### MIHICTEPCTBO ОСВІТИ І НАУКИ УКРАЇНИ MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

### TERNOPIL VOLODYMYR HNATIUK NATIONAL PEDAGOGICAL UNIVERSITY

#### EDUCATIONAL AND PROFESSIONAL PROGRAM

The second level of higher education in specialty 014 SECONDARY EDUCATION (INFORMATICS) in the field of knowledge 01 EDUCATION / PEDAGOGY Qualification: Master of Education, Lecturer in computer science

### APPROVED BY THE ACADEMIC COUNCIL

### The Head of the Academic Council

\_\_\_\_\_ /V. P. Kravets/

(protocol № 13 dated "27" June 2017)

Educational program enacts from September «01» 2017

(order №220-p dated August «30» 2017)

Ternopil 2017

## 1. Profile of the educational and professional program in specialty

### **014 SECONDARY EDUCATION**

by subject specialty (specialization)

014.09 Secondary education (Computer science)

1 - General information						
Full name of higher	Ternopil Volodymyr Hnatyuk National Pedagogical					
educational institution	University,					
and structural unit	Faculty for physics and mathematics,					
	Department of Computer science and its teaching					
	methods					
The degree of higher	Master					
education and the name	Master of Education. Lecturer in computer science,					
of the qualification in	teacher of computer science					
the language of the						
original						
The official name of the	Educational and professional program of preparation of					
educational program	higher education applicants of the second (master's) level					
	in the field of knowledge 01 Education / Pedagogy,					
	specialty 014 Secondary education, subject specialization					
	014.09 Secondary education (Computer science)					
Type of diplome and	Master's degree, unitary, 90 ECTS credits, term of study 1 year 4 months, during which higher education students					
the volume of the						
ducational program	must complete disciplines, prepare course work, undergo					
educational program	practical training and certification					
Availability of	NRC (NQF - national qualifications framework) of					
accreditation	Ukraine – level 7, FQ-EHEA – second cycle, QF-LLL –					
	level 7					
Cycle/Level	Bachelor's degree, specialist (from related specialties),					
	confirmed by a state-issued document issued by the					
	higher educational institution of III-IV accreditation level					
Prerequisites	Ukrainian					
Teaching languages	Certificate on specialty's accreditation: series HД-IV №					
	2073782, dated: 15.03. 2016, validity: till 01.07.2026					
The duration of the	http://tnpu.edu.ua/					
educational program						

2 - The purpose of the educational program					
Providing the fundamental theoretical and practical training of specialists for:					
- solving problems of anal	ysis and synthesis of complex systems on the basis of the				
latest information techno	ologies with application of modern achievements of				
computer sciences;					
- conducting scientific rese	arches with the use of new information technologies in the				
development and managem	nent of complex objects based on information systems;				
- implementation of scient	fic research, applied and pedagogical activity on the basis				
of modern methodologies.					
3 - Char	acteristics of the educational program				
Subject area (branch of	Pedagogy and psychology of higher education, teaching				
knowledge, specialty,	methods in high school, technology of e-learning;				
specialization) (if	computer science and information technologies:				
available))	programming technologies, operating systems, tools for				
	development software systems development, computer				
	simulation, system analysis of information objects,				
	organization of databases and knowledge, distributed				
	systems technologies, modern Web technologies, cloud				
	technologies, basics of robotics;				
	other (55:35:10).				
	Field of knowledge 01 Education / Pedagogy,				
	Specialty 014 Secondary education,				
	Specialization 014.09 Secondary education (Computer				
	science)				
Orientation of the	e Professional				
educational program	The program includes in-depth basic training in computer				
	science, humanitarian, psychological and pedagogical,				
	special and scientific and practical training taking into				
	account the current state of computer science, focuses of				
	the actual specialization, within which further				
	professional and scientific careers are possible: computer				
	science (theoretical and applied), information and				
	communication technologies in education, theory and				
methods of computer science education.					
The program is based on the thorough knowledge of the					
peculiarities of the field of information technology taking					
	into account its current state, focuses on topical				
	specialization, within which further professional and				
	scientific careers are possible.				

