MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE "IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"

APPROVED

by the Academic Council
of Igor Sikorsky Kyiv Polytechnic Institute
(protocol № 5 dated 30.06.2020)

Chairman of the Academic Council

Mykhailo ILCHENKO

Software Engineering of Multimedia and Information Retrieval Systems

EDUCATIONAL RESEARCH PROGRAMME

Second (master's) level of higher education

Speciality	**121 Software Engineering**
Field of knowledge	**12 Information Technologies**
Qualification	**Master in Software Engineering**

Entered into force by order
of the Igor Sikorsky Kyiv
Polytechnic Institute rector
from 08.07.2020 № 1/231

Kyiv – 2020

PREAMBLE

DEVELOPED by the project group:

Project team leader
Sulema Yevheniia Stanislavivna,
Candidate of Technical Sciences, Associate Professor,
Associate Professor of the Department of Computer Systems Software

Project team members:
Onay Mykola Volodymyrovych,
Candidate of Technical Sciences, Associate Professor,
Associate Professor of the Department of Computer Systems Software
Zabolotnia Tetiana Mykolaivna,
Candidate of Technical Sciences, Associate Professor,
Associate Professor of the Department of Computer Systems Software
Oleshchenko Liubov Mykhailivna,
Candidate of Technical Sciences, Associate Professor,
Associate Professor of the Department of Computer Systems Software
Liushenko Lesia Anatoliivna,
Candidate of Technical Sciences,
Senior Lecturer of the Department of Computer Systems Software
Khitsko Yana Volodymyrivna,
Candidate of Technical Sciences,
Senior Lecturer of the Department of Computer Systems Software
Yusyn Yakiv Oleksiiovych,
Assistant of the Department of Computer Systems Software

Leheza Viktor Petrovych,
Acting Head of the Department of Computer Systems Software,
Doctor of Technical Sciences, Professor

AGREED:

The Scientific and Methodological Commission of the University
on specialty 121 Software Engineering

Chairman of the SMCU 121 Ivan DYCHKA

(protocol № 1 dated 14.05.2020)

The Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute

Chairman of the Methodological Council Yurii YAKYMENKO

(protocol № 10 dated 18.06.2020)

TAKE INTO ACCOUNT:

Professional examination was conducted:

Oleksii DYSHLEVYI - Head of Educational Training Programs for Junior Specialists in Kyiv and Vinnytsia, EPAM Systems IT Company

Illia SHASTIN - Leading Engineer of Video Internet Technologies LLC

The Educational program was discussed after receiving all the wishes and suggestions from students and graduates of the Educational program and approved at an extended meeting of the Department of Computer Systems Software (Protocol № 8 of May 20, 2020).

The Educational program was considered and approved by the scientific and methodological subcommittee on the Program Subject Area 121 Software Engineering (Protocol № 3 of 22 May 2020).

CONTENTS

1. PROFILE OF THE EDUCATIONAL PROGRAM

Program Subject Area 121 Software Engineering

1 – General Information	
Full name of the higher education institution and institute / faculty	National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” (Igor Sikorsky Kyiv Polytechnic Institute). Faculty of Applied Mathematics
Degree of higher education and title of qualification in the original language	Master Degree Qualification – Software Engineering
The official name of the educational program	Software Engineering of Multimedia and Information Retrieval Systems
Type of diploma and scope of educational program	Diploma of Master, single, 120 credits, term of study 1 year, 9 months
Availability of accreditation	Ministry of Education and Science of Ukraine Certificate of Accreditation НД-IV № 1157819 National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" in accordance with the Accreditation Commission decision of June 27, 2013, protocol №105 (order of the Ministry of Education and Science of Ukraine from 01.07.2013 №2494l) in the direction (specialty) 0501 Informatics and computer technology 8.05010301 Software systems recognized as accredited at the IV (fourth) level. The certificate is valid until 01.07.2023
Cycle / level of higher education	NQF of Ukraine – 8 level, QF-EHEA – the second cycle, EQF-LLL – 7 level
Prerequisites	First level of higher education (bachelor level).
Term of the educational program	Until the next accreditation
Language (s) of instruction	Ukrainian / English
Internet address of the permanent placement of the educational program	Published on sites: https://osvita.kpi.ua/op http://fpm.kpi.ua http://pzks.fpm.kpi.ua

