

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

EDUCATIONAL-PROFESSIONAL PROGRAM

**Software Engineering
First (Bachelor's) level**

specialty **121 Software Engineering**

branch **of 12 Information Technologies**

knowledge

qualification **Bachelor 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
from _____ 2019
Rector _____ Y.I. Sokol
(Order № __ from " ____ " _____ 2019)

NTU "KhPI"
Kharkiv 2019

LETTER OF APPROVAL
of educational and professional program

Higher education level	First (Bachelor)
Branch of knowledge	12 Information Technologies
Specialty	121 «Software Engineering»
Specialization	
Qualification	Bachelor of Software Engineering

APPROVED

Scientific-methodical committee on the
specialty "Software Engineering"
Head of the Committee

_____ M.D. Godlevsky

« ____ » _____ 201_ .

RECOMMENDED

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

_____ RP Miguschenko

« ____ » _____ 201_ .

AGREED

Head of the Department of Software
Engineering and Management Information
Technologies

_____ MD 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__ . № _____ .

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PREFACE

Educational program (EP) for training Bachelors 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 Technology, 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 Technology.
3. Candidate of Technical Sciences, Associate Professor O.V. Shmatko - Associate Professor of the Department of Software Engineering and Management Information Technology.

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	Bachelor Educational qualification: Bachelor of Software Engineering Qualification in a diploma: a Bachelor of Software Engineering
The official name of the educational program	Software Engineering
Type of diploma and volume of educational program	Bachelor's degree, single, 240 ECTS credits, term of training 4 years
Availability of accreditation	
Cycle / Level	NRC Ukraine - level 6, FQ-EHEA-first cycle, EQF LLL-6 level
Preconditions	Completed secondary education, an educational degree of a junior bachelor in related (or other specialties) in accordance with the conditions and rules of admission.
Teaching language	Ukrainian, Russian, English
The duration of the educational program	
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
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Orientation of the educational program	The bachelor's educational and professional 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 bachelor's program is to focus on the formation of the broadest scientific and technical outlook of the future professional.
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The main focus of the educational program and specialization	<p>General:</p> <ul style="list-style-type: none"> - 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. <p>Special:</p> <ul style="list-style-type: none"> - 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;
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	<p>– gaining decision-making skills based on the methods of modern control theory of complex systems and objects of management using computational intelligence technologies.</p> <p>Keywords: software, information technology, software engineering</p>
Features of the program	<p>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.</p>
4 - Eligibility of graduates to employment and further training	
Suitability for employment	<p>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.</p> <p>Graduates can work in professions according to the National Classification of Professions DK 003: 2010:</p> <p>2131.2 Database Administrator 2131.2 Data Administrator 2131.2 Access Administrator 2131.2 System Administrator 2131.2 Computer Software Engineer 2132.2 Software engineer 2132.2 Developer (database) 2131.2 Software and Multimedia Analyst 2132.2 Application Developer 2139.2 Computer Engineer 2149.2 Research Engineer 3121.2 IT Specialist 3121.2 Specialist in Software Development and Testing 3121.2 Specialist in the development of software 3121.2 Specialist in computer graphics (design)</p>
Further training	<p>A student who has been trained in this curriculum and received a bachelor's degree may continue to study at higher education institutions of Ukraine and abroad for</p>

	a bachelor's degree in the field of knowledge "Information Technologies" or related.
5 - Teaching and evaluation	
Teaching and learning	The teaching process involves the use of such learning techniques as: problem-oriented lectures, laboratory works, practical classes, work in small groups, seminar-discussions, brain storms, 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 specialized tasks and practical problems in the field of designing software in the course of professional activity or in the process of training.
General competencies	C01. Ability to think, analyze and synthesize. C02. Ability to apply knowledge in practical situations. C03. Ability to communicate in the state language both verbally and in written form.

	<p>C04. Ability to communicate in a foreign language both verbally and in written form.</p> <p>C05. Ability to learn and master modern knowledge.</p> <p>C06. Ability to search, process and analyze information from various sources.</p> <p>C 07. Ability to work in a team.</p> <p>C08. Ability to act on the basis of ethical reasoning.</p> <p>C 09. The desire to save the environment.</p> <p>C10 Ability to act socially responsibly and consciously.</p> <p>C11 The ability to exercise their 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, human and civil rights and freedoms of Ukraine.</p> <p>C12 Ability to preserve and increase the moral, cultural, scientific values and achievements of society on the basis of understanding of the history and regularities of the subject area, its place in the general system of knowledge about nature and society and in the development of society and technology, use different types and forms of motor activity for active rest and healthy lifestyle.</p>
<p>Professional competencies</p>	<p>C13 Ability to identify, classify and formulate requirements to software.</p> <p>C14 Ability to participate in software design, including simulation (formal description) of its structure, behavior and processes of operation.</p> <p>C15 Ability to develop architectures, modules and components of software systems (including web applications and mobile applications).</p> <p>C 16 Ability to formulate and provide software quality requirements in accordance with customer requirements, specifications and standards.</p> <p>C 17 Ability to follow the specifications, standards, rules and recommendations in the professional field in the implementation of life cycle processes.</p> <p>C 18 Ability to analyze, select and apply methods and tools for providing information security (including cyber security).</p> <p>C 19 Knowledge of informational data models, the ability to create software for storing, extracting and evaluating data.</p>

