MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
KHMELNYTSKYI NATIONAL UNIVERSITY

APPROVED

by the Academic Board of
Khmelnytskyi National University
Minutes of 28 02 2023 № 10

Head of the Academic Board
_____ Mykola SKYBA
Signature Name, surname

EDUCATIONAL AND PROFESSIONAL PROGRAMME

Type of the educational programme

SOFTWARE ENGINEERING

Name of the educational programme

HIGHER EDUCATION LEVEL	**First (Bachelor's)**
PROGRAMME SUBJECT AREA	**121 "Software Engineering"** Code and name
FIELD OF STUDY	**12 "Information Technology"** Code and name
EDUCATIONAL QUALIFICATION	**Bachelor of Software Engineering** Name

The educational programme is put into force
from 1 September 2023

Order of 5 07 2023 № 24

Rector _____ Serhii MATIUKH
Signature Name, surname

Khmelnytskyi 2023

SUBMITTED

by the Department of Software Engineering

Minutes of 9 February 2023, № 4

Department Chair

_____ Leonid BEDRATIUK

PROJECT GROUP

Guarantor (Head of the project group)

_____ Leonid BEDRATIUK, D.Sc., Professor

Members of the project group:

_____ Yurii FORKUN, Ph.D., Associate Professor

_____ Oksana YASHYNA, Ph.D., Associate Professor

_____ Ivan HURMAN, Ph.D., Associate Professor

_____ Nataliia PRAVORSKA, Ph.D., Associate Professor

APPROVED:

Academic Board of the Faculty of Information Technologies

Minutes of 20 02 2023 № 4

Head of the Academic Board

_____ Oleh SAVENKO

Educational and Methodological Department

Head _____ Larysa LIUBOKHYNETS

Educational Department

Head _____ Oleh SAMOLIUK

Department for Higher Education Quality Assurance

Head _____ Hanna KRASYLNYKOVA

LETTER OF APPROVAL

Head of the Student Council
of the Faculty of Information Technologies

Sophia KRAVCHUK

Director of the NGO "IT-CLUSTER Khmelnytskyi"

Stepan TANASIYCHUK

I. Educational Programme Profile for the Programme Subject Area 121 Software Engineering

1. General Information	
Full Name of the Higher Education Institution and Structural Unit	Khmelnytskyi National University Faculty of Information Technologies Department of Software Engineering
Higher education level	Bachelor's
Name of the educational qualification	Bachelor in Software Engineering
Official name of the educational programme	Educational and professional programme "Software Engineering"
Diploma type and educational programme volume	Bachelor's diploma, single, educational programme volume 240 ECTS credits, term of study – 3 years 10 months
Accreditation	Accreditation Commission of Ukraine, Certificate (ID, № 23008745, 12 June 2019) – valid for five years until 1 July 2024
Cycle/Level	NQF – Level 6; FQ-EHEA – First Cycle; EQF LLL – Level 6
Prerequisites	Complete general secondary education Availability of complete general secondary education
Language(s) of teaching	English, Ukrainian
Term of the educational programme	Until the next update, not exceeding the accreditation period
Permanent web page of the educational programme	https://khmnu.edu.ua/op-b-fit/
2. Objective of the Educational Programme	
The educational programme aims to develop the intellectual potential of students, future specialists in software engineering who are competitive in the labour market both in Ukraine and abroad. Through their innovative educational, scientific, and entrepreneurial activities, they are capable of successful professional self-realisation, technology and knowledge transfer, adapted to the needs of the modern world and life challenges.	
3. Educational Programme Characteristics	
Subject Area	12 Information Technology; 121 Software Engineering *Objects:* Software, processes, tools, and resources for development, maintenance, and quality assurance of software. *Learning Objectives:* Training specialists capable of setting and solving tasks related to software development, maintenance, and quality assurance. *Theoretical content of the course*: Fundamental mathematical, informational, physical, and economic principles related to software creation and maintenance; basics of domain analysis, modelling, design, construction, and software maintenance. *Methods, techniques, and technologies*: Methods and technologies of software development; collection, processing, and interpretation of research results in software engineering. *Tools and equipment:* Software, hardware, and tools for development, maintenance, and operation of software
Orientation of the Educational Programme	Educational and professional programme
Main Focus of the Educational Programme	Special education in the field of information technology in the Programme Subject Area "Software Engineering". The programme emphasises the ability to work simultaneously on stages of the software lifecycle and effective interaction between performers of stages. Keywords: Software, processes, tools, development resources, maintenance, operation, software quality assurance.

