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

I approve
Rector of NTU "KhPI"

_____Evgen SOKOL

"09"____May__2023

EDUCATIONAL AND PROFESSIONAL PROGRAM

"Software Engineering"

First (bachelor) level of higher education

in the specialty 121 - Software engineering
fields of knowledge 12 - Information technologies
Bachelor's degree in software engineering

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

_____/ Leonid TOVAZHNIANSKYI
Protocol No. 4
from "05"____May__2023

Kharkiv 2023

LETTER OF AGREEMENT

Educational and professional software engineering program

Level of higher education	First (undergraduate)
Branch of knowledge	12 Information technologies
Specialty	121 "Software engineering"
Qualification	Bachelor of Software Engineering

APPROVED

By the working group of the specialty of the specialty 121 "Software engineering"

Guarantor of the "Software Engineering" educational program

_____Yulia LITVINOVA

"___"_____2023

RECOMMENDED

Methodical Council of NTU "KhPI"

Deputy Chairman of the Methodical Council

_____Ruslan MYGUSHCHENKO

"___"_____2023

AGREED

Head of the Department of Software Engineering and Intelligent Management Technologies

_____Ihor GAMAYUN

"___"_____2023

AGREED

Director of the educational and scientific institute

of computer sciences and information technologies

_____ Mykhailo GODLEVSKYI

"___"_____2023

AGREED

Student (member of EP working group)

of the KN-220ae group

_____Daryna UDOD

"__"_____2023

REVIEWERS: Productive comments and feedback on the project of the educational and professional program (EPP) were received from:

1. EPAM SYSTEMS LLC
2. LLC "NIX SOLUTIONS LTD"
3. ACADEMY SMART LLC

PREFACE

Corresponds to the standard of higher education of the first (bachelor) level in the specialty 121 "Software engineering", which was approved by the order of the Ministry of Education and Science of Ukraine dated 10/29/2018 No. 1166.

Developed by the project group from the specialty 121 "Software engineering"Educational and Scientific Institute of Computer Sciences and Information Technologies of the National Technical University "Kharkiv Polytechnic Institute"consisting of:

Guarantor of the educational program

Litvinova Yuliya Serhiyivna, Candidate of Technical Sciences, Associate Professor of the Department of Software Engineering and Intelligent Management Technologies.

OP working group members:

1. Cherednichenko Olga Yuriivna, doctor of technical sciences, associate professor, professor of the Department of Software Engineering and Intelligent Management Technologies.
   (name,academic degree, academic title, position)
2. Oleksandr Vitaliyovych Shmatko, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Software Engineering and Intelligent Management Technologies.
   (name,academic degree, academic title, position)
3. Daryna Viktorivna Udod, student of group KN-220ae
   student (name, group)

