

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**

Ternopil Volodymyr Hnatiuk  
National Pedagogical University

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**EDUCATIONAL AND PROFESSIONAL PROGRAM**

**The first (bachelor) higher education degree  
in specialty 014 Secondary Education (Mathematics)  
The field of knowledge 01 Education/Pedagogy  
Qualification: Bachelor of Education, Teacher of Mathematics**

**Stamp/Ministry of Education and Science of Ukraine//  
Ternopil Volodymyr Hnatiuk National  
Pedagogical University//**

**02125544/**

**Approved by Academic Board  
Head of the Board/V.P.Kravets  
(protocol №13 as of 27.06.2017)**

**The curriculum comes into force from 01.09.2017  
(order № 220-p from 30.08.2017)**

**Ternopil 2017**

## GENERAL CHARACTERISTICS

Program Profile	
<b>Education Degree</b>	Bachelor
<b>Field of Study</b>	01 Education
<b>Specialty</b>	014 Secondary Education (according to subject specialties)
<b>Subject Specialty</b>	014.04 Secondary Education (Mathematics)
<b>Specialization</b>	-
<b>Qualification</b>	Bachelor of Secondary Education (Mathematics), teacher of mathematics, computer science
<b>Type of diploma and the scope of the educational program</b>	singular, 240 credits ECTS
<b>Higher Educational Institution</b>	Ternopil Volodymyr Hnatiuk National Pedagogical University
<b>Accreditation Organization</b>	Accreditation Committee of Ukraine
<b>Certification Frames</b>	Certificate on specialty's accreditation: series HД-IV № 2073782, from 27.01.2015., protocol № 114, validity: till 01.07.2025 .
<b>Program's Level</b>	FQ-EHEA – 2 <sup>nd</sup> cycle, EQF LLL – level 7, HPK – level 7

<b>A</b>	Purpose of educational program	Provision of knowledge acquisition, skills, and understanding related to mathematics study areas to higher educational institutions. This shall enable them to access a wide range of employability and further training. Being ready to successfully acquire more complex programs from science researchers and developers.
<b>B</b>	<b>Program's Characteristics</b>	
1.	Subject area	01 Education/Pedagogy
2.	Program and specialty's main focus	Training of specialists in order to partake in organizational and managerial, analytical, scientific, and research activities in pedagogical education focusing on the application of research in basic areas of mathematics, physics, and astronomy.
3.	Program's Orientation	Educational and professional

4.	Peculiarities and differences	Peculiarities are seen in the expansion of the varieties of means of acquisition and development of skills and competencies, which include: conduction of interdisciplinary scientific researches, elaboration, in cooperation with other teachers, of methodological recommendations on holding seminars on the specialty, conduction of practical seminars on the specialty's discipline in order to learn innovative methods and technologies of computer science and mathematics researches. The study is open for foreign students.
<b>C</b>	<b>Employment and Further Education</b>	
1.	Employment	A specialist is able to perform the indicated professional activities (according to ДК 003:2010):2310.2 2320 Teacher of a secondary educational institution
2.	Further Education	FQ-EHEA – 3 <sup>rd</sup> cycle, EQF LLL – level 8, HPK – level 8
<b>D</b>	<b>Teaching Style and Methodology</b>	
1.	Approaches to studying and teaching	Such include: student-centered and problem-oriented teaching, digital education via Moodle system, self-study, and teaching based on research etc. Teaching is performed through: lectures, multimedia lectures, interactive lectures, seminars, practical and lab seminars, remote and self-studying, and individual classes etc.
2.	Assessment forms	Such include: oral and written exams, pass/fail exams, practice report presentation, and course paper (projects) presentation etc..

<b>IV – Program Competencies</b>	
<b>Integral competence</b>	The ability to solve complex tasks and problems in the field of education and computer science, which implies conduction of researches, elaboration of innovations and is characterized by the indefiniteness of conditions and requirements.
<b>General competencies</b>	<b>GC1</b> The ability to analyze and synthesize based on basic logical arguments and proven facts. <b>GC2</b> The acquisition of flexible means of thinking that allows to understand and solve problems and tasks, preserving critical attitude toward defined scientific concepts. The openness to the implementation of