Programme Features	Integrated training of specialists to solve tasks in the field of software engineering focused on team development, project management, and the development of synchronous work skills in the software lifecycle stages.
4. Suitability of Graduates for Employment and Further Education	
Employability	According to the National Occupational Classification ДК 003: 2010 2132.2 Software Engineer 2132.2 Database Programmer 2132.2 Application Programmer 3121 Computer Software Development Specialist 3121 Software Development and Testing Specialist
Further Education	Ability to study at the second (master's) level of higher education. Acquisition of additional qualifications in the postgraduate education system.
5. Teaching and Examination	
Teaching and Training	Student-centred training, lectures, laboratory classes in small groups, individual study based on textbooks and lecture notes, and consultations with lecturers.
Examination	Written exams, credits, testing, defences of practice, course projects, laboratory works, defence of qualification work.
6. Programme Competencies	
Integral Competence (IC)	Ability to solve complex, specialised tasks or practical problems in software engineering, characterised by complexity and uncertainty of conditions, using information technology theories and methods.
General Competencies (GC)	GC1. Ability for abstract thinking, analysis, and synthesis. GC2. Ability to apply knowledge in practical situations. GC3. Ability to communicate in the state language both orally and in writing. GC4. Ability to communicate in a foreign language both orally and in writing. GC5. Ability to learn and acquire modern knowledge. GC6. Ability to search, process, and analyse information from various sources. GC7. Ability to work in a team. GC8. Ability to act based on ethical considerations. GC9. Desire to preserve the environment. GC10. Ability to act socially, responsibly and consciously. GC11. Ability to exercise one's rights and duties as a member of society, understand the values of a civic (free democratic) society and the necessity of its sustainable development, the rule of law, human rights and freedoms in Ukraine. GC12. Ability to preserve and enhance the moral, cultural, scientific values and achievements of society based on understanding the history and regularities of the development of the subject area, its place in the general system of knowledge about nature and society, and in the development of society, technology, and technologies; to use various types and forms of physical activity for active rest and lead a healthy lifestyle.
Special (Professional) Competencies (PC)	PC1. Ability to identify, classify, and formulate software requirements. PC2. Ability to participate in software design, including modelling (formal description) of its structure, behaviour, and operational processes. PC3. Ability to develop architectures, modules, and components of software systems. PC4. Ability to formulate and ensure software quality requirements following client requirements, technical specifications, and standards. PC5. Ability to adhere to specifications, standards, rules, and recommendations in the professional field during the implementation of lifecycle processes. PC6. Ability to analyse, select, and apply methods and tools for ensuring information security (including cybersecurity).

