical developments.</p>
9 - Academic mobility	
National Credit Mobility	<p>On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and leading technical universities of Ukraine.</p> <p>The procedure for organizing academic mobility programs for participants in the educational process is regulated by the "Regulations on Academic Mobility of Students, Postgraduate Students, Doctoral Students, Scientific and Pedagogical and Scientific Workers of NTU "KhPI", which is posted on the website of the educational department (https://blogs.kpi.kharkov.ua/v2/nv/dokumenty/normatyvni-dokumenty/).</p> <p>"The Regulation on the Procedure for Expulsion, Suspension of Studies, Renewal and Transfer of Students of Higher Education, as Well as Granting Them Academic Leave and the Right to Repeat Studies at NTU "KhPI", which is also posted on the website of the educational department, establishes the procedure for expulsion, suspension of studies, renewal and transfer of persons studying in educational</p>

	<p>programs licensed in accordance with the established procedure (https://blogs.kpi.kharkov.ua/v2/nv/dokumenty/normatyvni-dokumenty/). The provision also applies to persons studying at accredited (if accreditation is provided for by national legislation) educational programs in educational institutions of foreign countries, in case of their renewal or transfer to NTU "KhPI".</p>
International Credit Mobility	<p>A bilateral agreement has been concluded for a semester exchange with the Pomeranian Academy in Slupsk (Poland). Also, based on bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and leading higher education institutions in the relevant field. Regulated by the "Regulations on Student Training and Internships (Scientific Internships) of Post-graduate Students, Doctoral Students, Scientific and Scientific and Pedagogical Workers in Leading Higher Education Institutions and Scientific Institutions Abroad".</p>
Education of foreign students	<p>According to the license, the training of foreigners and stateless persons is provided.</p>

List of EP components

Code N/A	<i>Educational program components (disciplines, projects/assignments, practice, final qualification work)</i>	<i>Number of credits</i>	<i>Form of final assessment</i>
1	2	3	4
1. Obligatory educational components (for both Ukrainian citizens and foreigners)			
1.1 General training			
GT1	Fundamentals of Scientific Researches	3,0	exam
GT2	Innovative Entrepreneurship and Startup Project Management	3,0	tests
GT3	Intellectual Property	3,0	tests
GT4	Environmental Education	3,0	tests
1.2 Specialized (professional) training			
ST1	Technogenic and Ecological Safety Management	5,0	exam
ST2	Environmental Principles of Country Sustainable Development	4,0	tests
ST3	Environmental Management	4,0	exam
ST4	Eco-innovations in the Development of New Technologies	4,0	exam
ST5	Scientific Research and Modelling in Ecology	4,0	exam
ST6	International Cooperation and Grant Writing in Environmental Protection	3,0	exam
2. Practical training (for both Ukrainian citizens and foreigners)			
PP1	Pre-graduation practice	15,0	tests
3. Attestation (for both Ukrainian citizens and foreigners)			
	Attestation	15,0	
Total volume of components:		66	
4. Optional educational component (for both Ukrainian citizens and foreigners)			

1	2	3	4
4.1 Profile training			
4.1.1 Profiled discipline package 01 “Environmental engineering”			
OP1.1	Biosphere Protection Equipment	6,0	exam
OP1.2	Equipment and Basics of Designing Environmentally Safe Technologies Using CAD	3,0	exam
OP1.3	Production Automation and Instruments of Environmental Control and Monitoring	4,0	tests
4.1.2 Profiled discipline package 02 “Environmental Safety”			
OP2.1	Technologies for Ensuring Ecological Safety	6,0	exam
OP2.2	Biosecurity and State Bio-protection	6,0	exam
OP2.3	Transboundary Ecological Safety	4,0	tests
4.2 Optional student disciplines of the profile preparation (the list of disciplines is attached to the curriculum)		8,0	
<i>General volume of optional components:</i>		<i>24</i>	
<i>TOTAL VOLUME OF EDUCATIONAL PROGRAM:</i>		<i>90</i>	

LIST OF EDUCATIONAL COMPONENTS OF THE EDUCATIONAL PROGRAM AND THEIR LOGICAL SEQUENCE

Distribution of the content of the educational program by groups of components and preparation cycles