The main focus of the	Full higher education in the field of computer science and			
educational program	teaching methods in combination with specialization -			
and specialization	computer science.			
Peculiarities of the	The program provides for additional specialization,			
program	relevant practices and a separate form of final			
	certification.			
4 - Eligibility of g	graduates for employment and further training			
Eligibility for	Field of activity of graduates: educational institutions,			
employment	research organizations, IT services of state and non-state			
	institutions.			
	Primary positions and professional titles of works: a			
	teacher of specialties, a researcher, an expert, a computer			
	science consultant, a mathematician engineer, a			
	programmer engineer, a system administrator, an IT			
	specialist, a specialist in the processing of socio-			
	economic and environmental information, mathematical			
	and 3D modeling, specialist in designing and			
	distributed detenance tools manager (aggistent manager)			
	of the enterprise (institution, organization)			
Eurthan training	Possibility of continuing education at the third			
Further training	(educational and scientific) level (doctor of philosophy).			
	nostgraduate study doctoral programs in computer			
	science (theoretical and applied): receiving postgraduate			
	education from related and other specialties: Certification			
	training.			
	5 - Teaching and assessment			
Виклалання та	Approaches: student-centered learning, problem-oriented			
навчання	learning e-learning in the Moodle system self-learning			
	research-based learning.			
	Teaching takes place in the form of: lectures (including			
	multimedia and interactive lectures), seminars, practical			
	classes with solving problem situations, laboratory			
	research works, individual research tasks, independent			
	work on the basis of electronic educational complexes.			
	consultations with teachers regarding the defence of the			
	qualification master's thesis			
Ошінювання	Oral and written examinations examinations and tests in			
	the form of tests, current (modular) test control, tests.			
	essay, defence of practice reports, defence of term			
	papers, defence of master's qualification thesis.			
	6 – Program Competencies			
Integral competence	The ability to solve complex tasks and problems in the			
B	field of education and computer science which implies			
	conduction of researches, elaboration of innovations and			

	is characterized by the indefiniteness of conditions and				
	requirements.				
General competencies	GC1 Analysis and synthesis The ability to analyze and				
	synthesyze based on basic logical arguments and proven				
	tacts.				
	GC2 Flexibility of thinking The acquisition of flexible				
	means of thinking that allows to understand and solve				
	problems and tasks, preserving critical attitude toward				
	defined scientific concepts. The openess to the				
	miniplementation of knowledge and competencies in a wide range of possible work positions and everyday life				
	CC3 Croup work The ability to work in a term. The				
	ability to perform lab researches in a group under a				
	ability to perform lab researches in a group under a				
	demonstrate the ability to take into cosideration strict				
	requirements of a discipline planning and time				
	management.				
	GC4 Communication skills The ability to communicate				
	efficiently and present complex compund information in				
	a consise manner both oral and written using information				
	and communication technologies and relevant technical				
	terminology.				
	GC5 Popularization skills The ability to conduct an oral				
	presentation and write a coherent article based on the				
	results of a conducted research, as well as on modern				
	conceps of computer science for a non-professional				
	audience (non-specialists). The ability to communicate				
	with non-specialists using teaching skills.				
	regrading both professional integrity and understanding				
	of possible impost of computer science and technologies				
	on society				
Professional	PC1 Deep knowledge and understanding The ability to				
competencies of	use computer technologies and computer science laws in				
specialty	a combination with mathematical tools for describing				
	natural elements. The ability to analyze processes of				
	projecting, program sets elaboration without the use of				
	data, web-applications, computer and information				
	systems hardware, computer networks from the				
	perspective of fundumental professional knowledge, as				
	well as based on relevant mathematical methods. The				
	ability to analyze and synthesize scientific and technical,				
	natural and scientific, and overall scientific information.				
	PC2 Problems solution The ability to formulate,				
	analyze, and synthesize solutions of scientific problems				

at an abstract level by means of their decomposition to their components, which can be separately researched in their more or less important aspects.

**PC3 Problems solution** The ability to formulate, analyze, and synthesize solutions of scientific problems at an abstract level by means of their decomposition to their components, which can be separately researched in their more or less important aspects.

**PC4 Simulation competencies** The ability to build relevant information phenomena simulations, research them in order to retrieve new conclusions and deepen the understanding of such phenomena.

**PC5 Mathematical competencies** The ability to understand and efficiently use mathematical and nummeral methods, which are often used in computer science and information technologies. The ability to use professional and special knowledge in the field of mathematical simulation of probability theory and mathematical statistics for statistical processing of experimental data and the retrieved results in the field of computer science and information technologies.

**PC6 Computer skills** Professional use of the computer and information technologies. The ability to elaborate and implement computer application (technologies) and apply existing ones. The ability to project program sets, data-bases, web-application by means of relevant software and hardware, perform the configuration and administration of computer networks, including computer study networks, and to determine methodology of effective technical solutions search.