	PC7. Proficiency in knowledge about information data models; ability to create software for data storage, retrieval, and processing. PC8. Ability to apply fundamental and interdisciplinary knowledge to resolve software engineering tasks successfully. PC9. Ability to evaluate and consider economic, social, technological, and ecological factors affecting the professional activity field. PC10. Ability to accumulate, process, and systematise professional knowledge regarding the creation and maintenance of software and recognise the importance of lifelong learning. PC11. Ability to implement phases and iterations of the life cycle of software systems and information technologies based on relevant software development models and approaches. PC12. Ability to execute the system integration process and apply standards and change management procedures to maintain the integrity, overall functionality, and reliability of the software. PC13. Ability to reasonably choose and master the toolkit for software development and maintenance. PC14. Ability for algorithmic and logical thinking. **Defined by the Educational Programme:** PC15. Ability for parallel work on stages of the software lifecycle and effective interaction between stage performers.
7. Programme Learning Outcomes (PLO)	
PLO1	To analyse, purposefully search for, and select the necessary information, reference resources, and knowledge for solving professional tasks, considering modern scientific and technical achievements.
PLO2	To know the code of professional ethics, understand the social significance and cultural aspects of software engineering, and adhere to them in professional activities.
PLO3	To understand the software lifecycle's leading processes, phases, and iterations.
PLO4	To know and apply professional standards and other regulatory documents in the field of software engineering.
PLO5	To understand and apply relevant mathematical concepts, domain and system methods, object-oriented analysis, and mathematical modelling for software development.
PLO6	To select and utilise a software development methodology appropriate for the task.
PLO7	To understand and apply in practice the fundamental concepts, paradigms, and basic principles of functioning linguistic, instrumental, and computational tools of software engineering.
PLO8	To have the skills to develop a human-machine interface.
PLO9	To know and be able to use methods and tools for collecting, formulating, and analysing software requirements.
PLO10	To conduct a pre-project survey of the subject area and system analysis of the design object.
PLO11	To select initial data for design, guided by formal methods of requirement descriptions and modelling.
PLO12	To apply effective software design approaches in practice.
PLO13	To know and apply methods for algorithm development, software design, and data and knowledge structures.
PLO14	To use instrumental software tools in practice for domain analysis, design, testing, visualisation, measurement, and software documentation.
PLO15	To make informed decisions when choosing programming languages and development technologies to address the tasks of creating and maintaining software.
PLO16	To possess skills in team development, approval, design, and release of all types of software documentation.
PLO17	To be skilled in applying methods of component software development.
PLO18	To know and be able to apply information technologies for data processing, storage, and transmission.
PLO19	To know and apply methods for software verification and validation.
PLO20	To know approaches to software quality evaluation and assurance.

PLO21	To understand, analyse, select, and competently use tools to ensure information security (including cybersecurity) and data integrity relative to applied tasks and created software systems.
PLO22	To know and apply project management methods and tools.
PLO23	To have the ability to document and present software development results.
PLO24	To calculate the economic efficiency of software systems.
Defined by the Educational Programme	
PLO25	To have the ability to effectively collaborate with performers from different stages of the software lifecycle, coordinating simultaneous work on stages.
PLO26	To know and apply methodologies, tools, and strategies for resource, time, and communication management to ensure effective parallel work on various software lifecycle stages.
PLO27	To professionally develop and process Ukrainian and English language sources in the subject area, recognise the need for lifelong learning to deepen acquired knowledge and gain new professional knowledge in software engineering, adapt to work in a specific profession, promote an active and healthy lifestyle as an effective component of professional development.
PLO28	To associate oneself as a member of the civic society and scientific community, acknowledge the supremacy of the law, especially in professional activities, understand and be able to use one's own rights and freedoms, and show respect for the rights and freedoms of others.

8. Resource Support for Programme Implementation	
Staff	All teachers meet the qualification according to their speciality and have a level of scientific and professional activity, confirmed by fulfilling at least four types and results of licensing requirements.
Logistics	Availability of training premises, computer workstations, and multimedia equipment meets the needs. For conducting practical work, information search, and processing results, there are specialised computer classes of the faculty with the necessary software.
Information and Educational and Methodological Support	Availability of: - Ukrainian and foreign professional periodicals of the relevant speciality profile in the library (including in electronic form); - official website of KhNU, on which the primary information about the organisation of the educational process is located; - MOODLE modular learning environment; - access to Scopus, Web of Science; - University's electronic library; - educational programme, curriculum, and work programmes for all academic courses of the curriculum; - programmes of all types of practical training and final examination; - guidelines for performing laboratory and practical works, coursework, and qualification work.
9. Academic Mobility	
National Credit Mobility	Possible exchange under inter-university cooperation based on bilateral agreements between Khmelnytskyi National University and universities of Ukraine (Taras Shevchenko National University of Kyiv, Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine, Yuriy Fedkovych Chernivtsi National University, Zaporizhzhia National University)
International Credit Mobility	Possible exchange under participation of KhNU in international academic mobility projects, in particular, Erasmus+ (Lublin University of Technology, Cracow University of Technology, Kielce University of Technology, Kazimierz Wielki University, Bydgoszcz University of Science and Technology)
Training of foreign students	Possible in two languages (English, Ukrainian)

