

**MINISTRY OF EDUCATION AND SCIENCE  
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE  
«IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE»**

**APPROVED**

by Scientific Council of  
Igor Sikorsky Kyiv Polytechnic Institute  
(protocol №10 from 13.12.2021)

Chairman of the Academic Council

**Mykhailo ILCHENKO**

**COMPUTER SYSTEMS SOFTWARE  
ENGINEERING  
ІНЖЕНЕРІЯ ПРОГРАМНОГО ЗАБЕЗПЕЧЕННЯ  
КОМП'ЮТЕРНИХ СИСТЕМ  
EDUCATIONAL PROFESSIONAL PROGRAM**

**First (bachelor's) level of higher education**

<b>Specialty</b>	<b>121 Software Engineering</b>
<b>Field of Study</b>	<b>12 Information Technologies</b>
<b>Qualification</b>	<b>Bachelor in Software Engineering</b>

Enacted from the 2022/2023 academic year  
by order of the Rector of  
Igor Sikorsky Kyiv Polytechnic Institute  
№ HOH/75/2022, February 15, 2022

Kyiv – 2021

## **PREAMBLE**

**DEVELOPED** by the project team:

*Project team leader:*

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PhD, Associate Professor

Associate Professor of the Department of Computer Engineering

*Members of the project team:*

**Mykhailo NOVOTARSKY,**

Doctor of Engineering, Senior Research Fellow

Professor of the Department of Computer Engineering,

**Anatoliy SERGIYENKO,**

Doctor of Engineering, Senior Research Fellow

Professor of the Department of Computer Engineering,

**Victor POREV,**

PhD,

Associate Professor of the Department of Computer Engineering

**Sergii STIRENKO**

the Chairman of the Department of Computer Engineering,

Doctor of Engineering, Professor

### **APPROVED BY:**

Scientific and Methodical Commission of Igor Sikorsky Kyiv Polytechnic  
Institute by specialty 121 “Software Engineering”

Chairman of the SMCU 121 Ivan DYCHKA

(protocol №3, December 2, 2021)

Methodical council of Igor Sikorsky Kyiv Polytechnic Institute

Chairman of the Methodical council Anatoliy MELNICHENKO

(protocol №2, December 9, 2021)

## **TAKEN INTO ACCOUNT:**

Remarks and proposals of stakeholders based on the results of the public discussion:

- by scientific and pedagogical staff of the Department of Computer Engineering;
- by applicants of higher education who are studying under the educational program of specialty 121 “Software engineering”;
- by specialists of the educational and methodical department of Igor Sikorsky Kyiv Polytechnic Institute;
- by software engineering specialists.

Changes to the national classifier DK 003:2010 <https://mon.gov.ua/ua/npa/prozatverdzhennya-zmini-10-do-nacionalnogo-klasifikatora-dk-0032010>

Changes to the approved License conditions for conducting educational activities from December, 15, 2015 №1187, introduced in accordance with the Resolution of the Cabinet of Ministers <https://zakon.rada.gov.ua/laws/show/1187-2015-%D0%BF#Text>

Recommendations for updating educational programs and features of developing curricula for bachelors (Igor Sikorsky Kyiv Polytechnic Institute order from 30.11.2020 №HOH/35/2020 "On improving educational programs of the first (bachelor's) level of higher education" and accordingly changed the list of mandatory and selective educational components

The update of the educational program is agreed with the stakeholders, the positive feedback provided on the program remains relevant.

Professional expertise was carried out:

- Victoria Taraniuk - QA manager of GlobalLogic Company
- Alex Shevelo - Technical leader of SoftServe Company

The educational program was discussed after receiving all the recommendations and suggestions and approved at an extended meeting of the Department of Computer Engineering (protocol №5, December 02, 2021)

## CONTENTS

1.	Profile of the educational program	5
2.	The list of educational program components	11
3.	Structural and logical scheme of the educational program	13
4.	The certification form of higher education applicants	14
5.	Correspondence matrix of program competences to components of the educational program	15
6.	Matrix of providing leaning outcomes with relevant components of the educational program	16