	<p>knowledge and competencies in a wide range of possible work positions and everyday life.</p> <p><b>GC3</b> The ability to work in a team. The ability to perform lab researches in a group under a leader's supervision, as well as competencies that demonstrate the ability to take into consideration strict requirements of a discipline, planning, and time management.</p> <p><b>GC4</b> The ability to communicate efficiently and present complex compound information in a concise manner both oral and written using information and communication technologies and relevant technical terminology.</p> <p><b>GC5</b> 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 concepts of computer science for a non-professional audience (non-specialists). The ability to communicate with non-specialists using teaching skills.</p> <p><b>GC6</b> Correspondence to ethical principles regarding both professional integrity and understanding of possible impact of computer science and technologies on society.</p>
<b>Professional competencies of specialty</b>	<p><b>PC1</b> The ability to use computer technologies and computer science laws in 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 fundamental 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.</p> <p><b>PC2</b> 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.</p> <p><b>PC3</b> The ability to build relevant information phenomena simulations, research them in order to retrieve new conclusions and deepen the understanding of such phenomena.</p> <p><b>PC4</b> The ability to understand and efficiently use mathematical and numerical 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</p>

	<p>experimental data and the retrieved results in the field of computer science and information technologies.</p> <p><b>PC5</b> 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.</p> <p><b>PC6</b> 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 understand ways of practical use of communication skills and use communication concepts effectively. The understanding of factors, which influence communication both positively and negatively, and the ability to identify or take in account such factors in certain communication situations.</p> <p><b>PC7</b> 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 ways 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.</p> <p><b>PC8</b> 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 the acquired mathematical, fundamental and professional knowledge through self-education. The ability to conduct references search, which are related to a specialty; the ability to evaluate them critically based on professional</p>
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	<p>knowledge. The ability to self-educate.</p> <p><b>PC9</b> 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.</p> <p><b>PC10</b> 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.</p>
<b>Program outcomes of studying</b>	
	<p><b>Knowledge and competence in subject area:</b></p> <p><b>POS1</b> Resourceful awareness of various pedagogical 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;</p> <p><b>POS2</b> Ability to apply and project, and implement existing systems and approaches of remote teaching, as well as new ones; to be able to manage the process of digital teaching and maintain it;</p> <p><b>POS3</b> Sufficient knowledge in the field of educational calculations in order to apply monitoring and statistics technologies and successfully conduct scientific research under supervision of a mentor to comply with the requester's interests;</p> <p><b>POS4</b> Ability to understand and analyze scientific publications according to the chosen specialty, to track the newest specialty's achievements;</p> <p><b>POS5</b> Ability to conduct a search of scientific references, which belong to the field of professional occupation;</p> <p><b>POS6</b> Awareness of various communication theories;</p> <p><b>POS7</b> Knowledge and understanding, which regard to philosophical aspects of computer science as a discipline, in particular – to computer science philosophy and fundamental problems of computer science;</p>

	<p><b>POS8</b> Fundamental knowledge and understanding, which regard actual courses of scientific research in computer science, such as: applied mathematics and computer science, theory of systems and system analysis, methodology of scientific research. The scope of such knowledge is to be sufficient to successfully partake in one of scientific groups;</p> <p><b>POS9</b> Resourceful mathematical expertise in the field of discrete mathematics, computational mathematics, algorithms, complexity theory, and probability theory;</p> <p><b>POS10</b> Resourceful knowledge of languages and paradigms of programming, technologies of programming, and operational systems;</p> <p><b>POS11</b> Resourceful knowledge and skills to apply instrumental means of software elaboration;</p> <p><b>POS12</b> Resourceful knowledge in the field of system research, system simulation, system analysis of computerization objects ;</p> <p><b>POS13</b> Expertise on modern theories of data-base and knowledge organization, as well as methods and technologies of their elaboration;</p> <p><b>POS14</b> Knowledge of basics of computer and computer networks architecture and the ability to apply them to the process of feasibility study assessment of information technologies ;</p> <p><b>POS15</b> Resourceful knowledge of distributed systems technologies;</p> <p><b>POS16</b> Resourceful knowledge of web technologies;</p> <p><b>POS17</b> Knowledge and skills to organize cloud computing.</p> <p><b>Cognitive skills and competencies in subject area:</b></p> <p><b>POS18</b> Resourceful training in theoretical, methodological, and algorithmic basics of information technology for the purpose of using mathematics whilst resolving applied and scientific tasks in the field of information systems and technologies;</p> <p><b>POS19</b> Resourceful training in the field of programming, algorithmic thinking, and methods of program engineering for the implementation of software;</p> <p><b>POS20</b> Knowledge of standards, methods, and ways of managing processes of a life cycle of information systems, products, and services of information technologies; expertise on the technology of software elaboration according to a requester's requirements;</p> <p><b>POS21</b> Resourceful knowledge in the field of system research and the ability to apply them whilst managing IT</p>
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projects, system simulation, objects of computerization system analysis conduction, decision-making, methods, and systems of AI elaboration;