	<p>C 20 Ability to apply fundamental and interdisciplinary knowledge to successfully solve software engineering tasks (including web applications and mobile applications).</p> <p>C 21 Ability to assess and take into account the economic, social, technological and environmental factors that influence the field of professional activity.</p> <p>C 22. Ability to accumulate, process and systematize professional knowledge about software development and maintenance and recognition of the importance of lifelong learning.</p> <p>C23. Ability to implement phases and iterations of the life cycle of software systems and information technologies based on appropriate models and approaches to software development.</p> <p>C24. The ability to integrate the system, apply standards and change management procedures to maintain integrity, overall functionality, and software reliability.</p> <p>C25 Ability to reasonably choose and develop software development and maintain software.</p> <p>C26 Ability to algorithmic and logical thinking.</p>
7 - Program training results	
Program results of training in general preparation	<p>RTg01. Ability to analyze, search and choose the resources and knowledge necessary for the solution of the professional tasks of the information source, taking into account the modern achievements of science and technology.</p> <p>RTg 02. Know the code of professional ethics, understand the social significance and cultural aspects of software engineering and adhere to them in professional activities.</p> <p>RTg 03. Know the basic processes, phases and iterations of the software lifecycle.</p> <p>RTg 04. Know and apply professional standards and other normative and legal documents in the field of software engineering.</p> <p>RTg 05. Know and apply appropriate mathematical concepts, methods of domain, system and object-oriented analysis and mathematical modeling for software development.</p> <p>RTg 06. Ability to choose and use appropriate methodology for creating software.</p>

RTg 07. Know and apply the fundamental concepts and basic principles of the operation of language, instrumental and computational software engineering.

RTg 08 Be able to develop a human-machine interface.

RTg 09. Know and be able to use methods and tools for collecting, formulating and analyzing software requirements.

RTg 10. Conduct a pre-project survey of the subject area, a systematic analysis of the object design.

RTg 11. Choose input data for design, guided by formal descriptions of requirements and modeling.

RTg 12 Apply effective approaches to software design.

RTg 13. Know and apply methods of developing algorithms, designing software and data and knowledge structures.

RTg 14. Apply instrumental software tools for domain analysis, design, testing, visualization, measurement and documentation of software.

RTg 15 Reasonably choose programming languages and technology to solve the problems of developing and maintaining software.

RTg 16. Have skills in team development, design and release of all types of software documentation.

RTg 17 Be able to apply component software development techniques.

RTg 18 Know and be able to apply information processing, storage and data transfer technologies (including web applications and mobile applications).

RTg 19. Know and be able to apply verification and validation software (including web applications and mobile applications).

RTg 20. Know how to evaluate and ensure software quality (including web applications and mobile applications).

RTg 21. Know, analyze, choose, apply information security tools (including cybersecurity) and data integrity in accordance with application tasks being solved and software systems being developed.

RTg 22 Know and be able to apply methods and tools for project management.

RTg 23. Be able to document and present the results of software development.

RTg 24. Be able to calculate the economic efficiency of software systems.

8 - Resource support 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-methodical 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
Training of foreign applicants for education	According to the license, training of foreigners and stateless persons is eprovided.

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	Ukrainian as a foreign language	6	Exam
CC 2	Language of professional training	9	Exam
CC 3	Foreign Language	18	Credit, and exam in the last semester
CC 4	Physics	4	Exam
CC 5	Linear algebra	4	Exam
CC 6	Mathematical analysis	7	Exam
CC 7	Green computing	3	Exam
CC 8	Economics of software development	4	Credit
CC 9	Physical Education	18	Credit
CC 10	Fundamentals of software systems architecture	3	Exam
CC 11	Fundamentals of the theory of algorithms	3	Credit
CC 12	Fundamentals of Operating Systems	3	Credit
CC 13	Fundamentals of software development	8	Exam
CC 14	Computer Mathematics	11	Credit, and exam in the last semester
CC 15	Fundamentals of Software Engineering	4	Credit
CC 16	Fundamentals of Probability Theory	4	Exam

CC 17	Fundamentals of the theory of mathematical statistics	3	Exam
CC 18	Operations Research	8	Credit, and exam in the last semester
CC 19	Quality and software testing	4	Exam
CC 20	Fundamentals of the theory of soft computation	3	Exam
CC 21	The theory of decision making	6	Exam
CC 22	Modeling and analysis of software	5	Exam
CC 23	Methods of processing empirical information	4	Credit