# 1. PROFILE OF THE EDUCATIONAL PROGRAM

## Specialty 121 Software Engineering

1 – General information	
Full name of the University and Institute/Faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Informatics and Computer Science
Higher education degree and title of qualification in the original language	Degree - Bachelor Qualification – Bachelor in Software Engineering
The official title of the educational program	Computer Systems Software Engineering
Diploma type and scope of educational program	Bachelor diploma, single, 240 credits ESTC, term of study 3 years, 10 months
Availability of accreditation	Accreditation certificate of the specialty НД 1192548 Certificate is valid until July 1, 2023.
The level of the National Qualifications Framework (NQF)	NQF of Ukraine – 6 level QF-EHEA – first cycle EQF-LLL – 6 level
Prerequisites	Availability of complete general secondary education
Language(s) of Instruction	Ukrainian / English
The validity of educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	Published on the sites: <a href="http://osvita.kpi.ua/op">http://osvita.kpi.ua/op</a> <a href="http://comsys.kpi.ua">http://comsys.kpi.ua</a>
2 – The goal of the educational program	
<p>The goal of the educational program is train of highly qualified specialists in the area of Software Engineering. They will be able to solve difficult specialized tasks and practical problems, which are related to design, development, quality assurance and support of Computer Systems Software Engineering, as well as the preparation of the Higher Education Applicant for further training in the chosen specialty in accordance with mission and strategy of Igor Sikorsky KPI.</p> <p>The goal of the educational and professional program corresponds to the strategy of development of Igor Sikorsky KPI for 2020-2025. The vision is to promote the formation of the society of the future on the basis of the concept of sustainable development.</p>	

<b>3 – Education program characteristics</b>	
Subject area	<p>Field of expertise – 12 Information Technologies</p> <p>Qualification – 121 Software Engineering</p> <p><i>Objecst of activity</i> Bachelor in Software Engineering are: Software, processes, tools and resources of development, maintenance and quality assurance Software.</p> <p><i>Goal of leaning:</i> training of specialists capable of setting and solving tasks that are related to the development, maintenance and quality assurance of Computer Systems Software.</p> <p><i>The theoretical content of the subject area:</i> basic Mathematical, Information, Physical, Economic provisions regarding the creation and support of Software, the fundamentals of Domain Analysis, Simulation, Design, Construction, Maintenance of Software.</p> <p><i>Methods, techniques, and technologies:</i> methods and technologies of Software development; collection, processing and interpretation of the results of research in Software Engineering.</p> <p><i>Tools and equipment:</i> software, hardware and tools for the development, maintenance and operation of Software.</p>
Orientation of the Educational Program	Educational and professional
The main focus of the educational program	<p>The main focus of the Education Program is on education and Professional Training in Computer Systems Software Engineering. This is done by merging classical academic university teaching with participation in contract IT-projects.</p> <p>The program is focused on the formation of such competencies of Higher Education Applicants that make possible their comprehensive professional, intellectual and social progress in the field of Software Engineering.</p> <p>It provides an opportunity for Higher Education Applicants to independently form the educational trajectory of the educational process to master new technologies and scientific knowledge.</p> <p><i>Keywords:</i> Software, Computer Systems, Engineering, Analysis, Developing, Programming, Design, Modeling, IT-projects.</p>
Features of the program	<p>Implementation of the program involves the involvement of professionals - practitioners, industry experts, representatives of employers.</p> <p>Participants of the educational process have the opportunity to join the programs of international academic mobility.</p>
<b>4 – Suitability of graduates for employment and further training</b>	
Suitability for employment	<p>Bachelors in Software Engineering can work as specialists in the Design, Development and Testing of Software in the field of Information Technology</p> <p>According to the classifier of professions ДК003: 2010 graduates can perform the following types of professional work:</p> <p>3121 Technician-programmer;</p> <p>3121 Information Technology Specialist;</p> <p>3121 Specialist in Software Development and Testing Jobs;</p> <p>3121 Specialist in the Development of Computer Programs.</p>
Further training	Continuation of education at the second (master's) level of higher education. Acquisition of additional qualifications in the system of postgraduate education.