**POS22** Ability to apply principles of organization and functioning of hardware of modern information processing systems of various use;

**POS23** Ability to project in the professional field, competence to build and use simulations for describing objects and processes as well as perform their quality analysis;

**POS24** Knowledge of intellectual property objects rights and management protection peculiarities;

**POS25** Modern perception of evaluation principles of a company's prospectus aims and tasks, which functions in the field of computer science and information technologies, as well as the organization of its departments operation;

**POS26** Modern perception of principles of structural and functional organization of a company's management, which operates in the field of computer science and information technologies;

**POS27** Modern perception of technological approaches of making and implementing innovative management decisions;

**POS28** 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;

**POS29** Ability to conduct commercialization of intellectual elaborations results and securing their ownership;

**POS30** 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.

**Practical skills in subject area:**

**POS31** 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;

**POS32** Knowledge of discrete structures and the ability to apply modern methods of discrete mathematics whilst analyzing, synthesizing, and projecting information systems of different kinds;

**POS33** Knowledge of principles of accidental occurrences and the ability to apply probable and statistical methods of solving professional problems;

**POS34** Knowledge of modern methods of building and analyzing effective algorithms and the ability to apply them in specific occasions;

**POS35** Knowledge of theoretical peculiarities of numeral methods, ways of their adaptation to engineering tasks and the ability to apply numeral methods whilst solving various applied tasks;

**POS36** Knowledge of principles of structural programming, modern procedure-oriented languages, basic data structures, and the ability to apply them whilst program implementation of professional tasks algorithms;

**POS37** 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;

**POS38** Knowledge of modern technologies and instrumental means of program systems elaboration and the ability to apply them at all levels of a life cycle;

**POS39** Knowledge of general principles of organization and functioning of operational systems and the ability to elaborate elements of system software;

**POS40** 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;

**POS41** 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;

**POS42** Knowledge of server technologies for creating web-applications and the ability to apply methods and instrumental means for their projecting;

**POS43** Knowledge of principles, methods, and algorithms of CG and the ability to apply them whilst elaborating graphic interfaces of human-computer interaction;

**POS44** Knowledge of the ‘data warehouse’ concept and their operational and analytical processing, as well as their intellectual analysis;

**POS45** Knowledge of principles of team work; the ability to work in a team and apply program systems of project management.

**General skills and competencies:**

**POS46** Ability to form an adamant worldview, pluralism, political consciousness and culture; adequate perception of modern problems of society development, human existence, and spiritual culture;

	<p><b>POS47</b> 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;</p> <p><b>POS48</b> Ability to effective communicative interaction, healthy lifestyle, new knowledge acquisition, and self-improvement;</p> <p><b>POS49</b> Ability to conduct research of innovative processes of projecting and maintaining program complexes, data-bases, web applications, 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 ;</p> <p><b>POS50</b> Ability to identify new opportunities for projecting 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;</p> <p><b>POS51</b> Understand natural and scientific basics of EP and healthy lifestyle;</p> <p><b>POS 52</b> Understand peculiarities of organization and maintenance of learning process at higher school.</p>
<b>Resource provision</b>	
<b>Personnel support</b>	94,2% of scientists and pedagogues, who deal with teaching disciplines of the specialty 014 Secondary Education specialized in 04 Mathematics and possess scientific degrees and academic title, 80% of them have experience in research and practical work in their specialty
<b>Inventory and logistics management</b>	Study and inventory facilities consists of 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.
<b>Informational, learning, and teaching materials</b>	The use of a digital resources server based on LMS Moodle and library resources of Ternopil Volodymyr 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.
<b>Academic mobility</b>	
<b>National credit mobility</b>	Based on two-way agreements between Ternopil Volodymyr Hantiuk National Pedagogical University and

	other higher educational institutions of Ukraine.
<b>International credit mobility</b>	Based on two-way agreements between Ternopil Volodymyr Hantuk National Pedagogical University and other higher educational institutions of foreign partner countries.
<b>Study of foreign applicants of higher education</b>	Possible after having passed certain Ukrainian language courses.