PC7 Advanced communication skills The ability to communicate with colleagues of the very field of study on scientific achievements both non-professionally and professionally. The ability to compose oral and written reports, discuss scientific topics in the mother tongue and English. The ability to use efficiently and practically various theories in the field of communication. The ability to undestand ways of practical use of communication skills and use communication concepts The understanding of factors, effectively. which influence communication both positively and negatively, and the ability to identify or take in account such factors in certain communication situations.

**PC8 Researching skills** The ability to conduct scientific researches in the field of theory and methodology of

teaching mathematics, computer science, and information technologies; to formulate (as a presentation or report) new hypotheses and scientific tasks in the field of mathematics; to select a relevant course and methods for their resolution taking into consideration available resources. The ability to understand maws of practical use of communication skills, effectively applying communication concepts. The ability to conduct experiments as well as describe, analyze, process, and evaluate critically experimental data.

**PC9** The ability to study The ability to perceive new knowledge in the field of mathematics and integrate it into existing one. The ability, as a specialist, to cope with a certain narrow-branch area, which lays beyond the boundaries of a chosen specialty in mathematics. The ability to acquire new branches in the field of mathematics using acquired the mathematical. fundamental and professional knowledge through selfeducation. The ability to conduct references search, which are related to a specialty; the ability to evaluate them critically based on professional knowledge. The ability to self-educate.

**PC10 Erudition in the field of computer science and information technologies** The ability to describe a wide range of tasks on supervision and projecting of software without data, web-applications, computer networks based on the theory and knowledge regarding information technologies; such an ability is based on deep knowledge and understanding of a wide range of theories and branches in the field. The ability to use mathematics as a means of logical and algorithmical thinking in the process of the elaboration of mathematical and software provision for information technologies. The ability to use methods of observation, description, identification, and classification of computerization.

**PC11 Teaching skills** The ability to use effectively basic pedagogical concepts, analyze methods according to which teaching methods are applied in practice. The ability to be a mentor for junior colleagues to improve their teaching competence. Being able to combine effectively various technologies and teaching tools including digital and remote teaching.

7 – Program outcomes of studying					
	POS1 Knowledge and skills from the subject area:				
	– Resourceful	awareness	of	various	pedagogical

t s i	theories and technologies, which allow graduates to successfully teach professional disciplines at educational institutions and analyze critically literature in the field of methodology of teaching;
	- Ability to apply and project and implement existing
S 1 1	systems and approaches of remote teaching, as well as new ones; to be able to manage the process of digital reaching and maintain it:
	Sufficient knowledge in the field of advectional
	calculations in order to apply monitoring and statistics rechnologies and successfully conduct scientific research under supervision of a mentor to comply with the
1	requester's interests:
- - !	- Ability to understand and analyze scientific publications according to the chosen specialty, to track the newest specialty's achievements;
-	- Ability to conduct a search of scientific references
	which belong to the field of professional occupation:
	- Awareness of various communication theories:
-	- Knowledge and understanding which regard to
1	philosophical aspects of computer science as a discipline.
	n particular – to computer science philosophy and
t I	fundamental problems of computer science;
-	- Fundamental knowledge and understanding, which
1	regard actual courses of scientific research in computer
S	science, such as: applied mathematics and computer
S	science, theory of systems and system analysis,
1	methodology of scientific research. The scope of such knowledge is to be sufficient to successfully partake in
	one of scientific groups;
-	- Resourceful mathematical expertise in the field of discrete mathematics, computational mathematics,
2	B a complexity theory, and probability theory;
	- Resourceful knowledge of languages and paradigms
	bi programming, technologies of programming, and
	Degenerational Systems,
	- Resourceful knowledge and skills to apply
	Descurrential linearies of software elaboration,
	- Resource in the field of system
	computerization objects:
	Expansion objects,
	- Expertise on modern theories of data-base and
	rechnologies of their elaboration;