EDUCATIONAL PROGRAM PROFILESPECIALTY
121 – SOFTWARE ENGINEERING

1 - General information	
Higher educational institution and structural unit	National Technical University "Kharkiv Polytechnic Institute", Faculty of Computer Sciences and Software Engineering, Department of Software Engineering and Management Information Technologies
The degree of higher education and the title of the qualification in the original language	Bachelor Educational qualification:Bachelor of Science in Software Engineering Diploma qualification:Bachelor of Science in Software Engineering
The official name of the educational program	Software engineering
Type of diploma and scope of the educational program	Bachelor's degree, single, 240 ECTS credits, study period 3 years 10 months
Availability of accreditation	Accreditation Commission. Ukraine. Certificate - ND No. 2192171 dated 09/06/2017. Validity period - 07/01/2025.
Cycle/level	NRK of Ukraine – level 6, FQ-EHEA – first cycle, EQF LLL – level 6
Prerequisites	Completed secondary education, a junior bachelor's degree in a related field (or other specialties) in accordance with the conditions and rules of admission.
Language of teaching	Ukrainian, English
The term of validity of the educational program	According to the validity period of the accreditation certificate Updated annually
Link to the permanent posting of the description of the educational program	http://web.kpi.kharkov.ua/asu/121-inzheneriya-programnogo-zabezpechennya/
2 - The purpose of the educational program	
Training of specialists capable of setting and solving tasks related to the development, maintenance and quality assurance of softwarein combination with a high level of professional training, the formation of a scientific worldview and the provision of a broad perspective in the social, humanitarian, fundamental spheres andin software engineering. Achieving the specified goal is based on the principles of consistency and individualization of education, fundamentality and integrity of knowledge provision, practical orientation and awareness of the importance of acquired competences, symbiosis of scientific and systemic approaches.	
3 – Characteristics of the educational program	
Subject area (field of knowledge, specialty, specialization)	Field of knowledge: 12 - Information technologies Specialty: 121 – Software engineering Educational program - Software engineering Object: software, processes, tools and resources for software development, support and quality assurance. The purpose of training: training of specialists who are able to set and solve tasks related to the development, maintenance and quality assurance of software. Theoretical content of the subject area: basic mathematical, informational, physical, economic provisions regarding the creation and maintenance of software; basics of domain analysis, modeling, design, construction, software support.

	Methods, techniques and technologies: software development methods and technologies; collection, processing and interpretation of software engineering research results. Tools and equipment: hardware and software development, maintenance and operation of software.
Orientation of the educational program	Professional training of specialists in the field of software engineering.
The main focus of the educational program and specialization	Special education in the field of information technologies with the specialty "121 - Software engineering". In-depth study of computer mathematics, information technologies of software development and a foreign language for IT professionals. Keywords: software engineering, software, information technologies.
Features programs	Orientation on partnership with domestic and foreign educational and scientific institutions, the private sector, scientists and practitioners, participation in international programs. Training is carried out using innovative pedagogical technologies, in particular - a project approach in the educational laboratory "Innovation Campus" of NTU "KhPI", where students have the opportunity to master practical skills in software development and testing, as well as develop soft skills that are necessary for a modern software engineering specialist support for work in IT companies and IT departments. Conducting internships in IT companies and student participation in real projects. Ability to study in English.
4 – Eligibility of graduates to employment and further education	
Suitability for employment	Professional activity as a software engineer; software engineer; system programmer; database programmer; web programmer; system administrator; information systems support engineer; software development and testing specialist. Graduates can work in professions according to the National Classifier of Professions DK 003:2010approved by order of the Ministry of Economic Development and Trade of Ukraine dated August 18, 2020 No. 1574: 2131.2 Developers of computing systems 2132 Professionals in the field of programming 2132.2 Developers of computer programs 2132.1 Research staff (programming)
Further education	A student who has completed training under this educational program and received a bachelor's degree can continue his studies at the Higher Education Institutions of Ukraine and abroad to obtain a master's degree in the field of knowledge "Information Technologies" or related fields.
5 – Teaching and assessment	
Teaching and learning	The teaching process includes the use of such educational technologies as: lectures, laboratory works, practical classes, work in small groups, seminars-discussions, brainstorming, presentations that develop communication and leadership skills; student-centered learning, distance learning in the Office 365 system, independent work with literary sources; methods of project learning and challenge-based learning in the educational laboratory of the Innovation Campus of the Department of SEMIT NTU "KhPI"; mixed forms of education using distance platforms.
Assessment	Evaluation of the student's educational achievements is carried out according to the rating system.

