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

EDUCATIONAL-PROFESSIONAL PROGRAM
Software Engineering
Second (Master's) level

specialty	**121 Software Engineering**
branch of knowledge	**12 Information Technologies**
qualification	**Master of Software Engineering**

APPROVED by Academic Council
Chairman of the Academic Council
NTU "KhPI"
_____ L.L. Tovazhniansky
«____» _____ 20_____.
protocol №__ from «___» _____ 2019.

The educational program is put into action
Rector _____ Ye.I. Sokol
(Order № __ from «___» _____ 2019)

NTU "KhPI"
Kharkiv 2019

LETTER OF APPROVAL

of educational and professional program

Higher education level	Second (Master)
Branch of knowledge	12 Information Technologies
Specialty	121 "Software Engineering"
Specialization	121-01 "Distributed software systems and technologies » 121-02 «Intelligent systems software
Qualification	Master of Software Engineering

APPROVED
Scientific-methodical committee on the specialty "Information systems and technologies"
Head of the committee

_____ N..V. Sharonova

«____»_____201_ .

RECOMMENDED
Methodical Council of NTU "KhPI"
Deputy Chairman of the methodical council

_____R.P. Migushchenko

«____»_____201_ .

AGREED
Head of the Department of Software Engineering and Management Information Technologies
_____M.D. Godlevsky

«____»_____201_ .

AGREED
Dean of the Faculty of Computer Sciences and Software Engineering

_____M.M. Malko

«____»_____201_ .

APPROVED AND PROVIDED

By order of the rector of the National Technical University "Kharkiv Polytechnic Institute" from "_____" _____ 20___ p. № _____.

PREFACE

The educational program for training Masters in the specialty 121 – Software Engineering is prepared in accordance with the standard of higher education of Ukraine.

Developed by a working group of the Department of Software Engineering and Management Information Technologies of the Faculty of Computer Science and Software Engineering of the National Technical University "Kharkiv Polytechnic Institute", consisting of:

1. Doctor of Technical Sciences, Professor M.D. Godlevsky - the head of the department of Software Engineering and Management Information Technologies, the head of the project group (guarantor of the educational program).

2. Candidate of Technical Sciences, Associate Professor V.Ye. Sokol – Associate Professor of the Department of Software Engineering and Management Information Technologies.

3. Candidate of Technical Sciences, Associate Professor O.V. Shmatko – Associate Professor of the Department of Software Engineering and Management Information Technologies.

Reviews of external stakeholders:

1. Nix Solutions Company
2. Telesens Company
3. Sigma Company

Developed by a working group

Chairman of the working group

Godlevsky M.D., Doctor of Technical Sciences, Professor, Head of the Department of Software Engineering and Management Information Technologies of the National Technical University "Kharkiv Polytechnic Institute" _____

Members of the working group:

Sokol V.Ye., CTSc, Associate Professor, Associate Professor of the department of Software Engineering and Management Information Technologies of the National Technical University "Kharkiv Polytechnic Institute" _____

Shmatko O.V., CTSc, Associate Professor, Associate Professor of the department of Software Engineering and Management Information Technologies of the National Technical University "Kharkiv Polytechnic Institute" _____

1. Profile of the educational program in specialty number 121 - Software Engineering

1 - General information	
Full name of 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
Higher education degree and the name of the qualification	Master Educational qualification: Master of Software Engineering Qualification in Diploma: Master of Software Engineering
The official name of the educational program	Software Engineering
Type of diploma and volume of educational program	Master's degree, single. The volume of the educational and professional program of the Masters is 90 ECTS credits, duration of training 1 year 4 months. The volume of the educational and scientific program of the Master is 120 ECTS credits, the duration of training 1 year 9 months
Availability of accreditation	
Cycle / Level	NRC of Ukraine - 7th level, FQ-EHEA-the second cycle, EQF LLL-7 level
Preconditions	Bachelor's degree
Teaching language	Ukrainian, Russian, English
The duration of the educational program	To the next accreditation
Internet address of the permanent description of the educational program	http://asu.kh.ua/
2 - The purpose of the educational program	
A combination of high-level professional training with the formation of a scientific outlook and providing a broad outlook in the social, humanitarian, fundamental and software engineering fields. The achievement of the stated	