– Knowledge of basics	of computer and computer
networks architecture and t	the ability to apply them to the
process of feasibility stud	dy assessment of information
technologies;	
– Resourceful knowled	ge of distributed systems
technologies;	
– Resourceful knowledge	e of web technologies;
– Knowledge and skills to	o organize cloud computing
POS2 Cognitive skills a	nd competencies in subject
area:	
– resourceful training in	n theoretical, methodological,
and algorithmic basics of i	information technology for the
purpose of using mathem	atics whilst resolving applied
and scientific tasks in the	field of information systems
and technologies;	
– resourceful training in	n the field of programming,
algorithmic thinking, a	and methods of program
engineering for the implem	entation of software;
– knowledge of standa	rds, methods, and ways of
managing processes of	a life cycle of information
systems, products, and	services of information
technologies; expertise or	n the technology of software
elaboration according to a r	requester's requirements;
– resourceful knowledge	in the field of system research
and the ability to apply	them whilst managing IT
projects, system simulatio	n, objects of computerization
system analysis conductio	on, decision-making, methods,
and systems of AI elaboration	ion;
– ability to apply prin	nciples of organization and
functioning of hardwar	re of modern information
processing systems of vario	bus use;
– ability to project in the	professional field, competence
to build and use simulation	ons for describing objects and
processes as well as perform	m their quality analysis;
– knowledge of intellectu	ual property objects rights and
management protection peo	cultarities;
– modern perception of	t evaluation principles of a
company's prospectus aims	s and tasks, which functions in
the field of computer	science and information
technologies, as well a	as the organization of its
departments operation;	
– Modern perception of	principles of structural and
functional organization of	t a company's management,
which operates in the field	eld of computer science and

information technologies; – Modern perception of technological approaches of making and implementing innovative management
decisions;
– Ability to justify priorities of an innovative strategy
and form a mechanism of their implementation in an
innovative policy of a company, which operates in the
field of computer science and information technologies;
- Addity to conduct commercialization of intellectual elaborations results and securing their ownership:
- Ability to conduct monitoring and complex
evaluation of the efficiency of innovative operation of a
company, which operates in the field of computer science
and information technologies.
POS3 Practical skills in subject area:
– Ability to mathematical and logical thinking,
knowledge of basic concepts, ideas, and methods of fundamental mathematics and the ability to apply them
whilst solving specific tasks.
<ul> <li>Knowledge of discrete structures and the ability to</li> </ul>
apply modern methods of discrete mathematics whilst
analyzing, synthesizing, and projecting information
systems of different kinds;
- Knowledge of principles of accidental occurrences and the ability to apply probable and statistical methods
of solving professional problems;
<ul> <li>Knowledge of modern methods of building and</li> </ul>
analyzing effective algorithms and the ability to apply
them in specific occasions;
- Knowledge of theoretical peculiarities of numeral
and the ability to apply numeral methods whilst solving
various applied tasks;
– Knowledge of principles of structural programming,
modern procedure-oriented languages, basic data
structures, and the ability to apply them whilst program
Ability to think procedure oriented, the knowledge of
object-oriented programming languages, and the ability
to apply an object-oriented approach whilst programming
complex program systems;
- Knowledge of modern technologies and instrumental
means of program systems elaboration and the ability to
- Knowledge of general principles of organization and
isnowieuge of general principles of organization and

functioning of operational systems and the ability to
elaborate elements of system software;
- Knowledge of modern organizational theories of
data-bases and knowledge-bases, methods and
technologies of their elaboration, and the ability to
project logical and physical simulations without data-
bases, as well as projecting requests to them;
- Knowledge and skills of elaboration technologies for
distributed data-bases, 3D simulations, modern
information and communication technologies in order to
successfully conduct scientific research under the
supervision of a mentor;
- Knowledge of server technologies for creating web-
applications and the ability to apply methods and
instrumental means for their projecting;
<ul> <li>Knowledge of principles, methods, and algorithms of</li> </ul>
CG and the ability to apply them whilst elaborating
graphic interfaces of human-computer interaction;
- Knowledge of the 'data warehouse' concept and their
operational and analytical processing, as well as their
intellectual analysis;
<ul> <li>Knowledge of principles of team work; the ability to</li> </ul>
work in a team and apply program systems of project
management.
POS4 General skills and competencies:
– Ability to form an adamant worldview, pluralism,
political consciousness and culture; adequate perception
of modern problems of society development, human
existence, and spiritual culture;
- Ability to have an active life and civil position, share
social responsibility for a company's operation, which
operates in the field of computer science and information
technology;
<ul> <li>Ability to effective communicative interaction,</li> </ul>
healthy lifestyle, new knowledge acquisition, and self-
improvement;
- Ability to conduct research of innovative processes of
projecting and maintaining program complexes, data-
bases, webapplications, equipment of computer systems
and networks, and the ability to promote innovations and
a company at the market, which operates in the field of
computer science and information technology;
<ul> <li>Ability to identify new opportunities for projecting</li> </ul>
and maintaining program complexes, data-bases, web
applications, equipment of computer systems, computer
networks, and new kinds of economic activity (business),

