MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL UNIVERSITY
"LVIV POLYTECHNIC"

EDUCATIONAL AND SCIENTIFIC PROGRAM

third (educational and scientific) level of higher education

in the specialty 192 Building and civil engineering

fields of knowledge 19 Architecture and construction

Qualification: Doctor of Philosophy in specialty *Building and Civil Engineering*

Lviv 2021

I. EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

1. Doctor of Philosophy program profile in specialty 192 Building and Civil Engineering

1 – General information	
Full name of the higher education institution and structural unit	**Lviv Polytechnic National University**
The full title of the qualification in the original language	**Doctor of Philosophy of field of knowledge «Architecture and Construction» in specialty Building and Civil Engineering»**
Official title of educational program	Building and Civil Engineering
Type of diploma and scope of the educational program	Diploma of Doctor of Philosophy, single, 43 ECTS credits, the term of the educational component of the educational and scientific program is 1.5 years
Cycle/level	NQF of Ukraine– 8 level, FQ-EHEA – 3d cycle, EQF-LLL – 8 level
Prerequisites	Level of higher education "Master"
Language(s) of teaching	Ukrainian
The main concepts and their definitions	The educational and scientific program uses basic concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" dated 07/01/2014 No. 1556-VII with amendments and additions, the Law of Ukraine " On Scientific And Scientific-Technological Activities " dated 11/26/2015 No. 848-VIII with amendments and additions, Procedure of preparation of applicants of the degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions), approved by Resolution of the Cabinet of Ministers dated 03.23.2016 No. 261
2 – The aim of the educational program	
	To deepen theoretical knowledge and practical abilities and skills in the field of conducting scientific research activities in the field of construction and civil engineering, sufficient for conducting and successfully completing scientific research and professional and scientific activities.
3 – Characteristic of the educational program	
Subject area (field of knowledge, specialty)	***Field of knowledge 19 «Architecture and Construction»*** ***Speciality 192«Building and Civil Engineering»***
Orientation of the educational program	The educational and scientific program is aimed at relevant aspects of the specialty, which deepens the professional scientific outlook and provides a basis for conducting scientific research, within which a further scientific and teaching career is possible.
Features and differences	The scientific component of the educational and scientific program is determined by the individual study plan of the postgraduate student. The educational and scientific program covers a wide range of innovative areas of development of the theory and practice of construction and environmental engineering, which forms a theoretical and practical basis for conducting scientific research.
Accreditation information	Certificate of accreditation of the educational program №. 1246 dated 01.03.2021. The validity period of the certificate is 01.07.2026.

4 – Suitability of postgraduates of the educational program to employment and further education	
Suitability for employment	Working places in research institutes of the National Academy of Sciences of Ukraine, institutions of higher education of the Ministry of Education and Science of Ukraine, scientific and research institutions and high-tech construction companies of various types of activity and forms of ownership. Postgraduates can work in primary positions in the professions defined by the National Classifier of Ukraine DK 003:2010 "Classifier of Professions": 2142 Professionals in the field of civil engineering 2310-University and higher education teachers.
Further education	Advanced training in scientific and research institutes of the National Academy of Sciences of Ukraine, leading universities and research centers of the construction profile and acquiring the 4th academic research degree of higher education "Doctor of Science".
5 – Teaching and Assessment	
Teaching and learning	Combination of lectures and practical classes, a pedagogical workshop, consulting with a scientific supervisor, a scientific-pedagogical community with independent scientific-educational work.
Assessment	Exams, tests, oral presentations, current control.
6 – Program competencies	
Integral competence (INT)	The ability to produce innovative scientific ideas, to solve complex problems in the process of innovative research and professional activity, to use the methodology of scientific and pedagogical activity, to conduct original scientific research in the field of building and civil engineering, the results of which have scientific novelty, theoretical and practical significance.
General competences (GC)	1. In-depth knowledge of conceptual-methodological and methodical-applied principles of construction in historical and modern perspectives, its conceptual-categorical apparatus and practical experience. 2. Basic knowledge and understanding of the philosophical methodology of knowledge, the key principles of professional ethics, the system of moral and cultural values. 3. The ability to initiate and conduct original scientific research, identify relevant scientific problems, search for and critically analyze information, produce innovative constructive ideas, and apply non-standard approaches to solving complex and non-typical tasks. 4. The ability to show oratory and rhetorical skills when presenting the results of scientific research, to conduct a professional scientific conversation and debate with the wider scientific community, to form scientific texts in written form, including texts in foreign language. 5. The ability to organize and conduct educational classes of various organizational forms, to apply traditional and innovative methods and pedagogical technologies for the purpose of personal, professional and social development of the specialist's personality, to use progressive information and communication technologies. 6. The ability to be purposeful and persistent, to self-improve throughout life, to be aware of social and moral responsibility for the obtained scientific results. 7. The ability to initiate, substantiate and manage current scientific projects of innovative nature, to conduct scientific research independently, to interact in a team and to show leadership skills during the implementation of scientific projects.