goal is based on the principles of continuity and individualization of learning, the fundamental and integrity of knowledge, practical orientation and awareness of the place of the received competencies, symbiosis of scientific and system approaches, etc.	
3 - Characteristics of the educational program	
Subject area (branch of knowledge, specialty, specialization))	Branch of Knowledge: 12 Information Technologies Specialty: 121 - Software Engineering 121-01 - Distributed software systems and technologies 121-02 - Software for intelligent systems
Orientation of the educational program	The master's educational, professional, and educational program is designed for students who seek to become specialists in engineering and research field in the direction of software engineering. The main advantage of the master's program is to focus on the formation of the broadest scientific and technical outlook of the future professional.
The main focus of the educational program and specialization	**General:** - familiarization with modern methods of effective access to information, its collection, systematization and preservation; – the main paradigms of software design and development of computerized systems; – methods of planning the life cycle of software and developing a resource management model; – the main protocols of the Internet, models of Internet-services; – methods of designing information WEB-resources with the integration of external data and software products, using methods of information security. **Special:** – ensuring the preparation and obtaining deep knowledge for the effective use of new information and communication technologies in various subject areas of industry, education, in the IT companies; – gaining permanent skills in the use of modern communication technologies, virtualization technologies, storage and processing of large amounts of data in the development of modern information systems used in innovation activities of enterprises and business structures;

	– gaining decision-making skills based on the methods of modern control theory of complex systems and objects of management using computational intelligence technologies. Keywords: software, information technology, software engineering
Features of the program	Research and solving complex problems in the field of software engineering, information technology and research and innovation, analysis of existing modern computer systems. Focusing on partnership with domestic and foreign educational and scientific institutions, private sector, academics and practitioners, participation in international programs to improve the quality of education.
4 - Eligibility of graduates to employment and further training	
Suitability for employment	Professional activity as a software engineer; engineer developer; system developer; database developer; web- developer; system administrator; engineer for information systems maintenance; specialist in the development and testing of software. Graduates can work in professions according to the National Classification of Professions DK 003: 2010: 2131.2 Software Engineer 2132.2 Software Engineer 2132.2 Developer (database) 2132.2 System Developer 2131.2 Software and Multimedia Analyst 2132.2 Application Developer 2149.2 Research Engineer 3121.2 IT Specialist 3121.2 Specialist in Software Development and Testing 3121.2 Specialist in the development of software
Further training	A student who has been trained in this curriculum and received a master's degree may continue to study at higher education institutions of Ukraine and abroad to obtain a third educational-scientific level of higher education in the branch of knowledge "Information Technologies" or related.
5 - Teaching and evaluation	

Teaching and learning	The teaching process involves the use of such learning technologies as: problem-oriented lectures, laboratory works, practical classes, work in small groups, seminar-discussions, brain attacks, presentations that develop communication and leadership skills, independent work with literature sources, generalization skills ; mixed forms of learning using distance-based platforms of online courses.
Evaluation	The academic performance assessment of knowledge and skills of students is carried out in the form of current and summative assessment. Assessment of students' knowledge is carried out according to the modular rating system. Current assessment involves knowledge, skills and abilities of students at lectures, laboratory, practical and seminar sessions, and during individual training tasks and modular test works assessment. The summative assessment is carried out in the form of examinations, credits and final certification. The summative assessment of knowledge in the form of an exam is made in written form. A student of higher education is considered to be admitted to the final examination in the disciplines of the educational program, if he has completed all types of work provided by the curriculum in this discipline. The summative assessment in the form of a differentiated credit is based on the results of the current assessment (the sum of the marks obtained by the results of the current assessment) without the submission of additional forms of assessment. The assessment of applicants for higher education is based on the results of examinations and differentiated credits for each semester.
6 - Program competencies	
Integral competence	Ability to solve complex problems and problems of software engineering, which involves research with elements of scientific novelty and / or innovation in conditions of uncertainty requirements.
General competencies	GC-1. Ability to think, analyze and synthesize. GC-2. Ability to communicate in a foreign language both verbally and in written form. GC-3. Ability to conduct theoretical and applied research at the appropriate level. GC-4. Ability to motivate people and move towards a

