

МІНІСТЕРСТВО 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 (MATHEMATICS)
in the field of knowledge 01 EDUCATION / PEDAGOGY
Qualification: Master of Education, Lecturer in Mathematics

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

II. General characteristics

Profile of the program	
Education Degree	Master
Field of Study	01 Education / Pedagogy
Specialty	014 Secondary Education (according to subject specialties)
Subject Specialty	014.04 Secondary Education (Mathematics)
Second specialty (subject specialization)	014.08 Secondary Education (Physics)
Specialization	-
Qualification	Master of Secondary Education (Mathematics), lecturer математикиin mathematics, teacher of mathematics, physics
Type of diploma and the scope of the educational program	unitary, 90 ECTS credits
Higher Educational Institution	Ternopil Volodymyr Hnatiuk National Pedagogical University
Accreditation Organization	Accreditation Committee of Ukraine
Certification Frames	Certificate on specialty's accreditation: series НД-IV № 2073782, from 27.01.2015., protocol № 114, validity: till 01.07.2025 .
Level of the Program	FQ-EHEA – second cycle, EQF LLL – level 7, NRC (NQF - national qualifications framework) of Ukraine – level 7

A	Purpose of educational program	Ensure HEA the acquisition of knowledge, skills and understanding related to the fields of physics, astronomy and mathematics, which will enable them to gain access to employment and further education. Be prepared for the successful assimilation of more complex programs for researchers and developers.
B	Program's Characteristics	
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.	Orientation of the Program	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.
C	Employment and Further Education	
1.	Employment	A specialist is able to perform the indicated professional activities (according to SC 003:2010):2310.2 2310.2 Assistant 2310.2 Lecturer of higher educational institution 2320 Teacher of secondary educational institution 2320 Teacher of vocational education and training institution 2320 Teacher of a professional educational institution 2320 Methodologist of distance schools and departments
2.	Further Education (Academic rights)	FQ-EHEA – third cycle, EQF LLL – level 8, NRC (NQF - national qualifications framework) of Ukraine – level 8

D	Teaching Style and Methodology	
1.	Approaches to studying and teaching	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	Oral and written exams, pass/fail exams, practice report presentation, and course paper (projects) presentations, master's thesis defense etc.

IV – Program Competencies	
Integral competence	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.
General competencies	GC1 Analysis and synthesis The ability to analyze and synthesize based on basic logical arguments and proven facts. 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 openness to the implementation of knowledge and competencies in a wide range of possible work positions and everyday life. GC3 Group work 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. GC4 Communication skills 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. 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 concepts of computer science for a non-professional audience (non-specialists). The ability to communicate with non-specialists using teaching skills. GC6 Ethics Correspondence to ethical principles

	regrading both professional integrity and understanding of possible impact of computer science and technologies on society.
Professional competencies of specialty	PC1 Deep knowledge and understanding 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. 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 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. PC4 Mathematical competencies The ability to understand and efficiently use mathematical and numeral 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. PC5 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, databases, 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. PC6 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 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. PC7 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 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. PC8 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 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 knowledge. The ability to self-educate. PC9 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. PC10 Teaching skills The ability to use effectively basic
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	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.
V – Program outcomes of studying	
	POS1 Knowledge and competence in subject area: – 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; – 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; – 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; – 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 philosophical aspects of computer science as a discipline, in particular – to computer science philosophy and fundamental problems of computer science; – 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; – Resourceful mathematical expertise in the field of discrete mathematics, computational mathematics, algorithms, complexity theory, and probability theory; – Resourceful knowledge of languages and paradigms of programming, technologies of programming, and operational systems;

	– Resourceful knowledge and skills to apply instrumental means of software elaboration; – Resourceful knowledge in the field of system research, system simulation, system analysis of computerization objects; – Expertise on modern theories of data-base and knowledge organization, as well as methods and technologies of their elaboration; – 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; – Resourceful knowledge of distributed systems technologies; – Resourceful knowledge of web technologies; – Knowledge and skills to organize cloud computing. POS2 Cognitive skills and competencies in subject area: – 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; – resourceful training in the field of programming, algorithmic thinking, and methods of program engineering for the implementation of software; – 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; – resourceful knowledge in the field of system research and the ability to apply them whilst managing IT projects, system simulation, objects of computerization system analysis conduction, decision-making, methods, and systems of AI elaboration; – ability to apply principles of organization and functioning of hardware of modern information processing systems of various use; – 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; – knowledge of intellectual property objects rights and management protection peculiarities; – modern perception of evaluation principles of a
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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;

- 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;
- 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;
- Ability 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;
- Knowledge of discrete structures and the ability to 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;
- Knowledge of modern methods of building and analyzing effective algorithms and the ability to apply them in specific occasions;
- 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;
- 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;
- 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 apply them at all levels of a life cycle; – Knowledge 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; – Knowledge of principles, methods, and algorithms of 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; – Knowledge of principles of team work; the ability to 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; – Ability to effective communicative interaction, 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; – Ability to identify new opportunities for projecting
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	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.
Resource provision	
Human resources provision	100% 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, 70 % of them have experience in research and practical work in their specialty.
Inventory and logistics management	Study and inventory facilities of the faculty consist 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.
Informational, learning, and teaching materials	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.
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 mobility	Based on two-way agreements between Ternopil Volodymyr Hantiuk National Pedagogical University and other higher educational institutions of foreign partner countries.
Study of foreign applicants of higher education	Possible after having passed certain Ukrainian language courses.