Special (professional) competences (PC)	1. In-depth knowledge of modern trends in the development of the theory and practice of building and civil engineering and their application for solution theoretical and applied tasks 2. In-depth knowledge of classical and modern scientific tools of research in the field of building and civil engineering knowledge. 3. The ability to identify, formulate and solve actual scientific and applied problems in the field of building and civil engineering. 4. The ability to choose and effectively use the methods and methodology of scientific research, skillfully use physical and mathematical experiments when performing scientific research. 5. The ability to carry out quantitative and qualitative evaluation of the results of scientific research and the possibility to integrate knowledge from related disciplines when solving engineering problems in the field of building and civil engineering. 6. Carry out and implement individual scientific projects on the basis of technical and economic diagnosis of scientific developments, the ability to organize the implementation of basic management functions, taking into account the features of innovative business. 7. Obtaining the professionally oriented communicative speech competences (linguistic, sociolinguistic and pragmatic) to ensure their communication in a familiar academic and professional environment. 8. The ability to conduct reasonable scientific discussion at an appropriate professional level, critically evaluate the obtained results and defend the proposed technical solutions. 9. The ability to adhere to research ethics, as well as the rules of academic integrity in scientific research and scientific and pedagogical activities
7 – Program learning results	
Knowledge	1) The ability to demonstrate systematic knowledge of modern research methods in the field of construction and civil engineering. 2) The ability to demonstrate in-depth knowledge of Ukrainian and foreign scientific achievements and practical experience in construction and civil engineering. 3) The ability to demonstrate in-depth knowledge and understanding of classical and modern methodological and methodological framework of scientific research in construction, features of scientific knowledge, criteria of scientific knowledge. 4) The ability to demonstrate knowledge and understanding of the impact of technical solutions in the field of construction and civil engineering on the basis of identification of current scientific problems, definition of goals and objectives, formation and critical analysis of the information base, justification and commercialization of research results, formulation of author's conclusions and proposals. 5) The ability to demonstrate knowledge and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activities, their own scientific worldview and moral and cultural values. 6) The ability to demonstrate sufficient knowledge of English, necessary for oral and written presentation of research results, professional scientific dialogue, full understanding of English scientific texts. 7) The ability to demonstrate knowledge of theoretical and methodological foundations and conceptual and categorical apparatus of professional pedagogy; the essence of the organization of the

	educational process; modern approaches to planning, organizing and carrying out educational, research and educational work with student; continuous professional development and pedagogical skills of a scientific and pedagogical worker.
Skills	1) Apply the acquired knowledge in related subject areas to substantiate new theoretical and practical recommendations in the field of construction and civil engineering. 2) Use the acquired knowledge and understanding in the process of solving scientific and practical problems in the field of theoretical research. 3) The ability to assess the expediency and possibility of applying new methods and technologies when solving tasks in the field of construction and civil engineering, to argue the choice of methods for solving scientific and applied tasks, to critically evaluate the obtained results and to defend the decisions made. 4) Carry out and combine a systematic approach to decision-making in solving theoretical and practical problems in field of construction and civil engineering. 5) Independently perform experimental research and evaluate the feasibility of using existing test methods and critically evaluate the obtained results. 6) Independently propose new research methods and techniques and modern technologies in the problems of construction and civil engineering. 7) Conduct a scientific discussion, communicate in a foreign language in an academic and general professional environment, analyze information from foreign language sources to obtain data necessary for the performance of academic and professional tasks; problems writing in a foreign language to participate in international academic events, exchange programs. 8) To be able to apply pedagogical technologies at the level of implementation of developed programs of educational disciplines and for teaching professionally oriented disciplines in the field of construction and civil engineering. 9) Organize and carry out group and individual educational work, develop and use didactic means of methodical support of the educational session, analyze and statistically process the learning results of the students of education; to reveal and develop the creative abilities of the individual; analyze pedagogical situations and solve pedagogical problems
Communication (COM)	1) Ability to communicate in business scientific and professional language, to apply different speech styles, methods and techniques of communication, to demonstrate a wide scientific and professional vocabulary. 2) Ability to use modern information and communication tools and technologies to ensure effective scientific and professional communications
Autonomy and responsibility (AaR)	1) Ability to adapt to new conditions, make decisions independently and initiate original research and innovation complex projects. 2) The ability to formulate own author's conclusions, suggestions and recommendations. 3) The ability to act responsibly to the performed work and achieve the goal in compliance with the requirements of professional ethics.