	common goal, work in a team of employees. GC -5. Ability to communicate with representatives of other professional groups of different levels (with experts from other branches of knowledge / types of economic activity). GC -6. Ability to improve skills based on analysis of previous experience. Additionally for educational and scientific programs: GC -7 (1). Ability to generate new ideas (creativity).
Professional competence of the specialty (PC)	PC-1. Ability to identify, classify and formulate requirements to software. PC-2. Ability to analyze subject areas, formulate, analyze and model software requirements. PC-3. Ability to identify, classify and describe project tasks, to find rational methods and approaches to their solution. PC-4. Ability to design software, including modeling its architecture, behavior and processes of operation of individual subsystems and modules. PC-5. Ability to develop and implement new competitive ideas in software engineering. PC-6. Ability to assess the degree of validity of the application specifications, standards, rules and recommendations in the professional field and to adhere to them in the implementation of software life cycle processes. PC-7. Ability to effectively manage financial, human, technical and other project resources. PC-8 Ability to systematize professional knowledge about software creation and maintenance. PC-9. Ability to develop and coordinate processes, phases, and iterations of the software system's life cycle based on the application of appropriate models, methods and software development technologies. Additionally for educational and professional programs: PC-10 (1). Ability to ensure compliance with software quality requirements. Additionally for educational and scientific programs: PC-10 (2). Ability to plan and conduct scientific research, prepare the results of scientific works on software engineering prior to distribution. PC-11. Ability to apply and develop fundamental and

	interdisciplinary knowledge to successfully solve the scientific problems of software engineering.
7 - Program training results	
Program results of training (RT)	RT-1. Know and systematically apply methods of analysis and modeling of the application area, identifying information needs and gathering source data for software design. RT-2. To validate the choice of methods of forming requirements to the software system, to develop, analyze and systematize requirements. RT -3. Know and apply the basic concepts and methodologies for modeling information processes. RT -4. Evaluate and choose methods and models for developing, implementing, operating software and managing them at all stages of the lifecycle. RT -5. Develop and evaluate software design strategies; to substantiate, analyze and evaluate the project decisions taken from the point of view of the quality of the final software product. RT -6. Analyze, evaluate and choose methods, modern software and hardware tools and computer tools, technologies, algorithmic and software solutions for the efficient execution of specific production tasks in software engineering. RT -7. Choose the paradigms and programming languages for solving applied problems; apply in practice system and specialized tools, component technologies (platforms), and integrated software development environments. RT -8. Conduct an analytical study of the parameters of the functioning of software systems for their validation and verification, as well as to analyze selected methods, tools for automated design and software implementation. RT -9. Know and apply modern professional standards and other regulatory documents on software engineering. RT -10. Ability to make organizational and managerial decisions in conditions of uncertainty.

	RT -11. Acquire new scientific and professional knowledge, improve skills, forecast the development of software systems and information technologies. Additionally for educational and professional programs: RT-12 (1) Apply models and methods of evaluation and quality assurance at all stages of the software life cycle. RT -13 (1) Know and apply in practice various methodologies and means of reengineering of inherited software systems. ***Additionally for educational and scientific programs***: RT -12 (2). Apply in practice effective approaches to software design. RT -13 (2). Know and apply methods of developing algorithms, designing software and data and knowledge structures. RT -14. Apply in practice instrumental software tools for domain analysis, design, testing, visualization, measurement and documentation of software. RT -15 Motivatedly choose programming languages and technology to solve the problems of creating and maintaining software. RT -16. Have skills in team development, design and release of all types of software documentation. RT -17. Be able to apply component software development techniques. RT -18 Know and be able to apply information processing, storage and data transfer technologies. RT -19. Know and be able to apply the methods of software verification and validation. RT -20. Know the approaches to assessing and ensuring software quality. RT -21. Know, analyze, choose, apply information security tools (including cybersecurity) and data integrity in accordance with application tasks being solved and software systems created. RT -22. Know and be able to apply methods and tools for project management. RT -23. Be able to document and present the results of software development.