	Monitoring of students' knowledge and skills is carried out in the form of current and final control. Current control – oral and written survey, assessment of work in small groups, testing, defense of group and individual research tasks and projects. Final control - oral and written exams, assessments taking into account the accumulated points of the current control, defense of practical reports, defense of term papers. State certification – preparation and public defense (presentation) of the final qualification work. Evaluation is carried out according to the national scale ("excellent", "good", "satisfactory", "unsatisfactory"), 100-point scale and ECTS scale (A, B, C, D, E, FX, F).
6 – Software competencies	
Integral competence	The ability to solve complex specialized tasks or practical problems of software engineering, characterized by complexity and uncertainty of conditions, with the application of theories and methods of information technologies.
General competences	K01. Ability to abstract thinking, analysis and synthesis. K02. Ability to apply knowledge in practical situations. K03. Ability to communicate in the national language both orally and in writing. K04. Ability to communicate in a foreign language both orally and in writing. K05. Ability to learn and master modern knowledge. K06. Ability to search, process and analyze information from various sources. K07. Ability to work in a team. K08. The ability to act on the basis of ethical considerations. K09. The desire to preserve the environment. K10. The ability to act socially responsibly and consciously. K11. The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine. K12. The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technologies, to use various types and forms of motor activity for active recreation and leading a healthy lifestyle.
Special (professional) competences	K13. Ability to identify, categorize and formulate software requirements. K14. Ability to participate in the design of software, including modeling (formal description) of its structure, behavior and functioning processes. K15. Ability to develop architectures, modules and components of software systems. K16. Ability to formulate and ensure software quality requirements in accordance with customer requirements, specifications and standards. K17. Ability to adhere to specifications, standards, rules and recommendations in the professional field when implementing life cycle processes. K18. Ability to analyze, choose and apply methods and tools to ensure

	information security (including cyber security). K19. Knowledge of data information models, ability to create software for data storage, extraction and processing. K20. Ability to apply fundamental and interdisciplinary knowledge to successfully solve software engineering tasks. K21. The ability to evaluate and take into account economic, social, technological and environmental factors affecting the field of professional activity. K22. The ability to accumulate, process and systematize professional knowledge about creating and maintaining software and recognizing the importance of lifelong learning. K23. The ability to implement phases and iterations of the life cycle of software systems and information technologies based on appropriate software development models and approaches. K24. Ability to carry out the system integration process, apply change management standards and procedures to maintain the integrity, overall functionality and reliability of the software. K25. The ability to reasonably choose and master software development and maintenance tools. K26. Ability to algorithmic and logical thinking.
7 – Program learning outcomes	
Learning outcomes	LO01. Analyze, purposefully search for and select the information and reference resources and knowledge necessary for solving professional tasks, taking into account modern achievements of science and technology. LO02. Know the code of professional ethics, understand the social significance and cultural aspects of software engineering and adhere to them in professional activities. LO03. Know the main processes, phases and iterations of the software life cycle. LO04. Know and apply professional standards and other legal documents in the field of software engineering. LO05. Know and apply relevant mathematical concepts, methods of domain, system and object-oriented analysis and mathematical modeling for software development. LO06. The ability to choose and use the software creation methodology appropriate to the task. LO07. Know and apply in practice the fundamental concepts, paradigms and basic principles of the functioning of linguistic, instrumental and computing tools of software engineering. LO08. Be able to develop a human-machine interface. LO09. Know and be able to use methods and tools for gathering, formulating and analyzing software requirements. LO10. Conduct a pre-project survey of the subject area, system analysis of the design object. LO11. Select input data for design, guided by formal requirements description and modeling methods. LO12. Apply effective software design approaches in practice. LO13. Know and apply methods of developing algorithms, designing software and data and knowledge structures. LO14. Apply in practice instrumental software tools for domain analysis, design, testing, visualization, measurement and software documentation.

