MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY

APPROVED
by Rector of
Lviv Polytechnic
National University
_____ Yurii Bobalo
«___» _____ 2021

EDUCATIONALAND RESEARCH PROGRAM
third (educational and research) level of higher education
in specialty 111 "Mathematics"
field of knowledge 11 Mathematics and Statistics
Qualification: Doctor of Philosophy in specialty "Mathematics"

Considered and approved
by Academic Board
of Lviv Polytechnic
National University
(protocol No.
dated « __ » _____ 2021)

Lviv 2021

Developed by the working team in specialty “Mathematics” consisting of:

Head of the working team (guarantor):	
Nytrebych Z. M.	Dr. Phys.-Math. Sc., Prof., Head of the Higher Mathematics Department
Members of the working team:	
Ilkiv V.S.	Dr. Phys.-Math. Sc., Prof.
Mohonko A.Z.	Dr. Phys.-Math. Sc., Prof.
Andrusiak I.V.	Cand. Phys.-Math. Sc., Assoc.
Pelikh V.O.	Dr. Phys.-Math. Sc., deputy head of IPPMM Ya.S. Pidstryhacha of the National Academy of Sciences of Ukraine
Kinakh V.S.	head of the collegium and professional bureau of students of IMFN

Guarantor _____ Dr. Phys.-Math. Sc., Prof., Nytrebych Z. M.

Approved and brought into force by Order of the Rector of Lviv Polytechnic National University dated “___” _____ 2021 No.___

LETTER OF AGREEMENT
the educational and scientific program

Level of higher education	the third (educational and scientific)
Branch of knowledge	*11 Mathematics and Statistics*
Speciality	*111 Mathematics*
Qualification	doctor of philosophy

APPROVED
Scientific and methodical commission of speciality 111 **Mathematics**
Protocol № __
"__" _____ 2021

AGREED
Head of the educational and methodical department
_____Sviridov V.M.
"__" _____ 2021

Head of the SMC of the speciality 111 Mathematics
_____ Ilkiv V.S.
"__" _____ 2021

Vice-rector for scientific work
_____ Demidov I.V.
"__" _____ 2021

Acting Director
of the Institute of Applied Mathematics and Fundamental Sciences
_____ Hoshko L.V.
"__" _____ 2021

Vice-rector for scientific and pedagogical work
_____ Davydchak O.R.

RECOMMENDED
Scientific and methodological council of the University
Protocol No._____
"__" _____ 2021

I. EDUCATIONAL PART OF THE EDUCATIONAL AND RESEARCH PROGRAM

1. Profile of the Doctor of Philosophy program in the field of knowledge 111 Mathematics and Statistics in specialty 111 "Mathematics"

1 – General information	
1	**2**
Full name of higher education institution and structural unit	**Lviv Polytechnic National University**
Full name of qualification in original language	**Доктор філософії в галузі** «Математика і статистика» Doctor of Philosophy in Mathematics and Statistics
Official name of educational program	Математика Mathematics
Type of diploma and scope of educational program	Diploma of Doctor of Philosophy, single, 43 ECTS credits, term of the educational part of the Educational and Research Program 2 years
Availability of accreditation	Accredited by the Ministry of Education and Science of Ukraine
Cycle/level	NQF of Ukraine – 8th level, FQ-EHEA – 3rd cycle, EQF-LLL – 8th level
Prerequisites	Masters level of higher education
Language(s) of teaching	Ukrainian language
Basic concepts and their definitions	The Educational and Research Program uses the main concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" (dated 01.07.2014 No. 1556-VII) with amendments and additions, the Law of Ukraine "On Research and Technical Activity" (dated 26.11.2015 No. 848-VIII) with amendments and additions, the Procedure for training seekers of a higher education degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (research institutions), approved by the Resolution of the Cabinet of Ministers of Ukraine (dated 23.03.2016 No. 261)
2 – Aim of educational program	
	To provide in-depth theoretical knowledge and practical skills and abilities in the field of *Mathematics and Statistics* in the specialty of *Mathematics*, to develop philosophical and linguistic competences, carrying out research activities, further professional and scientific activities, preparing and defending a dissertation.