2 – The Purpose of the Educational Program	
The purpose of the educational program is to train specialists in the field of software engineering, in particular software engineering of multimedia and information retrieval systems, capable of solving complex scientific and technical, innovation-oriented problems and problems of software engineering of multimedia and information retrieval systems, capable of formulating production and scientific tasks for software development, maintenance and quality assurance, to find rational and optimal methods and means of their solution, to solve complex specialized problems and practical scientific problems in software engineering, to ensure sustainable development of IT companies, as well as training of applicants higher education to further study in the chosen specialty. The purpose of the educational program corresponds to the development strategy of Igor Sikorsky Kyiv Polytechnic Institute for 2020-2025 on the formation of the society of the future on the basis of the concept of sustainable development.	
3 – Characteristics of the Educational Program	
Subject industry	*Object:* processes of modeling, design, development, analysis and software quality assurance of multimedia and information retrieval systems. *The purpose of training*: training of specialists capable of setting and solving complex scientific and technical problems related to modeling, design, development, analysis and quality assurance of computer and information retrieval software. *Theoretical content of the subject area:* mathematical, algorithmic and software methods, models, methods of modeling, design, development, analysis and quality assurance of computer and information retrieval software. *Methods, techniques and technologies:* methods and technologies of software development; methods of processing, analysis and interpretation of research results in the field of software engineering of multimedia and information retrieval systems. *Tools and equipment:* software, hardware and tools for software development, maintenance and operation.
Orientation of the educational program	Educational and scientific
The main focus of the educational program	The educational program provides special education in the field of software engineering of multimedia and information retrieval systems. The program is aimed at the formation of such competencies of higher education students that make possible their comprehensive professional, scientific, intellectual and social development in the field of software engineering of multimedia and information retrieval systems. The program provides the acquisition of educational qualifications for the formulation of complex tasks of scientific and professional activities and their implementation. Applicants for higher education have the opportunity to acquire knowledge from other fields and deepen their knowledge in the field of software engineering of multimedia and information retrieval systems, thanks to the possibility of forming a flexible individual learning trajectory. Keywords: software, software tools, multimedia systems, information retrieval systems, specialized software, computer systems, information technology, development, maintenance and quality assurance of software.

Features of the program	Applicants for higher education undergraduate practice in software engineering of multimedia and information retrieval systems and mastering modern scientific methods of analysis of complex problems of professional activity. The program involves professional practitioners working for leading IT software companies and other stakeholders in the educational process. Participants in the educational process have the opportunity to participate in international academic opportunity programs, including one semester to study at one of the world's leading universities. In addition, the educational program is based on international professional standards of software engineering and IT project management, which are used in the creation of international software. Teaching in English and Ukrainian.
4 – Suitability of Graduates for Employment and Further Study	
Suitability for employment	Masters in Software Engineering can work as specialists in software design, development and testing in the field of information technology. According to the National Classification of Occupations SC 003:2010, graduates can work in the following professions: 2131.2 Database administrator; 2131.2 Data Administrator; 2131.2 Access Administrator; 2131.2 System administrator; 2131.2 Computer Communications Analyst; 2131.2 Software and Multimedia Analyst; 2131.2 Computer Software Engineer; 2131.2 Software Engineer; 2131.2 Programmer (database); 2131.2 Programmer (applied); 2132.1 Junior Researcher (Programming) 2132.1 Researcher (programming) 2132.1 Researcher-consultant (programming) 2132.2 Software Engineer 2132.2 Programmer (database) 2132.2 Application programmer 2132.2 System programmer 2139.2 Computer Application Engineer.
Further training	Masters who have special achievements in research, on the recommendation of the department have the opportunity to continue their postgraduate studies in the third level program FQEHEA, 8 level EQF-LLL and 8 level NQF. Internships in both domestic and foreign universities and companies. Participation in lifelong learning programs (LLL).