	LO15. Motivated to choose programming languages and development technologies to solve the tasks of creating and maintaining software. LO16. Have skills in team development, approval, design and release of all types of software documentation. LO17. Be able to apply methods of component software development. LO18. Know and be able to apply information technologies for data processing, storage and transmission. LO19. Know and be able to apply software verification and validation methods. LO20. Know approaches to evaluation and quality assurance of software LO21. To know, analyze, choose, competently apply the means of ensuring information security (including cyber security) and data integrity in accordance with the applied tasks being solved and the software systems being created. LO22. Know and be able to apply project management methods and tools. LO23. Be able to document and present the results of software development. LO24. Be able to calculate the economic efficiency of software systems. LO25. Apply the principles of moral, cultural, and scientific values and multiply the achievements of society, use various types and forms of motor activity to lead a healthy lifestyle and professional activity in the field of information technologies.
8 – Resource support for program implementation	
Staff support	Meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for the implementation of educational activities of educational institutions" dated December 30, 2015 No. 1187, Appendix 12; as amended in accordance with with CMU Resolution No. 365 dated 03/24/2021, appendix 15-16). The educational process is provided by scientific and pedagogical workers who work at the main place of work and have appropriate educational and/or professional qualifications. Practical teachers, specialists and employees of IT companies, foreign experts are also involved in teaching.
Material and technical support	Meets the technological requirements for material and technical support of educational activities in the field of higher educationin accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for conducting educational activities of educational institutions" of December 30, 2015, No. 1187, as amended in accordance with Resolution of the Cabinet of Ministers of Ukraine No. 365 of 24.03.2021, Appendix 17). In the educational process, educational facilities of NTU "KhPI" are used, in particular, computer laboratories and educational laboratory "Innovation Campus" of the SEMIT department, premises for scientific and pedagogical workers, other premises.
Informational and educational and methodological support	Meets the technological requirements for educational, methodical and informational support of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Decree of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for conducting educational activities of educational institutions" dated December 30, 2015, No. 1187, as amended, entered in accordance with Resolution of the Cabinet of Ministers No. 365 of March 24, 2021,

	Appendix 18). Application of the Office 365 system, LMS (Learning Management System) in the educational process, in particular, for distance learning. Access to the electronic repository (eNTUKhPIIR) of the scientific and technical library of NTU "KhPI" via the Internet (including the university Wi-Fi network) for access to educational publications and periodical scientific publications on IT, in particular, in English
9 – Academic mobility	
National credit mobility	On the basis of bilateral agreements on academic mobility.
International credit mobility	On the basis of bilateral agreements, as well as within the ERASMUS+ KA1 academic mobility programs, in particular with University Paris 13, France; University of Maribor, Slovenia; Universität Klagenfurt, Austria.
Education of foreign students of education	Training of foreign citizens and stateless persons is carried out in Ukrainian or English in accordance with the requirements of the Law of Ukraine "On Higher Education". At least 25% of scientific-pedagogical staff who ensure the implementation of the educational process in English have a document certifying English language proficiency at a level not lower than B2 in accordance with the Common European Recommendations on Language Education: Study, Teaching, Evaluation (Common European Framework of Reference for Languages, CEFR).

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

Code n/a	*Components of the educational program*	*Number of credits*	*Final control form*
1	2	3	4
Mandatory OP components			
General training			
GT 1	History and culture of Ukraine	3	Exam
GT 2	Ukrainian language (professional direction)	3	Exam
GT 3	Foreign Language	6	Test
GT 4	A foreign language for professional communication	6	6.7 – Test, 8 – Exam
GT 5	Basics of humanitarian and philosophical knowledge in professional activity	3	Exam
GT 6	Higher mathematics	11	Exam
GT 7	Physics	4	Exam
GT 8	Physical Education	12	Test
Special (professional) training			
PT 1	Fundamentals of programming	11	Exam
PT 2	Fundamentals of software engineering	4	Test
PT 3	Computer architecture and operating systems	4	Test
PT 4	Theory of algorithms	4	Test
PT 5	Probability theory and mathematical statistics	5	Exam
PT 6	Data models and structures	4	Exam
PT 7	Object-oriented programming	4	Exam
PT 8	Computer networks	3	Test
PT 9	Mathematical models and analysis of systems	5	Test
PT 10	Computer mathematics	13	4 – Test, 5,6 – Exam
PT 11	Basics of web development	4	Exam
PT 12	Design and development of databases	4	Exam
PT 13	Software requirements engineering	4	Test
PT 14	CI/CD	3	Test
1	2	3	4
PT 15	Software architecture and design	8	Exam
PT 16	Software quality, testing and support	4	Exam
PT 17	Fundamentals of cyber security	3	Exam
PT 18	Decision making theory	4	Exam
PT 19	Scientific and practical seminar Software engineering	7	Test
PT 20	Software modeling and analysis	4	Exam
PT 21	Practical seminar on mathematical methods in software engineering	3	Test
PT 22	Artificial intelligence systems	3	Test
PT 23	Fundamentals of software project management	3	Exam
PT 24	Introductory practice at "Innovation Campus"	3	Test