3 – Educational program characteristics	
Subject area (field of knowledge, specialty)	Field of knowledge – 11 Mathematics and Statistics, specialty – 111 " Mathematics".
Educational program orientation	The educational and scientific program is aimed at relevant aspects of mathematics, within a further scientific and/or teaching career is possible.
Features and differences	The educational and scientific program covers a wide range of mathematical problems, which forms an updated theoretical base for conducting scientific research.
4 – Suitability of educational program graduates for employment and further education	
Suitability for employment	Jobs in public and private higher education institutions, scientific and research institutions as teachers and researchers, in enterprises and organizations of various types of activities and forms of ownership in managerial positions.
Further education	Completion of the scientific program of the fourth (scientific) level of higher education to obtain the degree of Doctor of Science.
5 – Teaching and evaluation	
Teaching and learning	Lectures, practical classes, elaboration of publications in leading mathematical publications, consultations with teachers, writing abstracts, preparation for publication of scientific articles and abstracts of reports, speeches at scientific seminars and conferences, preparation of a dissertation.
Evaluation	Written and oral exams, assessments, oral and computer presentations.
6 – Program competencies	
Integral competence (INT)	The ability to solve complex problems of mathematical; to carry out research and innovation activity, which involves a profound rethinking of existing and creation of new integral knowledge, conducting scientific research at the international and national level.
General competences (GC)	1) Knowledge of modern research methods in the field of mathematical, and in related fields of science;
	2) critical analysis, evaluation and synthesis of new ideas;
	3) the ability to effectively communicate with the broad scientific community and the public in matters of applied mathematics, read and understand foreign scientific articles freely;
	4) ability to self-develop and self-improve, demonstrate oratorical skills when presenting the results of scientific research;
	5) social responsibility for the results of strategic decision-making;
	6) initiation of original research and innovation complex projects;
	7) leadership and ability to work autonomously and in a team during project implementation.
Special (professional) competences (SC)	1) Knowledge of development trends and the most important new developments in the field of mathematical, as well as related areas;
	2) knowledge and understanding of modern scientific theories and methods, the ability to effectively apply them for the synthesis and analysis of tasks of scientific research;
	3) ability to effectively apply mathematical methods, including mathematical and computer modeling;
	4) ability to integrate knowledge from other disciplines, apply a systematic approach and take into account aspects of further

	practical implementation of the obtained results when solving applied problems;
	5) ability to develop and implement projects, which make it possible to rethink existing or create new knowledge, and also monitor the trends of their practical implementation;
	6) ability to argue the choice of the method of solving the given problem, to critically evaluate the obtained results.
7 – Program learning outcomes	
Knowledge (KN)	1) Knowledge of modern research methods of mathematical research;
	2) knowledge and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, own scientific worldview and moral and cultural values;
	3) knowledge of the English language, necessary for oral and written presentation of the results of scientific research, conducting professional scientific dialogue, full understanding of English-language scientific texts.
Skills (SK)	1) To search, analyze and critically evaluate information from various sources;
	2) apply knowledge and understanding to solve problems of synthesis and analysis of elements and systems characteristic for the chosen specialization;
	3) to investigate phenomena and processes in complex natural, technical and economic systems, using the methods of mathematical and computer modeling;
	4) apply a systematic approach when solving theoretical and applied problems, integrating knowledge from other disciplines;
	5) develop a strategy for solving scientific and applied problems, taking into account the perspective of their practical implementation;
	6) to work effectively both individually and as part of a team;
	7) conduct a scientific conversation and discussion in Ukrainian and English at an appropriate professional level, present the results of scientific research in oral and written form, organize and conduct training sessions.
Communication (COM)	1) Ability to communicate effectively at the professional and social levels;
	2) ability to present and discuss the obtained results and transfer the acquired knowledge.
Autonomy and responsibility (AaR)	1) Ability to adapt to new conditions, make decisions independently and initiate original research and innovation complex projects;
	2) ability to formulate one's own author's conclusions, proposals and recommendations;
	3) ability to take responsibility for the work performed and achieve the set goal in compliance with the requirements of professional ethics.
8 – Resource support for program implementation	
Specific characteristics of staffing	100% of scientific and pedagogical workers involved in teaching professionally oriented disciplines have scientific degrees in their specialty
Specific characteristics of material and technical support	Usage of modern computer equipment and appropriate software, in particular, "Mathematics", "Statistics", "Maple", "Latex" packages