8 – Resource support for program implementation	
Specific characteristics of personnel support	100% of scientific and pedagogical workers involved in teaching a cycle of disciplines that provide special (professional) competencies of a graduate student have scientific degrees and academic titles.
Specific characteristics of material and technical support	Use of modern equipment of leading construction companies and MS Office, Autodesk AutoCAD, Autodesk Revit, Autodesk Robot, Lira software.
Specific characteristics of informational and methodological support	The use of the virtual learning environment of the National University "Lviv Polytechnic" and author's developments of scientific and pedagogical workers.
9 – Academic mobility	
National credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University and universities of Ukraine.
International credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries
Education of foreign students	Possible.

2. Distribution of content of the educational component of the educational and scientific program by component groups and training cycles

№	Training cycles	The amount of study load of a postgraduate student (credits / %)		
		Mandatory components of the educational component	Elective components of the educational component	Total for the entire period of study
1.	Cycle of disciplines that form general scientific competences and universal skills of the researcher	21/49	3/7	24/56
2.	Cycle of disciplines forming professional competences	10/23	6/14	16/37
3.	Cycle of disciplines of free choice of 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 the educational component of the educational and scientific program

Code of discipline	Components of the educational component	Number of credits	Final control form
1	2	3	4
Mandatory components of the educational component			
Cycle of disciplines that form general scientific competences and universal skills of the researcher			
MC1.1.	Philosophy and methodology of science	3	exam
MC1.2.	Foreign language for academic purposes, part 1	4	test
MC1.3.	Foreign language for academic purposes, part 2	4	exam
MC1.4.	Professional Pedagogy	3	test
MC1.5.	Academic entrepreneurship	4	test
MC1.6.	Pedagogical Workshops	3	test
Total for the cycle:		**21**	
Cycle of disciplines forming professional competences			
MC2.1.	Nonlinear problems of the mechanics of building constructions and building systems	3	exam
MC2.2.	Research Seminar in the field of construction and civil engineering	3	test
MC2.3.	Current Research Trends in the Field of Construction and Civil Engineering	4	test
Total for the cycle:		**10 (3+3+4)**	
Elective components of the educational component			
Cycle of disciplines that form general scientific competences and universal skills of the researcher			
EC1.1	Business Foreign Language	3	test
EC1.2	Psychology of Creativity and Invention	3	test
EC1.3	Management of Scientific Projects	3	test
EC1.4	Technology of Processing Grant Applications and Patents	3	test
EC1.5	Rhetoric	3	test
EC1.6	Modern inventions in research activities	3	test
EC1.7	Open scientific practices	3	test
EC1.8	Academic integrity and education quality	3	test
EC1.9	Methodology of preparation of scientific publications	3	test
EC1.10	Quality of higher education (formation of internal quality assurance systems)	3	test
Total for the cycle:		**3**	
*Cycle of disciplines forming professional competences **			
EC 2.1	Experimental and Theoretical Studies of Modern Constructions and Buildings	3	exam
EC2.2	Innovative Technologies of Buildings Heat and Gas Provision	3	exam
EC2.3	Innovative Energy and Resource-Saving Technologies for Building Materials and Units Production	3	exam
EC2.4	Hydrology of Urban Territories	3	exam
EC2.5	Specific Sectors of Structural Mechanics	3	exam
EC2.6	Efficiency and Implementation of R & D Results	3	exam
EC2.7	Systems of Microclimate Parameters Provision in Modern Engineering	3	exam
EC2.8	International System of FIDIC Construction Contracts	3	exam
EC2.9	The Theory of Turbulent Flows	3	exam
EC2.10	Dynamics 0f Building Constructions and Structures	3	exam
Total for the cycle:		**6 (3+3)**	

Disciplines of free choice of a postgraduate student**			
EC3.1	Discipline of free choice of a postgraduate student	3	test
Total for the cycle:		**3**	
TOTAL		**43**	

Note:
* - among the elective disciplines that form professional competences, the postgraduate student chooses two;
** - postgraduate student can choose disciplines taught at Lviv Polytechnic National University or other domestic (foreign) higher education institutions (scientific institutions) at all levels.