Code n/a	*Components of the educational program*	*Number of credits*	*Final control form*
1	2	3	4
PT 25	Project (practice)	6	Test
PT 26	Pre-diploma practice	6	Test
PT 27	Certification	6	
The total amount of mandatory components		**180**	
Selective OP components			
OP 1	***Profiled package of disciplines 01 "Research and Development"***	**33**	
OP 1.1	Foreign language for scientific research	9	3,4 – Test, 5 – Exam
OP 1.2	Data collection and preparation	4	Test
OP 1.3	Probabilistic and statistical models	4	Test
OP 1.4	Experiment planning	4	Test
OP 1.5	Methods of modeling complex systems	4	Test
OP 1.6	Fuzzy logic and fuzzy systems	4	Test
OP 1.7	Basics of Machine Learning	4	Test
OP 2	***Profiled package of disciplines 02 "Software Development and Startup"***	**33**	
OP 2.1	Foreign language for business communication	9	3,4 – Test, 5 – Exam
OP 2.2	Basics of entrepreneurship	4	Test
OP 2.3	Business modeling	4	Test
OP 2.4	Basics of prototyping	4	Test
OP 2.5	Business planning of a startup	4	Test
OP 2.6	Business analytics of a startup	4	Test
OP 2.7	Internet marketing	4	Test
OP 3	***Profiled package of disciplines 03 "Innovation Campus"***	**33**	
OP 3.1	A foreign language for the development of corporate information systems	9	3,4 – Test, 5 – Exam
OP 3.2	Development of corporate information systems (part 1)	4	Test
OP 3.3	Development of corporate information systems (part 2)	4	Test
OP 3.4	Databases for corporate information systems	4	Test
OP 3.5	Architecture of corporate information systems	4	Test
OP 3.6	Project workshop	4	Test
OP 3.7	Formation and development of IT project teams	4	Test
Disciplines of the student's free choice of specialized training according to the list		15	
Disciplines of the student's free choice from the university-wide catalog of disciplines		12	
OD 1	*Discipline 1*	4	
OD 2	*Discipline 2*	4	
OD 3	*Discipline 3*	4	

Code n/a	*Components of the educational program*	*Number of credits*	*Final control form*
1	2	3	4
The total amount of sample components:		**60**	
GENERAL SCOPE OF THE EDUCATIONAL PROGRAM:		**240**	