2. LIST OF EDUCATIONAL AND PROFESSIONAL PROGRAM COMPONENTS AND THEIR GRADUAL SEQUENCE

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	Final assessment form
1. Obligatory components of EPP			
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
OC1.05	Computer information technologies in education and science (training)	3	Credit
Disciplinary cycle of professional training			
OC1.01	Psychology and pedagogy of higher education	3	Exam
OC1.02	Methods of mathematical proofs	3.5	Exam
OC1.03	Theory of chain fractions and their application	3	Exam
OC1.04	Solving differential equations with approximate methods	3.5	Exam
OC1.05	Computer Mathematics	3	Credit
OC1.06	Mathematical methods of operations research	3	Credit
2. Selective components of EPP			
2.1. Disciplines to higher institution selection			
SC2.1.01	Elementary physics	4	Credit
SC2.1.02	Methodology of teaching physics	8	Credit, экзамен
SC2.1.03	History of mathematics	3	Credit
SC2.1.04	Contemporary concepts of the foundations of geometry	3	Credit
SC2.1.05	Elective course (Olympiad Problems in Mathematics)	3	Credit
SC2.1.06	Computer simulation in mathematics	3	Credit
SC2.1.07	Theoretical physics	3	Credit
SC2.1.08	Selected functional analysis questions	3	Credit
SC2.1.09	Selected questions of linear algebra	3	Credit
2.2. Practical training			
PT2.3.01	Course work on the methodology of teaching physics	1	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	6	
Total amount of selective components:		33	
General amount of educational and professional program		90	

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

Forms of certification for higher education applicant	Certification is conducted by means of public defense of the master's thesis.
Requirements for qualification work (if available)	Master's qualification thesis is a qualifying scientific, scientific and methodical or scientific and technical work. It is carried out by the HEA solely under the supervision of the scientific supervisor on the basis of theoretical knowledge and practical skills obtained by HEA during the entire period of study, and independent research work, which is associated with the development of specific theoretical and scientific-production tasks of an applied nature, due to the specifics of the corresponding specialty. The qualification work should be the result of a complete scientific research, have internal unity and show that the author possesses modern methods of scientific research and is able to solve scientific problems of a theoretical and practical significance independently. The work must have an internal unity and reflect the development results of the chosen theme. The material should include discussion questions related to viewing persistent views and representations, original views of the author to solve the problem. It is necessary to use general scientific and special methods of scientific knowledge, the legality of which is fully justified in each case of their use. It is necessary to give weighty and convincing evidence in favor of the chosen concept, to thoroughly analyze and reasonably criticize the points of view opposite to it. Scientific information in the work should be presented in the most complete form, necessarily revealing the course and results of the study with a detailed description of the research methodology. The completeness of scientific information should be reflected in the detailed factual material with substantiation, hypotheses, theoretical generalizations. Materials of the work should contain specific well-formulated recommendations aimed at improving the research object. The presentation of the material is subject to one leading idea, clearly defined by the author.
Requirements for public defence (presentation) (if available)	The defense of the master's thesis takes place in the form of a report of the HEA in the presence of the members of the examination board. The report should be accompanied by a demonstration of the

graphic part in the form of a presentation with a handout or posters.

The defense of qualifying work takes place in open sessions of the examination board. The agenda of the examination board meeting and the schedule of protection is approved by the order of the university and is notified in advance to the students. The agreement on the admission to defence must be proved by the signature of the scientific supervisor, and then signed by the head of the department. In the period stipulated by the normative documents, the HEA must hand over the following materials to the responsible secretary of the examination board: an explanatory note; references of the director and reviewers in envelopes; a description of himself and his credit book; CD with electronic documents.

The duration of defence is usually set to 30 minutes. The duration of the report is 8-10 minutes. In the course of the report, HEA should use a developed presentation, which contains visual materials for a clear demonstration of the main provisions of their work.

The report ends with the formulation of conclusions, where the master student should clearly identify the main results of the work, make comparisons with known counterparts and tell about the prospects for further developments in this direction and the practical application of the results.

After the report, a HEA answers the questions of the members of the examination board, which are aimed at determining the level of his/her professional training and erudition in general. Questions are asked orally and included into the protocol of the meeting. All questions must be answered argumentatively by the student.

After answering the question, the review of the scientific supervisor and a review of the qualification work are read. Then HEA answers the comments of the reviewer. With the permission of the head of the examination board other members of the meeting may join the discussion.

After the public defense of the work at the closed meeting of the examination board, the results of the defense are discussed and decisions are made on the assessment of the work. In assessing the report of the HEA, first of all, attention is drawn to the fact that the speaker freely and confidently knows the material of the work, modern terminology, whether he/she can report without the help of the text of the report. It is important that the speaker be able to explain the materials of tables, charts, drawings, schemes confidently and easily.