<b>5 – Teaching and assessment</b>	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of separated learning, practice and excursions; implementation of the diploma project. Individual lessons in selected disciplines. Application of information and communication technologies such as online lectures, distance courses, etc.
Assessment	Current and semester control in accordance with the Regulations on the rating system for assessing the learning outcomes of students of the Igor Sikorsky Kyiv Polytechnic Institute KPI, verbal and written exams, testing etc.
<b>6 – Program competences</b>	
Integral competence	Ability to solve difficult specialized problems or practical problems in the field of Computer Systems Software and are characterized by complexity and uncertainty of conditions, with application of theories and methods of the Information Technologies.
<b>General competences (GC)</b>	
GC1	Ability to abstract Thinking, Analysis and Synthesis.
GC2	Ability to apply Knowledge in Practical Situations.
GC3	Ability to communicate in the State Language both verbally and in writing.
GC4	Ability to communicate in a Foreign Language both verbally and in writing.
GC5	Ability to learn and master Modern Knowledge.
GC6	Ability to search, processing and analysis of Information, from different sources.
GC7	Ability to work in a Team.
GC8	Ability to act on the basis of Ethical Considerations.
GC9	The desire to preserve the Environment.
GC10	Ability to act socially responsibly and consciously.
GC11	Ability to exercise their rights and responsibilities as a member of Society, to realize the values of Civil (free democratic) Society and the need for its sustainable development, the rule of law, human and civil Rights and Freedoms in Ukraine.
GC 12	Ability to preserve and increase Moral, Cultural, Scientific values and achievements of society based on understanding 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, Techniques and Technologies, different types and forms of physical activity to rest and lead a Healthy Lifestyle.
<b>Professional competencies (PC)</b>	
PC1	Ability to identify, classify and formulate Software requirements.
PC2	Ability to participate in Software Design, including Modeling (formal description) its Structure, Behavior, and Operating Processes
PC3	Ability to develop Architectures, Modules and Program System Components
PC4	Ability to formulate and ensure Software Quality Requirements in accordance with Customer Requirements, terms of reference and standards.
PC5	Ability to adhere to Specifications, Standards, Rules and Recommendations in the professional field when implementing Life Cycle Processes.
PC6	Ability to analyze, select, and apply Security Methods and Tools (including Cybersecurity).
PC7	Knowledge of Information Data Models, ability to create Software for storing, extracting and processing Data.

PC8	Ability to use Fundamental and Interdisciplinary Knowledge to successfully solve Software Engineering problems.
PC9	Ability to assess and take into account Economic, Social and Environmental factors that affect the Field of Professional Activity.
PC10	Ability to accumulate, process and systematize Professional Knowledge about the creation and maintenance of Software and recognition of the importance of lifelong learning.
PC11	Ability to implement Phases and Iterations of the Life Cycle of Software Systems and information technologies based on appropriate Software Development Models and Approaches.
PC12	Ability to implement the System Integration Process, apply change Management Standards and Procedures to Maintain Integrity, overall Functionality and Reliability of Software.
PC13	Ability to reasonably select and master Software Development and Maintenance Tools.
PC14	Ability to Algorithmic and Logic thinking.
PC15	Ability to develop and apply Network Technologies.
PC16	Ability to develop Mobile, Embedded and Real-time Systems.
PC17	Ability to develop and apply Methods and Algorithms of High-Performance Computing.
PC18	Ability to develop and apply Software for Highly Productive Computer Systems.
PC19	Ability to develop and apply Artificial Intelligence Systems.
<b>7 – Program learning outcomes (PLO)</b>	
PLO01	Analyze, purposefully search and select the Information and Reference Resources and Knowledge necessary for solving Professional Tasks, taking into account the Modern Achievements of Science and Technology.
PLO02	Know the code of Professional Ethics, understand the Social Significance and Cultural Aspects of Software Engineering and adhere to them in Professional Activities.
PLO03	Know the basic Processes, Phases, and Iterations of the Software Lifecycle.
PLO04	Know and apply Professional Standards and Other Legal Documents in the field of Software Engineering.
PLO05	Know and apply relevant mathematical Concepts, Methods of Domain-Based, System and Object-Oriented Analysis and Mathematic Modeling for Software Development.
PLO06	Ability to choose and use the appropriate methodology for creating Software.
PLO07	Know and apply in practice the Fundamental Concepts, Paradigms and Basic Principles of functioning of Language, Instrumental and Computational Means of Software Engineering.
PLO08	Be able to develop a Human-Machine Interface.
PLO09	Know and be able to use Methods and Means of collecting, formulating and analyzing Software Requirements.
PLO10	Implement a Pre-Project Survey of the Subject Area, System Analysis of the Design Object.
PLO11	Select the output data for design, based on the Modeling Requirements Description Methods.
PLO12	Put into practice effective approaches to Software Design.
PLO13	Know and apply methods for developing Algorithms, Software Design and Data and Knowledge Structures.
PLO14	Put into practice the Tools of Domain Analysis, Design, Testing, Visualization, Measurement and Documentation Software.