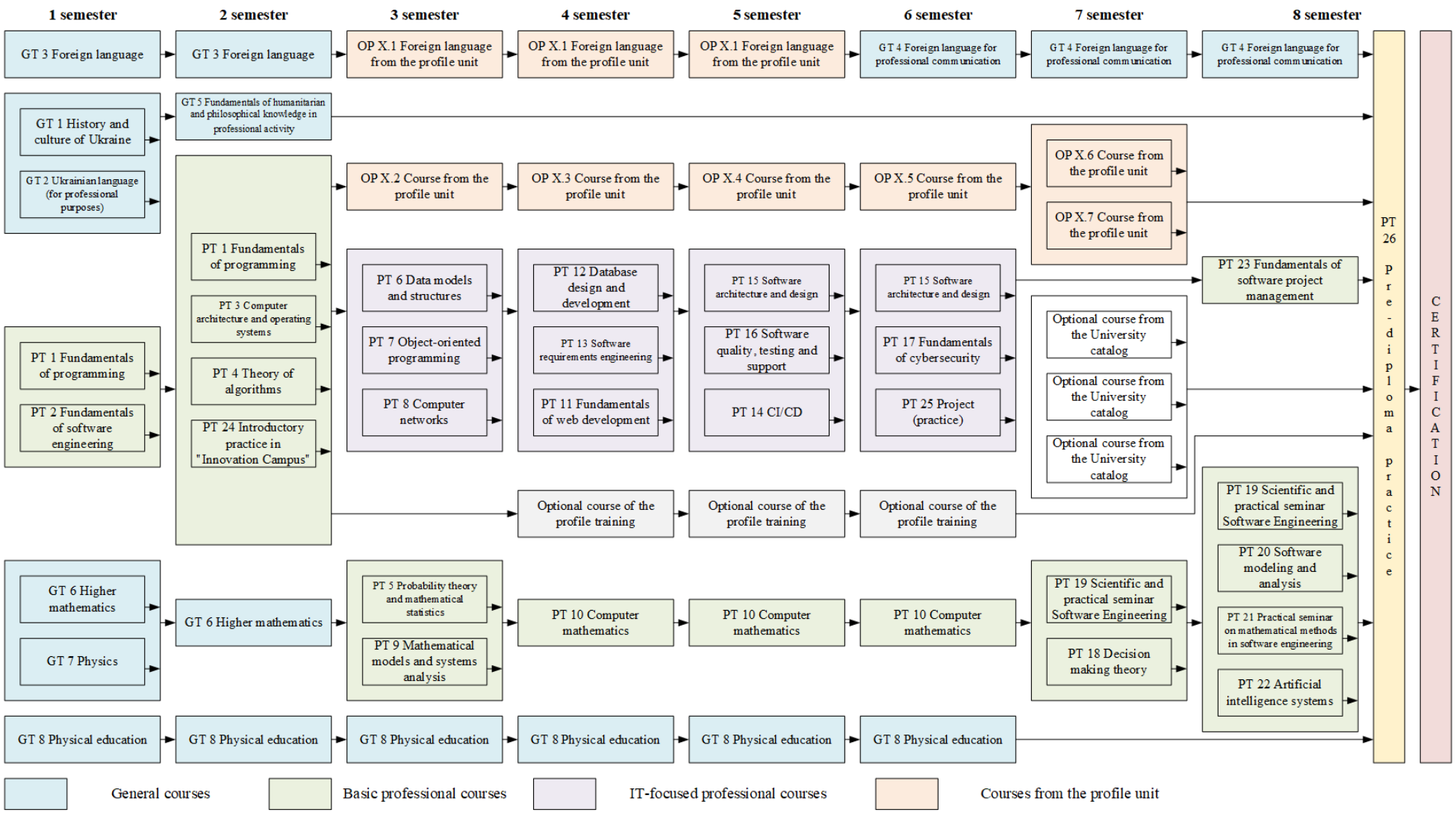
DISTRIBUTION OF THE CONTENT OF THE EDUCATIONAL PROGRAM BY GROUPS OF COMPONENTS AND TRAINING CYCLES

No	Training cycle	The volume of the educational load of the student of higher education (ECTS credits / %)		
		Mandatory components of the educational and professional program	Elective components of the educational and professional program	Total for the entire period of study
1	General training	48 / 21	-	**48 / 21**
2	Special (professional) training	132 / 54	-	**132 / 54**
3	Disciplines of free choice	-	60 / 25	**60 / 25**
Total for the entire period of study		**180 / 75**	**60 / 25**	**240 / 100**