CC 24	Systems of artificial intelligence	4	Exam
CC 25	Mathematical models and systems analysis	4	Exam
CC 26	Fundamentals of project engineering software engineering	4	Exam
CC 27	Fundamentals of Distributed Databases	4	Exam
CC 28	Scientific and practice seminar on the topic of thesis	8	Credit
CC 29	Practical seminar on Mathematical Methods in Software Engineering	3	Credit
	Internship	4	
	Graduation project development	4	
	Attestation	3	
	Total number of compulsory components	180	

Sample components of EP

Sample Set 1 "Web Development Based on Java Platform, Enterprise Edition"			
SS 1.1	Fundamentals of web development	7	Credit
SS 1.2	An advanced course in Java programming	5	Credit
SS 1.3	Application development based on the Spring framework	5	Credit
SS 1.4	Java Data Science Solutions	4	Credit
SS 1.5	Multilingual programming	4	Credit
SS 1.6	Organization of databases	4	Exam
SS 1.7	Object-Oriented Programming	8	Exam
SS 1.8	Fundamentals of computer networks	4	Credit
SS 1.9	Databases design	4	Exam
SS 1.10	Security of applications and data	3	Exam
SS 1.11	Practice Seminar on Database Design	3	Credit
SS 1.12	Architecture and software design	9	Exam
	Total number of components of the sample set 1		60

1	2	3	4
Sample Block 2 "Mobile Application Development"			
SS 2.1	Java and Kotlin for mobile development	4	Credit
SS 2.2	Android Architecture, Design and Patterns	8	Credit
SS 2.3	Android libraries and frameworks	5	Credit
SS 2.4	Testing and deploying mobile apps	4	Credit
SS 2.5	Cross-platform mobile development	4	Credit
SS 2.6	Organization of databases	4	Exam
SS 2.7	Object-Oriented Programming	8	Exam
SS 2.8	Fundamentals of computer networks	4	Credit
SS 2.9	Databases design	4	Exam
SS 2.10	Security of applications and data	3	Exam
SS 2.11	Practice Seminar on Databases Design	3	Credit
SS 2.12	Architecture and software design	9	Exam
Total component number of the sample set 2		60	
Total number of components of EDUCATIONAL PROGRAM:		240	

2.2 Structural-logical scheme of EP

Semester	Contents of educational activity
1	CC 1, CC 3, CC 4, CC 5, CC 6, CC 9, CC 13, CC 15
2	CC 2, CC 3, CC 4, CC 10, CC 11, CC 12, CC 13, CC 14, CC 15
3	CC 3, CC 10, CC 15, CC 17, SS 1.1, SS 1.6, SS 1.7, SS 1.8, SS 2.1, SS 2.6, SS 2.7, SS 2.8
4	CC 3, CC 10, CC 15, CC 18, CC 19, SS 1.1, SS 1.7, SS 1.9, SS 1.11, SS 2.2, SS 2.7, SS 2.9, SS 2.11
5	CC 3, CC 10, CC 19, CC 20, SS 1.2, SS 1.3, SS 1.12, SS 2.2, SS 2.3, SS 2.12

6	CC 3, CC 8, CC 10, CC 21, CC 30, SS 1.4, SS 1.5, SS 1.10, SS 1.12, SS 2.4, SS 2.5, SS 2.10, SS 2.12
7	CC 3, CC 22, CC 23, CC 24, CC 25, CC 26, CC 29
8	CC 3, CC 9, CC 27, CC 28, CC 29

3. Form of attestation of applicants for higher education

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

	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
CC-1			•	•		•		•				•							
CC-2			•			•		•			•	•							
CC-3				•		•													
CC-4	•							•		•	•								
CC-5	•																		
CC-6	•																		
CC-7	•																		
CC-8								•	•		•	•							
CC-9								•	•	•	•					•			
CC-10							•			•	•	•							
CC-11														•	•				
CC-12	•																		
CC-13																•			
CC-14																			
CC-15																			
CC-16								•					•						
CC-17																			
CC-18						•													
CC-19																			
CC-20	•	•					•						•			•	•		
CC-21																			
CC-22						•							•						
CC-23							•							•		•			

CC-24	.					.													
CC-25																			
CC-26	.												.	.					
CC-27																			
CC-28	.												.	.					.
CC-29		.				.								.	.	.			.
CC-30	.	.				.													

	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
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 1.9																	.		.
SS 1.10																		.	.
SS 1.11	
SS 1.12							.								.				
SS 2.1																			
SS 2.2																			
SS 2.3																			
SS 2.4															.				

Head of the graduation department _____ M.D. Godlevsky

Head of the project team

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