#### IV. FORMS OF CERTIFICATION FOR HIGHER EDUCATION APPLICANTS AND REGULATORY CONCEPT OF HIGHER EDUCATION APPLICANTS' TRAINING, WHICH IS LAID DOWN IN TERMS OF STUDY OUTCOMES

<b>Forms of certification for higher education applicant</b>	Certification is conducted by means of a qualification exam.
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#### VIII. LIST OF EDUCATIONAL AND PROFESSIONAL PROGRAM COMPONENTS AND THEIR GRADUAL SEQUENCE

##### 8.2.1. List of educational and professional program components

Code of discipline	Components of educational program (Disciplines, course papers, internships, qualification work/thesis)	Number of credits	Assessment
<b>OBJECTIVE COMPONENTS OF EDUCATIONAL PROGRAM</b>			
<b>Disciplinary cycle of overall training</b>			
OC1.01	History of Ukrainian statesmanship and national culture	5	Exam
OC1.02	Humans and environment	3	Pass/fail exam
OC1.03	Foreign language	7	Exam
OC1.04	Ukrainian (for professional purposes)	3	Exam
OC1.05	Philosophy	3	Exam
OC1.06	Health and safety, civic defense, and labor safety	4	Pass/fail exam
OC1.07	Physical education (Non-credit discipline)		Pass/fail exam
<b>Disciplinary cycle of professional training</b>			
OC1.01	General physics	13	Exam
OC1.02	Mathematic analysis	24	Exam
OC1.03	Psychology	6	Exam
OC1.04	Pedagogy	10	Exam
OC1.05	Methodology of teaching mathematics	10	Exam
OC1.06	Differential geometry and topology	4	Exam
OC1.07	Analytical geometry	8	Exam
OC1.08	Principles of geometry	3	Exam
OC1.09	Measure and integral	5	Exam

<b>Code of discipline</b>	<b>Components of educational program (Disciplines, course papers, internships, qualification work/thesis)</b>	<b>Number of credits</b>	<b>Assessment</b>
OC1.10	Projecting geometry and methods of depiction	4	Exam
OC1.11	Programming	6	Exam
OC1.12	Software of computer systems	3	Credit
OC1.13	Education technologies	3	Credit
OC1.14	Probability theory and mathematic statistics	4	Exam
OC1.15	Elementary mathematics	16	Credit
OC1.16	Lineal algebra	12	Exam
OC1.17	Discrete mathematics	3	Credit
OC1.18	Logics of mathematics	3	Credit
OC1.19	Complex analysis	4.5	Exam
OC1.20	Methodology of teaching computer science	3	Credit
OC1.21	Algebra and numeral theory	8	Exam
<b>SELECTIVE COMPONENTS OF THE EDUCATIONAL PROGRAM</b>			
<b>Disciplines to higher institution's selection</b>			
SC2.1.01	Economics	3	Credit
SC2.1.02	Sociology	3	Credit
SC2.1.01	Principles of law	3	Credit
SC2.1.02	Political studies	3	Credit
SC2.1.03	Data-bases of information systems	3	Credit
SC2.1.04	Differential equations	4	Exam
SC2.1.05	Computer networks	2	Credit
SC2.1.06	Principles of machine organization of computer systems	2	Credit
SC2.1.07	Web programming	2.5	Credit
SC2.1.08	Operational systems	3	Credit
SC2.1.09	System programming	2	Credit
SC2.1.10	Numeral methods	3	Exam
SC2.1.11	Academic competition tasks	4	Credit
SC2.1.12	Functional analysis	3.5	Exam
SC2.1.13	Analysis of algorithms	2	Credit
SC2.1.14	Methodology of didactics at recuperation institutions	2	Credit
<b>Practical training</b>			
OC2.3.01	Computer practice	3.5	Credit
OC2.3.02	Course paper	2	Credit
OC2.3.03	Professional (pedagogical) practice at summer recuperation institutions	4,5	Credit
OC2.3.04	Pedagogical practice	8	Credit
<b>Total</b>		88,5	
<b>General</b>		240	