5 – Teaching and Assessment	
Teaching and learning	The program provides for student-centered learning, a competency-based approach, as well as the implementation of problem-oriented learning technology. Learning style - active, which allows the graduate to choose subjects and organize time. General learning style - task-oriented. Information and communication technologies (e-learning, online lectures) are used during the training. Forms of training: lectures, practical and seminar classes, computer workshops and laboratory work; course projects and works; technology of blended learning, practice and excursions; independent work on the basis of textbooks and abstracts, consultations with teachers. During the first semester of study, the undergraduate chooses the direction of research. During the second and third semesters, he performs a master's thesis, which he presents and defends before the examination board. All participants in the educational process are provided with timely and understandable information on the goals, content and program learning outcomes, the procedure and evaluation criteria within the individual educational components.
Assessment	Assessment of students' knowledge is carried out in accordance with the Regulations on the rating system for assessing the learning outcomes of Igor Sikorsky KPI students for all types of classroom and extracurricular work (incoming, current, boundary, final control); modular tests, home tests, tests, tests, oral and written exams, reports on the internship, rector's control, defense of term papers, certification exam.
6 – Program Competencies	
Integral competence	Ability to solve complex specialized tasks or scientific and innovative problems of software engineering of multimedia and information retrieval systems, which involves conducting research with elements of scientific novelty and / or innovation in conditions of uncertainty.
General Competencies (GC)	
GC1	Ability to abstract thinking, analysis and synthesis.
GC2	Ability to conduct theoretical and applied research at the appropriate level.
GC3	Ability to generate new ideas (creativity).
GC4	Ability to motivate people and move towards a common goal, work in a team employees.
GC5	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity).
GC6	The ability to be critical and self-critical.
GC7	Ability to work in an international context.
GC8	Ability to identify and solve problems.
GC9	The ability to act socially responsibly and consciously.
GC10	Ability to improve their skills based on the analysis of previous experience.
GC11	Ability to communicate in state and foreign languages both orally and in writing.
GC12	The ability to focus on the result and achieve it.
GC13	Ability to coordinate their actions with stakeholders.
GC14	Ability to resolve conflicts and overcome crisis situations

GC15	Ability to be responsible for their decisions and actions.
GC16	Ability to show leadership qualities in different situations of professional activity.
GC17	Ability to implement innovative projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
GC18	Ability to create business models for commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
GC19	Ability to create a feasibility study for commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
GC20	Ability to manage commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
GC21	Ability to continuous self-improvement in the professional sphere, responsibility for teaching others in the conduct of scientific and pedagogical activities and research in software engineering.
GC 22	Ability to make strategic decisions that anticipate and formulate future directions for the development of customer-oriented processes, new business products and services.
GC 23	Ability to apply software methods of artificial intelligence in research activities.
GC 24	Ability to develop data processing software in GRID and cloud services.
Professional Competencies of the Specialty (PC)	
PC1	Ability to conduct research activities, including problem analysis, goal setting and objectives, selection of research methods and techniques, and evaluation of its quality.
PC2	Ability to apply modern conceptual and methodological knowledge in software engineering.
PC3	Ability to generate new complex ideas in software engineering.
PC4	Ability to communicate with the wider scientific community and the public in the field of software engineering.
PC5	Ability to initiate and implement innovative complex projects in software engineering, leadership during their implementation.
PC6	Ability to develop and implement software projects, including in-house research, which provides an opportunity to rethink existing and create new holistic knowledge and solve significant technical, social, scientific, cultural, ethical and other problems.
PC7	Ability to apply and develop fundamental and interdisciplinary knowledge to successfully solve scientific and technical problems in the field of software engineering.
PC8	Ability to set and solve problems for the development of new programming tools.
PC9	Ability to implement and maintain information systems.
PC10	Ability to design complex multimedia and information retrieval systems.
PC11	Ability to design and construct, implement and maintain web-based software systems to implement new information retrieval methods.
PC12	Ability to critically rethink existing software engineering technologies and track trends.