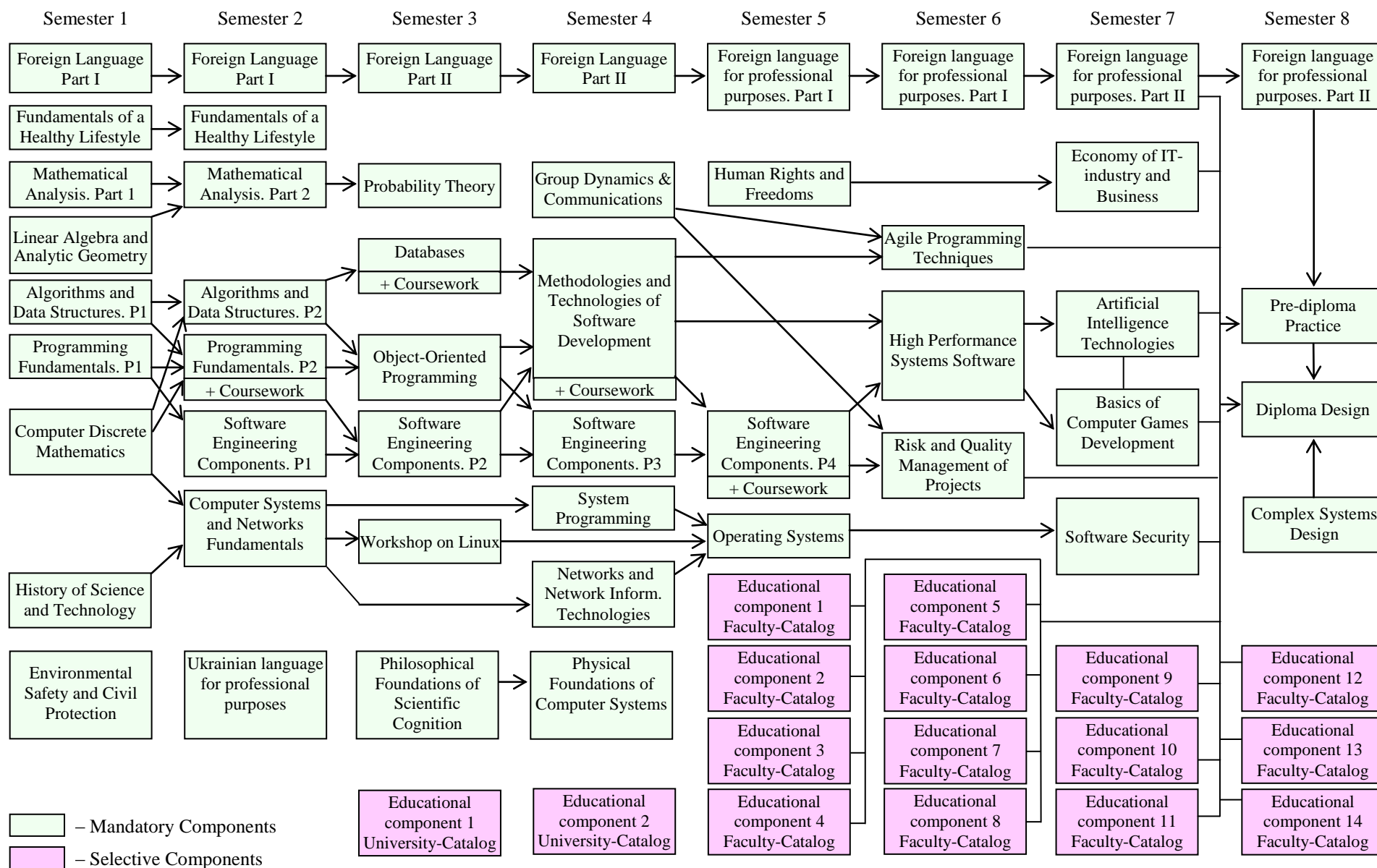
PLO15	Motivated to choose Programming Languages and Development Technologies to solve the problems of creating and maintaining Software.
PLO16	Have the skills of Team Development, Coordination, Design and Release of all types of Software Documentation.
PLO17	Be able to apply Software Component Development Techniques.
PLO18	Know and be able to apply Information Technologies for Data Processing, Storage and Transmission.
PLO19	Know and be able to apply Software Verification and Validation Methods.
PLO20	Know approaches to Software Evaluation and Quality Assurance.
PLO21	Know, analyze, select, skillfully apply the Means of Ensuring Information Security (including Cybersecurity) and Data Integrity, respectively, for solving Applied Problems and creating Software Tools.
PLO22	Know and be able to apply Project Management Methods and Tools.
PLO23	Be able to document and present Software Development Results.
PLO24	Be able to calculate the Economic Efficiency of Software Systems.
PLO25	Know the Software of Highly Productive Computer Systems.
PLO26	Know the principles of construction and functioning of Highly Productive Computer Systems.
PLO27	Know the Methods and Algorithms of High-Performance Calculations.
PLO28	Know and be able to apply Methods and Means of Artificial Intelligence.
<b>8 – Resource support for program implementation</b>	
Staffing	In accordance with the personnel requirements to ensure the implementation of educational activities for the relevant level of HE, approved by the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (in current edition)
Logistics	In accordance with the technological requirements for logistics of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 (in current edition)
Information, educational and methodical support	In accordance with the technological requirements for information, educational and methodical support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 (in current edition)
<b>9 – Academic mobility</b>	
National credit mobility	Possibility to conclude agreements on academic mobility, double graduation, etc.
International credit mobility	Agreements on international academic mobility (Eramus + K1) concluded with universities: 1. Melardalen University (Sveden). 2. University of Malta (Malta).
Training of foreign applicants for higher education	Training of foreign higher education applicants may be conducted in English or Ukrainian, provided the applicant has a command of the language of instruction at a level not lower than B2