Specific characteristics of informational and methodological support	Usage of Virtual Learning Environment of Lviv Polytechnic National University and teaching staff author's developments
9 – Academic mobility	
National credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University and technical universities of Ukraine
International credit mobility	Within the EU Erasmus+ program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries
Teaching of foreign seekers of higher education	Possible

2. Distribution of the content of Educational and Research Program educational part by component groups and training cycles

No	Training cycle	Amount of postgraduate teaching load (credits / %)		
		Mandatory components of educational part	**Selective components of the educational part**	**Total for the entire period of study**
1.	**The cycle of disciplines that form general scientific competences and universal skills of a researcher**	21/49	3/7	30 / 52,64
2.	**The cycle of disciplines that form the professional competencies of a researcher**	10/23	6/14	18 / 42,10
3.	**The cycle of subjects of free choice for a postgraduate student**	–	3/7	3/7
Total for the entire period of study		31/72	12/28	43/100

3. List of components of Educational and Research Program educational part

E/d code	Components of educational part	Number of credits	Form of control
1. Mandatory components of educational part			
1.1. The cycle of disciplines that form general scientific competences and universal skills of a researcher			
OK1.1	Philosophy and methodology of science	3	exam
OK1.2	A foreign language for academic purposes, part 1	4	test

OK1.3	A foreign language for academic purposes, part 2	4	exam
OK1.4	Professional pedagogy	3	test
OK1.5	Academic entrepreneurship	4	test
OK1.6	Pedagogical practice	3	test
Total per cycle:		**21**	
1.2. The cycle of disciplines that form the professional competencies of a researcher			
OK2.1	Methods of solving boundary value problems for differential equations with partial derivatives	**6**	exam
OK2.2	Selected sections of the theory of analytic functions and convex analysis	**4**	exam
Total per cycle:		**10**	
Total mandatory components:		**31**	
2. Selective components of the educational part**			
2.1. The cycle of disciplines that form general scientific competences and universal skills of a researcher			
VB1.1	Business Foreign Language	3	test
VB1.2	Psychology of creativity and invention	3	test
VB1.3	Management of scientific projects	3	test
VB1.4	Technology of registration of grant applications and patent rights	3	test
VB1.5	Rhetoric	3	test
VB1.6	Modern inventions in research activity	3	test
VB1.7	Open scientific practices	3	test
VB1.8	Academic integrity and quality of education	3	test
VB1.9	Methodology of preparation of scientific publications	3	test
VB1.10	Quality of higher education (formation of internal quality assurance systems)	3	test
Total per cycle:		**3**	**test**
2.2. The cycle of disciplines that form the professional competencies of a researcher			
VK2.1	Theory of distributions and their application	**3**	exam
VK2.2	Theory of whole and meromorphic functions	**3**	exam
VK2.3	Elements of general topology	**3**	exam
Total per cycle:		**6(3+3)**	
3. The cycle of subjects of free choice for a postgraduate student**			
VK3.1	Discipline of the graduate student's free choice	**3**	test
Total per cycle:		**3**	
Total selective components		**12**	
Total for Educational and Research Program:		**43**	

Note: * – pedagogical practicum can take place in the II or III year of study;

** – a graduate student can choose disciplines from point 2, point 3 (selective and free choice), while the share of these subjects must be at least 25% of the total number of ECTS credits

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4. MATRIX OF SUITABILITY OF SOFTWARE COMPETENCES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	ОК1.1	ОК1.2	ОК1.3	ОК1.4	ОК1.5	ОК1.6	ОК2.1	ОК2.2	VB1.1	VB1.2	VB1.3	VB1.4	VB1.5	VB1.6	VB1.7	VB1.8	VB1.9	VB1.1	VK2.1	VK2.2	VK2.3
INT	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GC1					●		●	●	●	●	●										
GC2																					
GC3	●		●							●			●				●		●	●	●
GC4	●		●	●							●			●							
GC5		●										●									
GC6						●	●	●	●												
GC7				●		●											●		●	●	●
SC1							●	●							●						
SC2									●	●	●			●		●		●			
SC3					●														●	●	●
SC4		●					●	●	●												
SC5						●															
SC6					●						●					●					

● – acquired competence;
OKi.j – mandatory components of the training program of the specialty; **VKi.j** – disciplines of the selective block;
INT – Integral competence. **GCi** – competency number in the list of general competencies of the program profile; **SCi** – competency number in the list of special competencies of the program profile.