PC13	Ability to develop new and improve existing models, methods, tools, processes in the field of software engineering, which provide the development or provide new opportunities for technology development and use of software.
PC14	Ability to design and construct information systems according to functional requirements.
PC15	Ability to model and design software systems in conditions of uncertainty of functional requirements.
PC16	Ability to develop information systems architecture using visual simulation tools.
PC17	Ability to optimize software models to solve application problems.
PC18	Ability to apply the acquired fundamental knowledge to develop software for automatic identification systems.
PC19	Ability to use methods of formal language theory and compilation to create new software engineering tools for multimedia and information retrieval systems.
PC20	Ability to develop and apply methods and algorithms for making optimal decisions.
PC21	Ability to conduct an objective analysis of the effectiveness of technical decisions.
PC22	Ability to solve complex optimization problems using software.
PC23	Ability to develop software methods for the analysis of economic and mathematical models.
7 – Program Learning Outcomes (PLO)	
PLO01	To know the fundamental and modern works of leading foreign and domestic scientists in the selected research issues, to formulate the purpose and objectives of their own research as part of the general civilization process.
PLO02	Know and adhere to the norms of scientific ethics and academic integrity.
PLO03	Know the theoretical foundations underlying research methods of information systems and software, research methodologies and computational experiments.
PLO04	Be able to make technical, methodological, organizational and managerial decisions in conditions of uncertainty.
PLO05	To be able to formulate from new research positions the general methodological basis of own scientific research, to define its urgency, the purpose and value for development of other branches of science, social and political, economic life.
PLO06	Be able to investigate the operating parameters of software life cycle processes, as well as to analyze the selected methods and tools to support these processes and be able to justify their choice.
PLO07	Demonstrate the results of scientific work, prepare presentations, reports, scientific articles on the results of work performed both in the native language and in one of the languages of the European Union.
PLO08	Understand and use in everyday activities the trends of information technology.
PLO09	Know the methods and models of software development, implementation, operation and management at all stages of the life cycle.
PLO10	Know a foreign language to ensure international communication in the framework of professional activities; know the etiquette of business correspondence
PLO11	To formulate a scientific problem taking into account the values of modern society and the state of its scientific development.
PLO12	Know the types of organization of business entities, models of personnel management, models of communication.

PLO13	Know the methods of scientific research, requirements for registration of research results
PLO14	To formulate, experimentally confirm, substantiate and apply in practice in the process of software development competitive ideas, methods, technologies for solving professional, scientific and technical problems in conditions of uncertainty.
PLO15	Know the design technologies and methods of ensuring high performance software systems
PLO16	Purposefully seek, understand, analyze, necessary for the solution of professional scientific problems information and reference and scientific and technical resources and sources of knowledge, taking into account modern advances in science and technology.
PLO17	Be able to draw up research results in the form of articles in scientific journals and abstracts of reports at scientific and technical conferences.
PLO18	Know the methods of analysis and modeling of the application area, identifying information needs and collecting source data for software design.
PLO19	Know the basic concepts and methodologies of modeling information processes.
PLO20	Know the methods and tools for modeling and designing information systems.
PLO21	Be able to develop the architecture of information systems using visual simulation tools.
PLO22	Know the principles of building software information retrieval systems.
PLO23	Be able to modify existing and develop new methods and algorithms for classification and clustering of data, taking into account the characteristics of the subject area
PLO24	Be able to modify existing and develop new methods and algorithms for extracting information from documents, taking into account the subject area.
PLO25	Be able to modify existing and develop new methods and algorithms for searching multimedia data in information retrieval systems, taking into account the characteristics of the subject area.
PLO26	Be able to design and publish for use by others their own software libraries for processing textual information.
PLO27	Be able to develop new query languages for software systems that are designed based on the requirements of the task and user scripts.
PLO28	Know and be able to apply in practice specialized templates for designing information retrieval systems.
PLO29	Be able to design and develop multi-agent information retrieval systems.
PLO30	Be able to design and develop distributed and centralized information retrieval systems.
PLO31	Be able to design and develop information retrieval systems that work with extremely large amounts of data.
PLO32	Know and be able to use the means of information compression of alphanumeric data.
PLO33	Know and be able to use methods to ensure noise immunity in the development of software for automatic identification systems.
PLO34	Be able to implement innovative projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.