FORM OF CERTIFICATION OF HIGHER EDUCATION ACQUIRES

Forms of attestation of applicants of higher education	Attestation is carried out in the form of public defense of qualification work.
Requirements for qualifying work	The qualification work involves the solution of a specialized task or a practical problem of software engineering, characterized by complexity and uncertainty of conditions, with the application of theories and methods of information technologies. There can be no academic plagiarism, falsification, or plagiarism in the qualification work. The qualification work must be published on the official website of the institution of higher education or its subdivision, or in the repository of the institution of higher education. Publication of qualification papers containing information with limited access shall be carried out in accordance with the requirements of current legislation.

STRUCTURAL AND LOGICAL SCHEME



CORRESPONDENCE MATRICES OF DETERMINED LEARNING OUTCOMES, COMPETENCES AND EDUCATIONAL COMPONENTS

Educational components	Learning outcomes																							
	LO01	LO02	LO03	LO04	LO05	LO06	LO07	LO08	LO09	LO10	LO11	LO12	LO13	LO14	LO15	LO16	LO17	LO18	LO19	LO20	LO21	LO22	LO23	LO24	LO25
GT 1	+	+																							+
GT 2	+																						+		
GT 3	+																						+		
GT 4	+																						+		
GT 5		+																							+
GT 6	+																								
GT 7	+																								
GT 8																									+
PT 1	+						+	+							+								+		
PT 2	+	+	+	+		+			+					+	+				+	+			+		
PT 3	+						+																		
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PT 7	+			+	+		+	+					+	+		+	+						+		
PT 8	+						+											+							
PT 9	+				+					+	+														
PT 10	+				+													+							
PT 11	+		+			+	+	+				+		+	+								+		
PT 12	+						+			+		+	+	+				+			+		+		
PT 13	+		+						+	+	+			+					+				+		
PT 14	+						+								+			+			+				
PT 15	+		+			+	+			+	+	+	+	+	+	+	+	+	+	+			+		
PT 16	+													+	+				+	+					
PT 17	+																	+			+				
PT 18	+				+						+	+												+	
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PT 20	+		+		+				+		+			+									+		
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PT 25	+	+	+	+		+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+		
PT 26	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Educational components	General competences												Special (professional) competences													
	K01	K02	K03	K04	K05	K06	K07	K08	K09	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	K23	K24	K25	K26
GT 1			+		+	+		+		+	+	+														
GT 2		+	+		+	+																				
GT 3		+		+	+	+						+														
GT 4		+		+	+	+						+					+									
GT 5	+				+			+	+	+	+	+									+					
GT 6	+				+	+														+						
GT 7	+				+	+														+						
GT 8		+					+					+														
PT 1	+	+			+	+								+											+	+
PT 2	+			+	+	+	+					+	+	+		+	+					+			+	
PT 3	+				+	+									+					+						+
PT 4	+				+	+														+						+
PT 5	+				+	+													+							+
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PT 10	+				+	+														+						+
PT 11		+			+	+							+	+								+			+	+
PT 12	+	+			+	+							+	+	+				+			+			+	+
PT 13				+	+	+							+	+		+	+	+					+	+	+	+
PT 14					+	+																		+	+	
PT 15	+	+			+	+	+						+	+	+		+		+				+	+	+	+
PT 16	+	+			+	+	+									+	+					+		+	+	+
PT 17					+	+												+		+						
PT 18	+	+			+	+														+	+					+
PT 19	+	+	+	+	+	+	+	+					+	+	+	+	+			+			+		+	+
PT 20	+	+			+	+								+	+	+	+		+				+			+
PT 21	+	+			+	+								+						+						+
PT 22	+				+	+		+											+	+						+
PT 23		+			+	+	+										+			+	+		+			
PT 24	+	+		+	+	+	+			+				+											+	+
PT 25	+	+		+	+	+	+			+			+	+	+	+	+	+	+			+	+	+	+	+
PT 26	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+