	and assure their implementation in the conditions of high				
	dynamism indefiniteness;				
	– Understand natural and scientific basics of EP and				
	healthy lifestyle;				
	– Understand peculiarities of organization and				
	maintenance of learning process at higher school.				
	8 – Resource provision				
Human resources	100% of scientists and pedagogues, who deal with				
provision	teaching disciplines of the specialty 014 Secondary				
	Education specialized (Computer science) possess				
	scientific degrees and academic titles with experience in				
	research and practical work in their specialty.				
Inventory and logistics	Study and inventory facilities of the faculty consist of				
management	auditoriums, study labs, (which are equipped with				
	modern computers and software), curricular rooms,				
	which are situated in facilities corresponding with current				
	sanitary, technical, and fire safety standards.				
Informational,	The use of a digital resources server based on LMS				
learning, and teaching	Moodle and library resources of Ternopil Volodymyr				
materials	Hantiuk National Pedagogical University; the				
	accessibility of online platforms of other libraries and				
	science institutions based on agreements; the use of				
	authorial works of scientists and pedagogues, which				
	include: study textbooks and study manuals approved				
	with the label of Ministry of Science and Education of				
	Ukraine; study textbooks and study manuals				
	recommended by the Academic University Council.				
	9 – Academic mobility				
National credit mobility	Based on two-way agreements between Ternopil				
	Volodymyr Hantiuk National Pedagogical University and				
	other higher educational institutions of Ukraine.				
International credit	Based on two-way agreements between Ternopil				
mobility	Volodymyr Hantiuk National Pedagogical University and				
	other higher educational institutions of foreign partner				
	countries.				
Study of foreign	Possible after having passed certain Ukrainian language				
applicants of higher	courses.				
education					

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

# 2.1 List of components of educational and professional program

Code /	Components of the educational program	Number	Assessment form	
Nº	(educational disciplines, course projects (works),	of credits		
	practice, qualification work)			
	1. Obligatory components of EPP			
OC	Disciplinary cycle of overall training			
OC1.01	Philosophy of science	3	Exam	
OC1.02	Methodology and organization of scientific research	3	Credit	
OC1.03	Management in education	3	Exam	
OC1.04	Foreign language (in professional orientation)	4	Exam	
	Disciplinary cycle of profession	nal training		
OC1.01	Psychology and pedagogy of higher education	3	Exam	
OC1.02	Algorithms and complexity theory	4	Exam	
OC1.03	Methodology of teaching computer science in high school	5	Exam	
OC1.04	Fundamentals of Information security	3	Credit	
2. Selective components of EPP				
	2.1. Disciplines to higher institut	tion selectior	1	
SC2.1.01	Modern operating systems	3	Credit	
SC2.1.02	Methodology of teaching mathematics	4	Exam	
SC2.1.03	Computer information technologies in education		Credit	
	and science	3		
SC2.1.04	Computer practice	3	Credit	
SC2.1.05	Coursework	3	Credit	
	2.2. Disciplines to student selection			
SC2.2.01	Software development technologies	3	Credit	
SC2.2.02	Elective course (E-Learning Technology)	3	Credit	
SC2.2.03	Elective course (Fundamentals of Robotics)	3	Credit	
SC2.2.04	Elective course (Modern Web-technologies)	6	Exam	
SC2.2.05	Elective course (Fundamentals of cloud technologies)	5	Credit	
SC2.2.06	Elective course (Integrated Programming Course)	3	Credit	
2.3. Practical training				
PT2.3.01	Design and technological practice	3	Credit	
PT2.3.02	Pedagogical practice	6	Credit	
PT2.3.03	Scientific and pedagogical practice	9	Credit	
PT2.3.04	Preparation of master's thesis	5		
Total amount of selective components:		23		
General amo	ount of educational and professional program	90		

#### 3. Form of certification of higher education applicants

The certification of higher education applicants is to establish the level and extent of the knowledge, skills and competences of the higher education applicant who is studying to the educational program, the requirements of higher education standards.

Certification of graduates of the educational program in specialty 014 Secondary education (by subject specialization 014.09 Secondary education (Computer science)) is conducted in the form of the defense of the master's thesis and ends with the issuance of the document of the established model for the award of the master's degree with qualification: Master of Education, Lecturer in computer science, teacher of computer science.

The certification is carried out openly and publicly.