5. MATRIX OF PROVIDING SOFTWARE LEARNING OUTCOMES BY RELEVANT COMPONENTS EDUCATIONAL PROGRAMS

	ОК1.1	ОК1.2	ОК1.3	ОК1.4	ОК1.5	ОК1.6	ОК2.1	ОК2.2	VB 1.1	VB 1.2	VB 1.3	VB 1.4	VB 1.5	VB 1.6	VB 1.7	VB 1.8	VB 1.9	VB1.1	VK2.1	VK2.2	VK2.3
KN 1					●		●	●	●					●		●			●	●	●
KN 2		●							●												
KN 3	●		●			●	●	●				●			●		●	●	●	●	●
SK 1					●																
SK 2		●									●					●					
SK 3					●																
SK 4		●				●															
SK 5		●				●	●	●						●			●				
SK 6						●					●										
SK 7					●		●	●				●									
COM1	●		●	●		●					●		●	●	●	●		●			
COM2	●		●			●				●	●		●	●			●		●	●	●
AaR 1						●			●		●										
AaR 2	●		●	●							●										
AaR 3				●		●					●					●					

● – the program output that is provided;

ОКi.j – mandatory components of the training program of the specialty; **VKi.j** – disciplines of the selective block;

KN i – knowledge; **SK i** – skills; **COM** – communication; **AaR –** autonomy and responsibility.

II. SCIENTIFIC PART OF THE EDUCATIONALAND RESEARCH PROGRAM

The scientific part of the Educational and Research Program allows the post-graduate student to conduct his own scientific research under the supervision of a scientific supervisor and write the results obtained in the research process in the form of a dissertation.

The dissertation work for obtaining the degree of Doctor of Philosophy is an independent detailed study of an actual scientific problem in specialty 111 "Mathematics", the results of which are characterized by scientific novelty and are published in relevant publications

The scientific part of the Educational and Research Program is drawn up as an individual plan of scientific work and is an integral part of the curriculum

An obligatory element of the scientific part of the Educational and Research Program is the preparation and publication of scientific articles, speeches at scientific conferences, specialized seminars, schools, and symposia.

Subjects of scientific research by specialty 111 "Mathematics":

1. Correctness of boundary value problems for typeless equations with partial derivatives in a limited domain.
2. Unique solvability of conditionally correct boundary value problems for equations with partial derivatives in unbounded domains.
3. The method of estimating small denominators in conditionally correct boundary value problems of mathematical physics.
4. Differential-symbolic method of solving point-to-point problems for equations with partial derivatives of second order in time and infinite order in spatial variables.
5. Correct solvability of problems with local pointwise conditions for systems of equations with partial derivatives.
Solutions of differential equations as analytic functions.
6. Topological properties of hyperspaces of convex compacts.
7. Classes of existence and uniqueness of the solution of the problem without initial conditions for nonlinear evolutionary equations and systems of the second order.
8. Nonlinear variational evolutionary inequalities with constant and variable parameters of nonlinearity in bounded and unbounded domains.
9. Classes of correctness of solving mixed problems in unbounded domains for nonlinear hyperbolic equations and systems.
10. Existence of locally integrable solutions of mixed problems in domains unbounded by spatial variables for nonlinear evolution equations of the type of beam oscillations.
11. On the non-existence of a global time-varying solution in nonlinear equations that model oscillatory processes.

III. ATTESTATION

Attestation of seekers of higher education degree of Doctor of Philosophy is carried out by a specialized academic board, permanently active or formed for a one-time defense based on a public presentation of scientific research in the form of a dissertation.

A mandatory condition for admission to the defense is the successful completion of the postgraduate student's study plan.

Seekers of higher education degrees of Doctor of Philosophy present their dissertations, as a rule, in a permanent specialized academic board on the relevant specialty, which functions in the higher educational institution in which the postgraduate student training took place. The academic board of a higher education institution has the right to submit to the National Agency for Quality Assurance of Higher Education documents for the accreditation of a specialized academic board formed for a one-time defense, or to apply to another higher education institution where a permanent specialized academic board operates on the relevant specialty.

The minimum volume of the main part of the dissertation is within 3.25 authors' pages for this Educational and Research Program.