II. List of Components of the Educational Programme and Their Logical Sequence

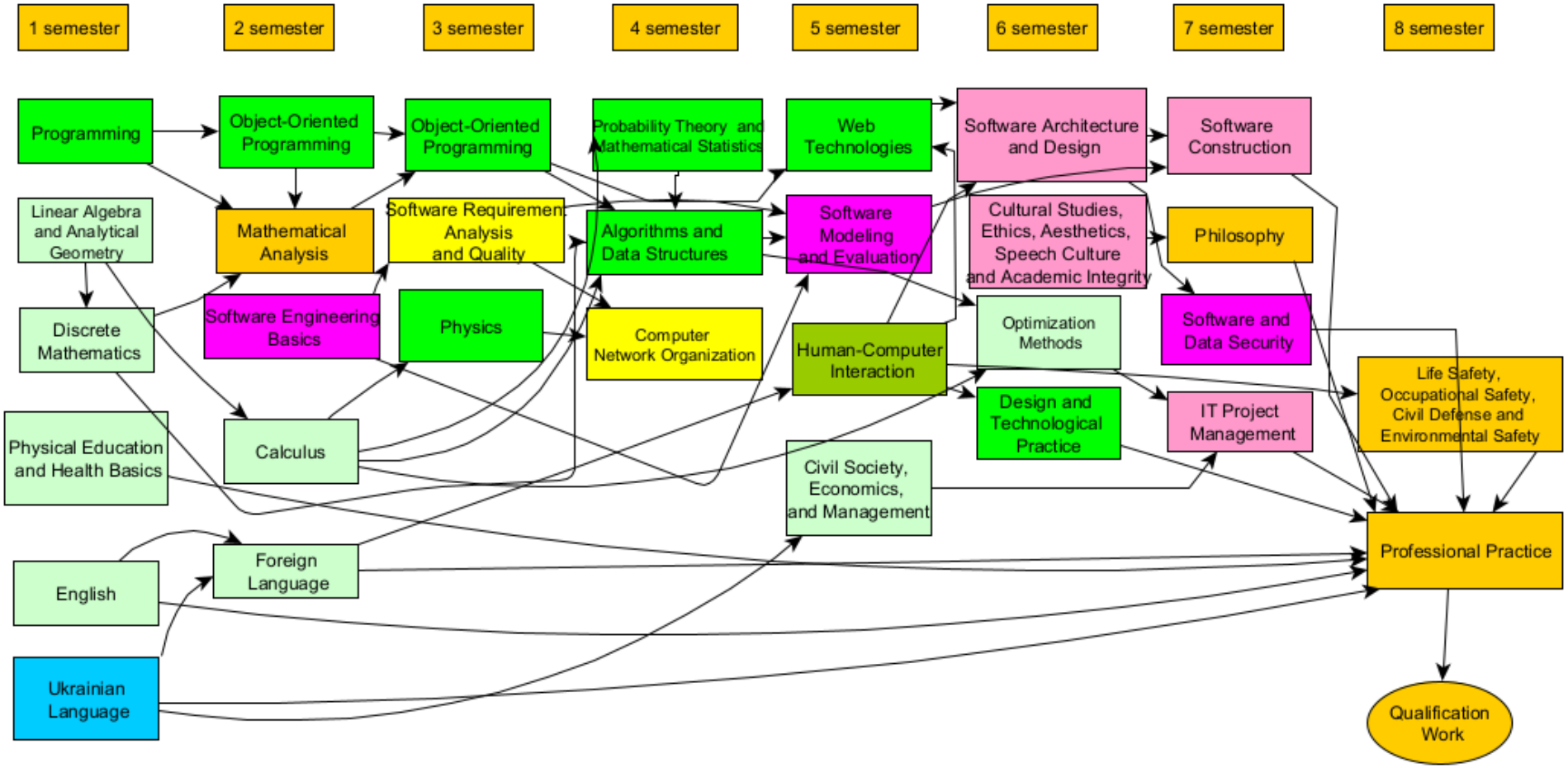
2.1. List of Components of the Educational Programme