## 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code Discipline	Components of the educational program (academic disciplines, course projects/course works, practices, qualification work)	Number of credits ECTS	Final assessment form
1	2	3	4
<b>1. MANDATORY (regulatory) components of EP</b>			
<b>1.1. General Training Cycle</b>			
GM 1	Ukrainian language for professional purposes	2	Final Test
GM 2	History of Science and Technology	2	Final Test
GM 3	Fundamentals of a Healthy Lifestyle	3	Final Test
GM 04.1	Practical course of a foreign language. Part I	3	Final Test
GM 04.2	Practical course of a foreign language. Part II	3	Final Test
GM 5	Economy of IT-industry and Business	4	Final Test
GM 6	Philosophical Foundations of Scientific Cognition	2	Final Test
GM 7	Environmental Safety and Civil Protection	2	Final Test
GM 8	Human Rights and Freedoms	2	Final Test
GM 09.1	Foreign Language for Professional Purposes. Part I	3	Final Test
GM 09.2	Foreign Language for Professional Purposes. Part II	3	Exam
GM 10.1	Mathematical Analysis. Part 1	5	Exam
GM 10.2	Mathematical Analysis. Part 2	5	Exam
GM 11	Linear Algebra and Analytic Geometry	4	Final Test
GM 12	Probability Theory	4	Final Test
GM 13	Computer Discrete Mathematics	5	Exam
GM 14	Group Dynamics and Communications	4	Final Test
<b>1.2. Professional Training Cycle</b>			
PM 01.1	Algorithms and Data Structures. Part 1	3.5	Final Test
PM 01.2	Algorithms and Data Structures. Part 2	4.5	Final Test
PM 02.1	Programming Fundamentals. Part 1	5.5	Exam
PM 02.2	Programming Fundamentals. Part 2	5.5	Exam
PM 03	Programming Fundamentals. Coursework	1	Final Test
PM 04	Computer Systems and Networks Fundamentals	5	Exam
PM 05	Databases	4	Exam
PM 06	Databases. Coursework	1	Final Test
PM 07.1	Software Engineering Components. Part 1	4	Final Test
PM 07.2	Software Engineering Components. Part 2	4	Final Test
PM 07.3	Software Engineering Components. Part 3	5	Exam
PM 07.4	Software Engineering Components. Part 4	4	Exam
PM 08	Software Engineering Components. Coursework	1	Final Test
PM 09	Software Security	4	Exam
PM 10	Pre-diploma Practice	6	Final Test