PLO35	Be able to create and implement business models for commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
PLO36	Be able to develop a feasibility study for commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from idea to implementation in the software market.
PLO37	Be able to manage commercial innovation projects in the field of software engineering of multimedia and information retrieval systems from the idea to the introduction of software on the market according to international standards.
PLO38	Be able to develop software methods for the analysis of economic and mathematical models.
PLO39	Be able to apply the methods of formal language theory and compilation to create new software engineering tools for multimedia and information retrieval systems.
PLO40	Be able to design architecture and find optimal and economically sound approaches to the development of multimedia and information retrieval systems.
PLO41	Be able to develop specialized programming languages for multimedia systems.
PLO42	Be able to develop 3D-visualization systems.
PLO43	Know the approaches, directions, models and methods of artificial intelligence, including machine learning; know the technology of software development of artificial intelligence systems
PLO44	Be able to apply artificial intelligence methods in research.
PLO45	Find and apply effective methods of artificial intelligence to solve applied problems, develop artificial intelligence systems
PLO46	Be able to develop and apply methods and algorithms for making optimal decisions.
PLO47	Be able to conduct an objective analysis of the effectiveness of technical decisions.
PLO48	Know the software methods of operations research and mathematical programming.
PLO49	Know and be able to apply software methods for solving optimization problems.
PLO50	Be able to perform controlled calculations in GRID and cloud systems, provide protection for GRID services, develop software for data processing in GRID and cloud services.

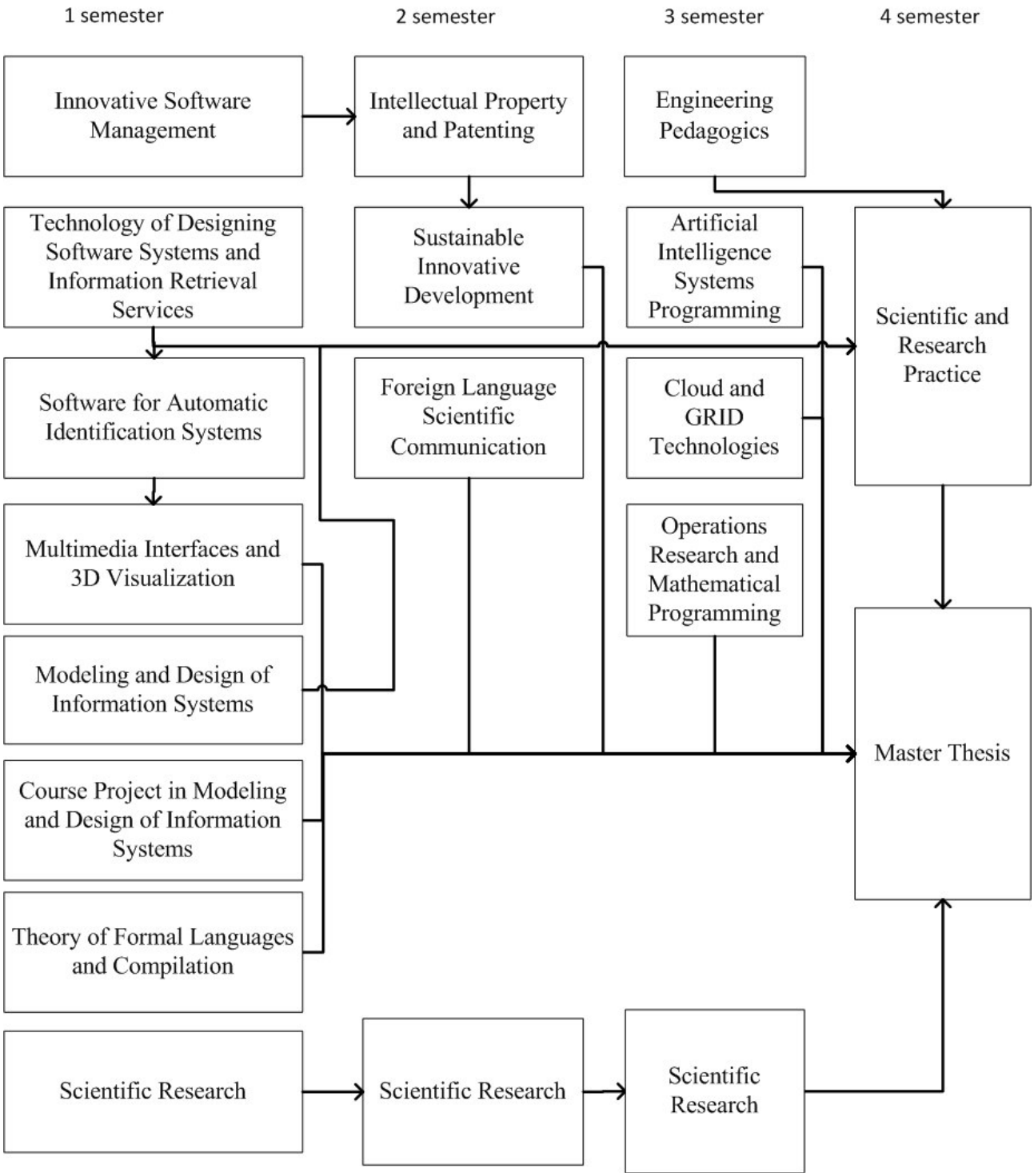
8 – Resource Support for Program Implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) version of 23.05.2018 №347. Involvement of specialists from the international IT company EPAM Systems.
Material and technical support	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) version of 23.05.2018 №347. Conducting laboratory classes, course and diploma projects in the educational and scientific laboratory "EPAM-KPI", educational and scientific laboratory of multimedia, multimedia and immersion technologies, specialized laboratory of the international project MEDIS.

Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) version of 23.05.2018 №347. Use of the Igor Sikorsky Kyiv Polytechnic Institute Scientific and Technical Library.
9 – Academic Mobility	
National credit mobility	Possibility of concluding agreements on academic mobility, double diplomacy.
International credit mobility	Agreements on international academic mobility (Erasmus + KA1) have been concluded with universities: 1. Melardalen University (Sweden). 2. University of Malta (Malta).
Training of foreign applicants for higher education	For foreign citizens, education is provided in English, and Ukrainian is studied as a foreign language.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Components of the educational program (academic disciplines, practices, qualification work)	Number of credits	Form of final control
1	2	3	4
1. NORMATIVE Educational Components			
1.1. General Training Cycle			
GE1	Intellectual Property and Patenting	3	credit
GE2	Sustainable Innovative Development	2	credit
GE3	Innovative Software Management	3	credit
GE4	Foreign Language Scientific Communication	4,5	credit
GE5	Engineering Pedagogics	2	credit
GE6	Artificial Intelligence Systems Programming	4	exam
GE7	Cloud and GRID Technologies	4	exam
1.2. Cycle of Professional Training			
PE1	Scientific Research	7,5	credit
PE2	Scientific and Research Practice	9	credit
PE3	Master Thesis	21	thesis defense
PE4	Technology of Designing Software Systems and Information Retrieval Services	5	exam
PE5	Software for Automatic Identification Systems	4	exam
PE6	Multimedia Interfaces and 3D Visualization	4	credit
PE7	Modeling and Design of Information Systems	4	exam
PE8	Course Project in Modeling and Design of Information Systems	1,5	credit
PE9	Theory of Formal Languages and Compilation	4	credit
PE10	Operations Research and Mathematical Programming	7,5	exam
2. SELECTIVE Educational Components			
2.1. Cycle of Professional Training (Selective Educational Components from Faculty / Department Catalogs)			
PS1	Educational component 1 of the F-Catalog	4,5	exam
PS2	Educational component 2 of the F-Catalog	6	credit
PS3	Educational component 3 of the F-Catalog	6	credit
PS4	Educational component 4 of the F-Catalog	6	credit
PS5	Educational component 5 of the F-Catalog	7,5	exam
Required components total amount:		90	
Selective components total amount:		30	
EDUCATIONAL PROGRAM TOTAL VOLUME		**120**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF FINAL CERTIFICATION OF APPLICANTS FOR HIGHER EDUCATION

Graduation certification of applicants for higher education under the educational-scientific program "Software Engineering of Multimedia and Information Retrieval Systems", Program Subject Area "Software Engineering" is conducted in the form of defense of the qualification work and ends with the issuance of a standard document on awarding a master's degree in software engineering. The qualification work is checked for plagiarism and after the defense is placed in the repository of the Scientific and Technical Library of the University for free access.

Graduation certification is carried out openly and publicly.