CEP code	Components of the Educational Programme (courses, course projects, practical training, qualification work)	Number of ECTS credits	Final control form	Semester
MANDATORY COMPONENTS OF THE EDUCATIONAL PROGRAMME				
General Training (MGT)				
MGT.01	Linear Algebra and Analytical Geometry	6	Exam	1
MGT.02	Mathematical Analysis	7	Exam	2
MGT.03	Discrete Mathematics	5	Exam	1
MGT.04	English	4	Pass/Fail	1
MGT.05	Probability Theory and Mathematical Statistics	5	Exam	4
MGT.06	Physics	6	Exam	3
MGT.07	Life Safety, Occupational Safety, Civil Defence and Environmental Safety	5	Exam	8
MGT.08	Philosophy	4	Pass/Fail	7
MGT.09	Cultural Studies, Ethics, Aesthetics, Speech Culture and Academic Integrity	4	Pass/Fail	6
MGT.10	Optimisation Methods	4	Pass/Fail	6
MGT.11	Civil Society, Economics and Management	4	Pass/Fail	5
MGT.12	Physical Education and Health Basics	3	Pass/Fail	1
MGT.13	Ukrainian Language	4	Pass/Fail	1
MGT.14	Foreign Language	8	Exam	2
MGT.15	Algorithms and Data Structures	7	Exam	4
Professional Training (MPT)				
MPT.01	Software Architecture and Design	7	Exam, Course Project	6
MPT.02	Programming	8	Exam	1
MPT.03	Object-Oriented Programming	1 2	Pass/Fail, Exam	2, 3
MPT.04	Software Engineering Basics	5	Pass/Fail	2
MPT.05	Databases	5	Exam	2
MPT.06	Software and Data Security	5	Exam	7
MPT.07	Computer Network Organisation	8	Exam	4
MPT.08	Software Construction	6	Exam	7
MPT.09	Software Modelling and Evaluation	5	Exam	5
MPT.10	Web Technologies	6	Exam, Course Project	5
MPT.11	IT Project Management	5	Exam	7
MPT.12	Software Requirement Analysis and Quality	7	Exam	3
MPT.13	Human-Computer Interaction	5	Exam	5
MPT.14	Design and Technological Practice	5	Pass/Fail	6
MPT.15	Professional Practice	5	Pass/Fail	8
MPT.16	Qualification Work	10	Qualification Work	8
Total volume of mandatory components		180		
SELECTIVE COMPONENTS OF THE EDUCATIONAL PROGRAMME				
	Selective courses of the 3rd semester	10	Pass/Fail*	3

	Selective courses of the 4th semester	10	Pass/Fail*	4
	Selective courses of the 5th semester	10	Pass/Fail*	5
	Selective courses of the 6th semester	10	Pass/Fail*	6
	Selective courses of the 7th semester	10	Pass/Fail*	7
	Selective courses of the 8th semester	10	Pass/Fail*	8
Total volume of selective components		60		
Total volume of the educational programme		240		

***** The number of pass/fail credits depends on the student's choice of selective courses

2.2. Structural-logical scheme of the Educational Programme



2.3. Selective components of the educational programme

Students choose the selective components of the educational programme from the University catalogue of selective courses, which consists of courses provided by various departments at different levels of higher education. The credit value of selective courses is a multiple of 4. The list of selective educational components from each department is updated annually. Students of this educational programme must choose 2-3 courses totalling 10 credits in each of the 3-8 semesters. The selection procedure is carried out under the Regulation on the procedure for implementing the right of students to choose educational courses at Khmelnytskyi National University freely. The university catalogue of selective courses is posted on the University website.