1	2	3	4
PM 11	Diploma Design	6	Defense
PM 12	Object-Oriented Programming	5	Exam
PM 13	Workshop on Linux	6.5	Exam
PM 14	System Programming	4.5	Exam
PM 15	Networks and Network Information Technologies	4	Exam
PM 16	Methodologies and Technologies of Software Development	4	Final Test
PM 17	Methodologies and Technologies of Software Development. Coursework	1	Final Test
PM 18	Operating Systems	5.5	Exam
PM 19	Agile Programming Techniques	4	Exam
PM 20	Risk and Quality Management of Projects	4.5	Exam
PM 21	Basics of Computer Games Development	4	Final Test
PM 22	High Performance Systems Software	4	Exam
PM 23	Complex Systems Design	4.5	Final Test
PM 24	Artificial Intelligence Technologies	4.5	Exam
PM 25	Physical Foundations of Computer Systems	4	Final Test
<b>2. SELECTIVE components EP</b>			
<b>2.1. General training cycle</b>			
GS 01	Educational component 1 General University-Catalog	2	Final Test
GS 02	Educational component 2 General University-Catalog	2	Final Test
<b>2.2. Professional training cycle</b>			
PS 01	Educational component 1 Faculty-Catalog	4	Final Test
PS 02	Educational component 2 Faculty-Catalog	4	Final Test
PS 03	Educational component 3 Faculty-Catalog	4	Final Test
PS 04	Educational component 4 Faculty-Catalog	4	Final Test
PS 05	Educational component 5 Faculty-Catalog	4	Final Test
PS 06	Educational component 6 Faculty-Catalog	4	Final Test
PS 07	Educational component 7 Faculty-Catalog	4	Final Test
PS 08	Educational component 8 Faculty-Catalog	4	Final Test
PS 09	Educational component 9 Faculty-Catalog	4	Final Test
PS 10	Educational component 10 Faculty-Catalog	4	Final Test
PS 11	Educational component 11 Faculty-Catalog	4	Final Test
PS 12	Educational component 12 Faculty-Catalog	4	Final Test
PS 13	Educational component 13 Faculty-Catalog	4	Final Test
PS 14	Educational component 14 Faculty-Catalog	4	Final Test
Total in <b>Mandatory Components:</b>		180	
Total in <b>Selective Components:</b>		60	
The Amount of Educational Components <b>that provide the Acquisition Competencies defined by the Higher Education Standard</b>		120	
<b>TOTAL VOLUME OF THE EDUCATIONAL PROGRAM</b>		<b>240</b>	

### 3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



## **4. THE CERTIFICATION FORM OF HIGHER EDUCATION APPLICANTS**

Graduation certification of Higher Education Applicants according to the educational-professional program "Computer Systems Software Engineering" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document on the award of a degree "Bachelor" with the award of a qualification: Bachelor in Software Engineering in the educational-professional program "Computer Systems Software Engineering".

Qualification work before the defense is checked for plagiarism and after the defense is placed in the repository of scientific and technical library of the University for free access.

Graduation certification is open and public.

## 5. CORRESPONDENCE MATRIX OF PROGRAM COMPETENCES TO COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20	PM 21	PM 22	PM 23	PM 24	PM 25	
GS 1						+				+	+	+	+		+	+			+					+	+													+		
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## 6. MATRIX OF PROVIDING LEARNING OUTCOMES WITH RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20	PM 21	PM 22	PM 23	PM 24	PM 25	
PLO 01		+	+			+	+								+	+	+	+			+	+	+	+	+															
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