5. MATRIX OF COMPLIANCE OF SOFTWARE COMPETENCIES WITH COMPONENTS OF THE EDUCATIONAL PROGRAM

	GE1	GE2	GE3	GE4	GE5	GE6	GE7	PE1	PE2	PE3	PE4	PE5	PE6	PE7	PE8	PE9	PE10
GC1	+	+	+	+	+	+	+	+	+	+							
GC2	+	+	+		+	+	+	+	+	+				+	+		+
GC3	+		+		+	+		+	+	+				+	+		
GC4			+		+												
GC5	+		+	+	+				+								
GC6	+		+		+			+		+					+		
GC7	+		+	+	+												
GC8	+		+		+			+		+					+		
GC9	+	+	+		+				+								
GC10	+	+	+	+	+			+	+	+					+		
GC11				+	+												
GC12	+		+		+	+	+		+								
GC13	+		+		+			+		+					+		
GC14	+		+		+		+										
GC15	+		+		+												
GC16			+		+				+								
GC17			+							+							
GC 18			+														
GC 19			+														
GC 20			+														
GC 21					+			+	+	+				+	+		
GC 22			+					+		+					+		
GC 23						+											
GC 24							+										
PC1								+	+	+					+		
PC2								+	+	+	+			+	+	+	
PC3								+	+	+					+		
PC4					+			+	+	+					+		
PC5			+		+			+	+	+					+		
PC6			+		+			+	+	+	+	+	+	+	+	+	+
PC7			+					+	+	+	+	+	+	+	+		+
PC8								+	+	+	+				+	+	
PC9								+	+	+	+	+	+	+	+	+	
PC10											+	+	+	+	+	+	
PC11						+		+	+	+	+				+		
PC12			+		+			+	+	+					+		
PC13			+					+	+	+	+			+	+	+	+
PC14								+		+	+			+	+	+	
PC15								+		+	+			+			+
PC16								+	+	+				+	+		
PC17								+	+	+	+			+	+		+
PC18												+	+				
PC 19								+		+	+		+	+		+	
PC20								+		+							+
PC21								+		+							+
PC22										+							+
PC23										+							+

6. MATRIX OF PROVIDING SOFTWARE LEARNING RESULTS BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GE1	GE2	GE3	GE4	GE5	GE6	GE7	PE1	PE2	PE3	PE4	PE5	PE6	PE7	PE8	PE9	PE10
PLO01		+	+	+	+	+	+	+	+	+							+
PLO02	+							+		+					+		
PLO03					+			+		+					+		+
PLO04			+			+		+	+	+							+
PLO05			+		+			+		+					+		+
PLO06			+					+		+	+			+	+		
PLO07				+				+		+					+		
PLO08		+	+						+						+		
PLO09			+					+	+	+	+	+	+	+	+		
PLO10				+													
PLO11		+	+					+		+					+		
PLO12	+		+						+								
PLO13			+					+	+	+					+		
PLO14								+		+					+		
PLO15						+	+	+		+	+			+	+		+
PLO16			+					+	+	+					+		
PLO17				+				+	+	+							
PLO18			+					+	+	+	+				+		
PLO19								+		+	+			+	+		+
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PLO21								+		+	+			+	+		
PLO22								+		+	+			+	+		
PLO23						+	+	+		+		+	+				+
PLO24						+	+				+						
PLO25								+	+	+		+	+	+			
PLO26								+	+	+		+					
PLO27								+	+	+	+	+	+	+	+		
PLO28								+	+	+		+		+	+		
PLO29								+	+	+		+		+	+		
PLO30							+	+		+		+	+	+	+		
PLO31						+	+	+		+	+	+	+				
PLO32													+				
PLO33												+					
PLO34			+					+	+	+	+	+	+	+	+		
PLO35			+					+	+	+	+	+	+	+	+		
PLO36			+					+	+	+	+	+	+	+	+		
PLO37	+		+	+				+	+	+	+	+	+	+	+		
PLO38								+		+				+	+		+
PLO39								+		+	+	+	+	+		+	
PLO40			+					+		+	+		+	+	+		+
PLO41													+				
PLO42													+				
PLO43						+											
PLO44						+		+		+							
PLO45						+		+		+							
PLO46								+		+							+
PLO47								+		+							+
PLO48																	+
PLO49																	+
PLO50							+										