III. Forms of student examination

The examination of students according to the educational and professional programme of the programme subject area "Software Engineering" is conducted in the form of defence of a qualification work and concludes with the issuance of a document of the established sample about awarding him a bachelor's degree with the assignment of an educational qualification: bachelor in software engineering;

The qualification work should be related to software development, support, and quality assurance. It must not contain academic plagiarism, fabrication, or falsification. To ensure accessibility and transparency, the work is published in the institutional repository of Khmelnytskyi National University.

IV. Requirements for an internal quality assurance system for higher education

The system of internal quality assurance of educational activities and the quality of higher education (internal quality assurance system) at the University meets the requirements of the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), Article 16 of the current Law of Ukraine "On Higher Education" (as amended).

The internal quality assurance system operates at the University at five organisational levels under the Regulations on the system of internal quality assurance of educational activities and higher education at KhNU, which is available in the "Regulatory Documents" section (URL: https://khmnu.edu.ua/normatyvni-dokumenty/).

The internal quality assurance system involves the following procedures and measures:

1) defining the principles and procedures for quality assurance in higher education;

2) monitoring and periodic review of educational programmes;

3) annual examination of students and academic staff of the University and regular publication of the results of such examination on the official website of the University, on information stands and in any other way;

4) providing advanced training for academic staff;

5) ensuring the availability of the necessary resources for the organisation of the educational process, including individual work of students, for each educational programme;

6) ensuring the availability of information systems for effective management of the educational process;

7) ensuring the publicity of information about educational programmes, degrees of higher education and qualifications;

8) ensuring the observance of academic integrity by university staff and students, including the creation and maintenance of an effective system for the prevention and detection of academic plagiarism;

9) other procedures and measures.

V. Matrix of compliance of programme competencies with the components of the educational programme

	MGT.01	MGT.02	MGT.03	MGT.04	MGT.05	MGT.06	MGT.07	MGT.08	MGT.09	MGT.10	MGT.11	MGT.12	MGT.13	MGT.14	MGT.15	MPT.01	MPT.0 2	MPT.0 3	MPT.0 4	MPT.0 5	MPT.0 6	MPT.0 7	MPT.0 8	MPT.0 9	MPT. 10	MPT. 11	MPT. 12	MPT. 13	MPT.14	MPT. 15	MPT. 16
IC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GC01	✓	✓	✓		✓	✓		✓	✓	✓				✓	✓		✓	✓									✓				✓
GC02	✓	✓	✓		✓	✓	✓			✓				✓	✓			✓					✓		✓	✓			✓	✓	✓
GC03												✓	✓																		✓
GC04				✓										✓																	✓
GC05				✓				✓	✓	✓			✓	✓	✓																✓
GC06				✓				✓	✓				✓	✓	✓																✓
GC07												✓											✓								✓
GC08								✓	✓																						✓
GC09						✓	✓																								✓
GC10							✓	✓	✓		✓																				✓
GC11											✓																				✓
GC12								✓	✓		✓	✓																			✓
PC01																								✓			✓		✓	✓	✓
PC02																✓			✓				✓	✓				✓	✓	✓	✓
PC03																✓								✓					✓	✓	✓
PC04													✓	✓					✓								✓	✓	✓	✓	✓
PC05																			✓					✓	✓		✓		✓	✓	✓
PC06																					✓	✓									✓
PC07															✓					✓									✓	✓	✓
PC08	✓	✓	✓		✓	✓				✓					✓				✓							✓					✓
PC09						✓	✓	✓																		✓			✓	✓	✓
PC10																✓	✓		✓				✓	✓			✓		✓	✓	✓
PC11																✓			✓				✓	✓					✓	✓	✓
PC12																✓					✓	✓	✓	✓			✓		✓	✓	✓
PC13																✓	✓	✓		✓					✓				✓	✓	✓
PC14	✓	✓	✓		✓	✓				✓				✓	✓		✓	✓											✓	✓	✓
PC15																							✓			✓			✓	✓	✓