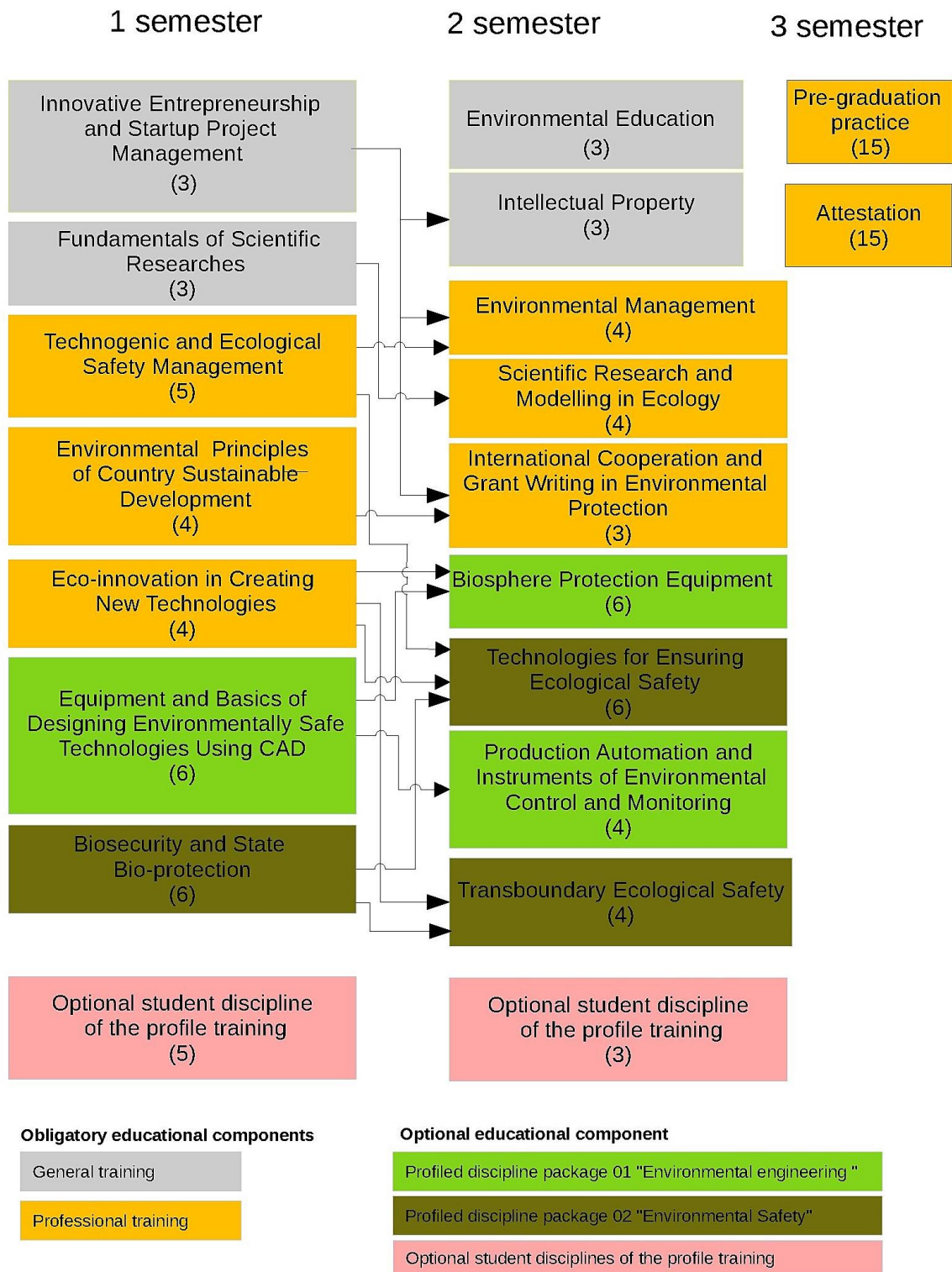
№ Item	Preparation cycle	Volume of educational workload of higher education student (ECTS credits / %)		
		Required components of the educational-professional program	Optional components of the educational-professional program	Total for the entire term of study
11	General preparation	12/ 13	-	12/ 13
22	Specialized (professional) preparation	54/60	-	54 /60
3	Elective courses	-	24/27	24 / 27
Total for the entire period of study		66 / 73	24 /27	90 / 100

FORM OF CERTIFICATION FOR HIGHER EDUCATION STUDENTS

Certification of higher education students is carried out in the form of public defense of a master's qualification project.

The qualification work involves independent solving of a complex problem in the field of ecology, environmental protection and/or balanced use of natural resources, accompanied by research and/or innovative approaches. The main results of the qualification work must be approved, published and checked for plagiarism. The qualification work must be placed in the repository of NTU "KhPI".

Structural and logical diagram



Correspondence matrix of defined learning outcomes, competencies and educational components

Results of education	Competencies																
	General							Special (professional)									
	GC-1	GC-2	GC-3	GC-4	GC-5	GC-6	GC-7	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7	SC-8	SC-9	SC-10
RE-1	GT1, GT4, ST2, ST3, ST5, ST6,							GT1, ST2, ST4, ST5	ST1, ST2 ST4, ST5 ST6								
RE-2	GT1 ST3 ST4							ST1									
RE-3	GT1 ST2							ST2 PP1									
RE-4				GT3 GT4 ST1					ST1			GT4					
RE-5							GT3 ST3			GT3			GT3 ST3				
RE-6									ST5		GT1 ST5						
RE-7					ST2 ST6							ST2 ST6			ST2 ST6		
RE-8						GT2 ST5 PP1						GT4 ST5 PP1					
RE-9				GT3			GT3 ST3						GT3 ST3				
RE-10		ST4, PP1												ST4			
RE-11					ST6	GT1 ST6 PP1								ST1 ST6	ST1 ST4 ST6		
RE-12															ST2		ST2
RE-13															ST1		ST4

Results of education	Competencies																
	General							Special (professional)									
	GC-1	GC-2	GC-3	GC-4	GC-5	GC-6	GC-7	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7	SC-8	SC-9	SC-10
															ST4		PP1
RE-14			ST1 ST3 PP1														ST1 ST6 PP1
RE-15		ST3 PP1															ST1 ST3 PP1
RE-16		ST3	ST1 ST3														ST2 ST3 ST4
RE-17			GT1						ST2								
RE-18						GT1 ST4 ST5 PP1					GT1 GT2 ST5 PP1						
RE-19										ST4 PP1	GT2 PP1						
RE-20				ST1 ST4													ST1 ST4 PP1

This document is a translation of the educational-professional program from Ukrainian into English. In case of discrepancies between the Ukrainian and English versions of the educational-professional program or any dispute regarding the interpretation of any provision of the educational-professional program, the Ukrainian language version of the program will prevail.