	RT -24. Be able to calculate the economic efficiency of software systems.
8 - Resource providing for the implementation of the program	
Staff providing	Meets staff requirements on 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 Educational Activities of Educational Institutions" of December 30, 2015, No. 1187, Appendix 12)
Material and technical providing	Corresponds to the technological requirements for the material and technical providing 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 Educational Activities of Educational Institutions" dated December 30, 2015, No. 1187, Appendix 13)
Information and educational and methodological providing	Corresponds to the technological requirements for educational, methodological and informational providing 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 educational activities of educational institutions" dated December 30, 2015, No. 1187, Annexes 14- 15)
9 - Academic mobility	
National Credit Mobility	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and higher educational institutions of Ukraine
International Credit Mobility	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and University Paris 13, Poznań University of Economics
Education of foreign applicants	According to the license, training of foreigners and stateless persons is provided.

2. List of components of the educational-professional program and their logical consistency

2.1 List of components of EP

Code n / a	Components of educational program	Number of credits	Form of summative assessment
1	2	3	4
Compulsory components of EP			
CC 1	Civil Defense	2	Credit
CC 2	Labor safety in the industry	2	Credit
CC 3	Intellectual Property	2	Credit
CC 4	Philosophical problems of modern scientific knowledge	2	Credit
CC 5	Architecture and technology of distributed software systems	6	Exam
CC 6	Project management in software engineering	6	Credit
CC 7	Fundamentals of scientific research of the processes of the life cycle of software systems	6	Exam
CC 8	Models and methods of decision support	6	Exam
CC 9	Models and technologies of software systems security	6	Exam
Additional compulsory components of educational-professional level of EP			
CC 10	English for academic purposes	6	Credit, and exam in the last two semesters
	Pre-diploma internship	9	Credit
	Scientific research work	4	Credit
	Attestation	3	
	Total number of compulsory components of educational and professional level of training	60	
Additional compulsory components of educational-scientific-level of EP			
CC 10	English for academic purposes	8	Credit, and exam in the last two semesters
CC 11	Analysis and simulation of problem-oriented software systems	4	Exam

	Pre-diploma	16	Credit
	Scientific research work	10	Credit
	Attestation	3	
	The total number of compulsory components of the educational-scientific level of training	76	
Sample components of educational and professional level of EP			
Sample Set 1 "Distributed Programming Systems and Technologies"			
SS 1.1	Templates for designing and integrating corporate applications	7	Exam
SS 1.2	Distributed databases and data warehouses	6	Exam
SS 1.3	Architecture and technology of mobile systems development	6	Credit
SS 1.4	Cloud technology and implementation	7	Exam
SS 1.5	Special seminar on the topic of diploma	4	Credit
	Total number of components of the sample set 1 for educational-professional level	30	
Sample Set 2 "Intelligent Systems Software"			
SS 2.1	Intelligent Systems Software	14	Credit, and exam in the last two semesters
SS 2.2	Fundamentals of the design of intelligent systems	6	Credit
SS 2.3	Intellectual analysis of data and knowledge extraction	4	Exam
SS 2.4	Formal research methods of software systems	6	Exam
	Total number of components of the sample set 2 for educational-professional level	30	
	Total number OF THE EDUCATIONAL PROGRAM OF EDUCATIONAL-PROFESSIONAL LEVEL	**90**	
Sample components of the educational-scientific-level of EP			
Sample Set 1 "Distributed Programming Systems and Technologies"			
SS 1.1	Templates for designing and integrating corporate applications	7,0	Exam
SS 1.2	Distributed databases and data storages	6,0	Exam