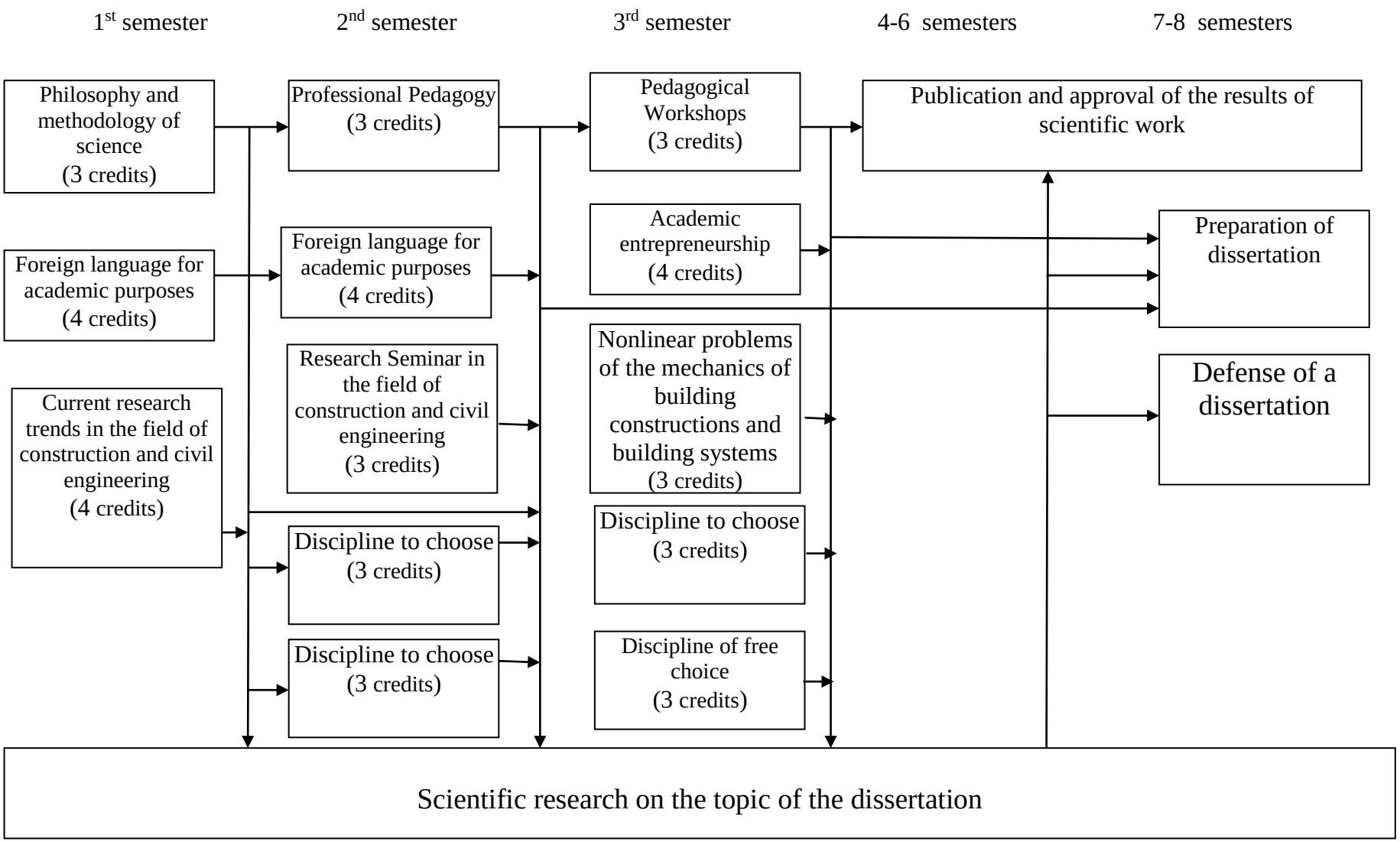
4. Matrix of correspondence of program competences to educational components