VI. Matrix of providing the programme learning outcomes (PLOs) with the relevant components of the educational programme

	MGT.01	MGT.02	MGT.03	MGT.04	MGT.05	MGT.06	MGT.07	MGT.08	MGT.09	MGT.10	MGT.1 1	MGT.1 2	MGT.13	MGT.14	MGT.15	MPT.01	MPT.02	MPT.03	MPT.04	MPT.05	MPT.06	MPT.07	MPT.08	MPT09	MPT.10	MPT.11	MPT.12	MPT.13	MPT 14	MPT.15	MPT.16
PLO01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓
PLO02								✓	✓			✓							✓										✓	✓	✓
PLO03																✓			✓								✓				✓
PLO04																			✓		✓					✓	✓		✓	✓	✓
PLO05	✓	✓	✓		✓	✓				✓					✓			✓						✓							✓
PLO06																		✓					✓	✓	✓				✓	✓	✓
PLO07										✓					✓		✓	✓		✓					✓				✓	✓	✓
PLO08						✓	✓																✓					✓			✓
PLO09				✓									✓	✓													✓		✓	✓	✓
PLO10																✓	✓		✓				✓	✓					✓	✓	✓
PLO11																✓	✓		✓				✓	✓			✓		✓	✓	✓
PLO12																✓	✓		✓				✓								✓
PLO13										✓					✓		✓			✓			✓	✓					✓	✓	✓
PLO14				✓									✓	✓		✓			✓				✓	✓							✓
PLO15																	✓	✓		✓					✓						✓
PLO16				✓									✓	✓					✓				✓			✓			✓	✓	✓
PLO17																							✓	✓		✓			✓	✓	✓
PLO18																				✓	✓	✓							✓	✓	✓
PLO19																							✓	✓					✓	✓	✓
PLO20																								✓			✓		✓	✓	✓
PLO21																				✓	✓	✓							✓	✓	✓
PLO22																										✓			✓	✓	✓
PLO23				✓									✓	✓					✓							✓			✓	✓	✓
PLO 24											✓															✓			✓	✓	✓
PLO 25																							✓			✓			✓	✓	✓
PLO 26																							✓			✓			✓	✓	✓
PLO27				✓			✓	✓	✓		✓	✓	✓	✓															✓	✓	✓
PLO28								✓	✓		✓																		✓	✓	✓

Sources

1 Закон України “Про освіту” [Electronic resource]. – URL: http://zakon3.rada.-gov.ua/laws/show/2145-19.

2 Закон “Про вищу освіту” [Electronic resource]. – URL: http://zakon4.rada.gov.-ua/laws/show/1556-18.

3 Національна рамка кваліфікацій (в редакції постанови Кабінету Міністрів України від 25 червня 2020 р. № 519). [Electronic resource]. – URL: https://zakon.rada.gov.ua/laws/show/519-2020-%D0%BF#Text

4 Стандарт вищої освіти України зі спеціальності _121 – Інженерія програмного забезпечення, затверджений наказом МОНУ від 29.10.2018 № 1166.

6 Методичні рекомендації щодо розроблення стандартів вищої освіти. Наказ МОНУ від 01.06.2016 № 600 (у редакції наказу МОНУ від 30.04.2020 № 584).

7 Лист МОНУ від 05.06.2018 № 1/9-377 “Щодо надання роз’яснень стосовно освітніх програм”.

8 Ліцензійні умови провадження освітньої діяльності. Постанова КМУ від 30 грудня 2015 № 1187 (в редакції постанови КМУ від 24.03.2021р., №365).

9 Лист МОНУ від 28.04.2017 № 1/9-239 “Зразок освітньо-професійної програми для першого та другого рівнів вищої освіти”.