SS 1.3	Architecture and technology of mobile systems development	6,0	Credit
SS 1.4	Cloud technologies and applications	7,0	Exam
SS 1.5	Special seminar on the topic of diploma (part 1)	4,0	Credit
SS 1.6	Models and technologies of family software systems development	3,0	Credit
SS 1.7	Special seminar on the topic of diploma (part 2)	3,0	Credit
SS 1.8	The theory and practice of developing distributed software systems	8,0	Exam
	The total number of component sample set 1 for educational and scientific level	44	
Sample Set 2 "Software of Intelligent Systems"			
SS 2.1	Intelligent Systems Software	16	Credit, and exam in the last two semesters
SS 2.2	Fundamentals of the design of intelligent systems	6	Credit
SS 2.3	Intellectual analysis of data and knowledge extraction	4	Exam
SS 2.4	Formal research methods of software systems	6	Exam
SS 2.5	Frameworks and platforms for machine learning	3	Credit
SS 2.6	Promising technologies and directions of development of intellectual software systems	5	Credit
SS 2.7	Big Data (Large Data Processing Technologies)	4	Exam
	Total number of components of the sample set 2 for educational-scientific level	44	
	Total number OF THE EDUCATIONAL PROGRAM OF EDUCATIONAL AND SCIENTIFIC LEVEL	**120**	

2.2 Structural-logical scheme EP

Semester	Contents of educational activity
9	CC 5, CC 6, CC 10, SS 1.1, SS 1.4, SS 2.1, SS 2.2, SS 2.3
10	CC 4, CC 7, CC 8, CC 10, SS 1.2, SS 1.3, SS 2.1, SS 2.4
11	CC 1, CC 2, CC 3, CC 9, CC 10, CC 11, SS 1.5, SS 1.6, SS 2.1, SS 2.5
12	CC 10, SS 1.7, SS 1.8, SS 2.1, SS 2.6, SS 2.7

3. Form of attestation of applicants for higher education

The attestation of graduates in the higher educational program of the specialty number 121 - Information systems and technologies is carried out in the form of Master's graduate thesis defense and ends with the issuance of the standard-issue document of awarding the graduate a Master's Degree with a qualification: Master of Software Engineering.

The attestation is carried out openly and publicly.

4. Matrix of compliance of program competencies to the components of the educational program

	GC 1	GC 2	GC 3	GC 4	GC 5	GC 6	GC 7	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10	PC 11
CC -1			•									•						
CC -2			•															
CC -3				•														
CC -4	•							•		•	•							
CC -5	•																	
CC -6	•																	
CC -7	•																	
CC -8									•			•						
CC -9										•								
CC -10												•						
CC -11														•	•			
SS 1.1																		
SS 1.2																•		
SS 1.3																		
SS 1.4																		
SS 1.5													•					
SS 1.6																		
SS 1.7						•												
SS 1.8																		
SS 2.2																•		
SS 2.3																		
SS 2.4						•							•					
SS 2.5														•		•		
SS 2.6						•												
SS 2.7																		

5. Matrix providing programmatic training results for the corresponding components of the educational program

	RT01	RT 02	RT 03	RT 04	RT 05	RT 06	RT 07	RT 08	RT 09	RT 10	RT 11	RT 12	RT 13	RT 14	RT 15	RT 16	RT 17	RT 18	RT 19	RT 20	RT 21	RT 22	RT 23	RT 24
CC-1			•									•												
CC-2			•																					
CC -3				•																				
CC -4	•							•		•	•													
CC -5	•																			•				
CC -6	•																			•				
CC -7	•																			•				
CC -8									•			•									•			
CC -9										•											•			
CC-10												•												
CC -11														•	•									
SS 1.1																				•			•	•
SS 1.2																							•	•
SS 1.3																						•		
SS 1.4																			•		•			
SS 1.5									•								•							
SS 1.6													•									•		
SS 1.7								•															•	•
SS 1.8														•				•		•				
SS 2.1											•													
SS 2.2										•														
SS 2.3																•				•				
SS 2.4																								
SS 2.5									•		•				•									
SS 2.6														•									•	•
SS 2.7																			•				•	

Head of the graduation department _____ M.D. Godlevsky

(signature) (last name)

Head of the project team (guarantor of the educational program) _____ M.D. Godlevsky

(signature) (last name)