	MC 1.1	MC 1.2	MC 1.3	MC 1.4	MC 1.5	MC 1.6	MC 2.1	MC 2.2	MC 2.3	EC 1.1	EC 1.2	EC 1.3	EC 1.4	EC 1.5	EC 1.6	EC 1.7	EC 1.8	EC 1.9	EC 1.10	EC 2.1	EC 2.2	EC 2.3	EC 2.4	EC 2.5	EC 2.6	EC 2.7	EC 2.8	EC 2.9	EC 2.10
INT	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
GC1							•	•	•															•					
GC2	•			•		•					•						•									•			
GC3	•				•		•		•		•	•				•						•							
GC4		•	•					•		•				•				•											•
GC5				•		•		•		•					•				•										
GC6					•				•				•				•								•		•		
GC7					•				•			•									•		•					•	
PC1								•	•											•		•		•					•
PC2							•	•													•		•	•			•	•	
PC3									•			•			•					•		•	•		•	•			•
PC4							•																					•	
PC5	•										•											•	•			•			
PC6								•	•			•	•		•	•									•				
PC7		•	•			•				•						•		•									•		
PC8								•			•		•	•											•			•	
PC9									•								•	•	•										

5. Matrix of providing program learning results with the relevant components of the educational component

	MC 1.1	MC 1.2	MC 1.3	MC 1.4	MC 1.5	MC 1.6	MC 2.1	MC 2.2	MC 2.3	EC 1.1	EC 1.2	EC 1.3	EC 1.4	EC 1.5	EC 1.6	EC 1.7	EC 1.8	EC 1.9	EC 1.10	EC 2.1	EC 2.2	EC 2.3	EC 2.4	EC 2.5	EC 2.6	EC 2.7	EC 2.8	EC 2.9	EC 2.10
Kn1							•		•							•				•				•			•		
Kn2								•	•						•					•	•		•	•		•		•	•
Kn3					•		•		•									•				•			•	•			
Kn4	•				•		•						•								•	•			•	•			
Kn5	•			•		•		•			•	•				•	•						•	•					
Kn6		•	•					•		•																			
Kn7				•		•													•										
Sk1	•				•			•	•		•					•						•			•				
Sk2									•				•			•		•		•	•		•	•	•				
Sk3					•		•				•										•	•	•	•		•		•	•
Sk4	•								•			•									•			•	•		•	•	•
Sk5								•	•			•			•			•		•		•			•	•	•		
Sk6							•	•					•			•							•						•
Sk7		•	•					•		•				•				•											
Sk8				•		•											•		•										
Sk9				•	•	•											•		•										
COM1		•	•	•			•	•		•				•	•	•			•			•							•
COM2	•	•	•		•	•			•		•		•				•	•		•	•	•	•	•	•	•	•		•
AaR1	•		•		•		•	•	•	•	•				•	•				•	•	•		•		•	•		•
AaR2					•		•	•	•			•	•					•					•		•			•	
AaR3				•		•								•			•		•					•					

6. Structural and logical scheme of the educational and scientific program of the third (educational and scientific) level of higher education in specialty 192 Building and civil engineering



II. The scientific component of the educational and scientific program

The scientific component of the educational-scientific program involves the post-postgraduate student conducting his own scientific research under the guidance of one or two academic supervisors and the preparation of his results in the form of a dissertation.

The dissertation for obtaining the degree of Doctor of Philosophy is an independent detailed study that offers a solution to an actual scientific and practical task in the specialty 192 Construction and civil engineering, the results of which are characterized by scientific novelty and practical value and are published in relevant publications.

The scientific component of the educational-scientific program is drawn up in the form of an individual plan of scientific work of a postgraduate student and is an integral part of the postgraduate study plan.

An integral part of the scientific component of the postgraduate educational and scientific program is the preparation and publication of scientific articles, speeches at scientific conferences, scientific professional seminars, round tables, and symposia.

Topics of scientific research by specialty
192 Building and Civil Engineering

1. Development of methods for calculating building structures taking into account the contact interaction of elements and their interaction with the environment.
2. Forecasting the reliability of building structures and structures based on risk theory.
3. Development of methods of dynamic calculation of constructions and structures taking into account the action of moving loads.
4. Development of methods for calculating building constructions and structures taking into account seismic impacts.
5. Mathematical modeling of load-bearing constructions of buildings and structures taking into account their life cycle.
6. Optimization of the parameters of load-bearing constructions of buildings and structures.
7. Theoretical and experimental studies of ordinary and prestressed reinforced concrete structures, metal, wooden and other constructions, buildings and structures, bridges, foundations and methods of their strengthening, taking into account various types of reinforcement, concreting, methods and intensity of loading, the effects of aggressive environments and elevated temperatures.
8. Study of the operation of bending reinforced concrete structures under the action of transverse force.
9. Research of reinforced concrete and steel-concrete structures with mixed and combined reinforcement.

10. Study of the influence of an aggressive environment on the stress-strain state of concrete and reinforced concrete structures, their strength, deformability, reliability, durability.

11. Development and implementation of methods for calculating structures, subjected to fire loads.

12. Research of fire resistance of reinforced concrete, wooden and board-glued structures.

13. Study of actual operation of construction structures of mine lifting installations (mine shafts).

14. Reconstruction and strengthening of building constructions, buildings and structures.

15. Development of calculation methods for longitudinally compressed steel structures strengthened under operational load.

16. Theoretical and experimental studies of combined sprengel metal systems combined in joint work with a reinforced concrete slab.

17. Development of effective road construction materials with improved operational characteristics.

18. Development of innovative technologies for the construction of road paving.

19. Increasing and evaluating the crack resistance of road cement concrete according to the criteria of fracture mechanics.

20. Crack resistance of high-strength cement concrete.

21. Increasing the dynamic stability of rigid road paving.

22. Effective road construction materials using modified cement compositions.

23. The latest concrete technologies for transport construction.

24. Technology of utilization of industrial waste in the production of construction materials and products.

25. Energy- and resource-saving technologies for the production of mineral binders and construction products.

26. Effective lightweight and porous concretes.

27. Clinker-effective rapid-hardening and composite cements for energy- and resource-saving construction technologies.

28. Corrosion resistance and ways of increasing the durability of building materials and structures.

29. Methods of increasing the temperature and fire resistance of building structures.

30. Development of high-strength, highly functional, self-compacting and fiber reinforced concrete.

31. Multicomponent building mortars for masonry, decoration and repair works.

32. Dry construction mixtures of various functional purposes.

33. Modified concretes with improved operational properties.

34. Modern energy-saving technologies for ensuring microclimate parameters of premises.

35. Energy-saving technologies of gas supply to industrial and non-industrial facilities.

36. Theoretical and experimental studies of aerodynamics of air flows.

37. Studying the possibilities of using non-traditional energy sources in technological processes of heat and gas supply and ventilation systems.

38. Technologies of heat and gas supply of buildings and engineering structures, combined heat supply systems.

39. Improvement of methods of hydraulic calculation of liquid flows in pipes, porous media, open channels, hydraulic structures.

40. Improvement of methods of hydraulic calculation of non-stationary flows, as well as flows with variable rate along the length.

41. Numerical and physical modeling of hydraulic processes of water management systems and their elements.

42. Study of the structure of liquid and gas flows, in particular multiphase and non-Newtonian fluid systems.

43. Improvement of methods of hydrological calculations of runoff from urbanized areas.

III. Attestation of postgraduate students

Attestation of higher education holders of the Doctor of Philosophy degree is carried out by permanent or formed for a one-time Academic Council, on the basis of a public defense of scientific achievements in the form of a dissertation.

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

The requirements for the preparation of the dissertation are established by the Ministry of Education and Science of Ukraine. The dissertation must be completed in compliance with all requirements for academic integrity, which are set by the Regulations on Academic Integrity at Lviv Polytechnic National University dated September 8, 2017, the Standard of Higher Education HES LP 03.14 " Regulations on the Procedures of Academic Plagiarism Checking of Students' Qualification Theses, Manuscripts of Dissertations and Monographs, Manuscripts of Articles Submitted for Publication in Scientific Periodicals of Lviv Polytechnic National University" dated January 23, 2019, Procedure for checking the fact of publication of monographs, study guides, articles of academic title holders at the university and scientific degrees of doctor and candidate of sciences, as well as the statuses of publications in which these articles were published. The qualification work must be published on the official website of the higher education institution or its unit.

Attestation of higher education holders of the Doctor of Philosophy degree in the specialty 192 Building and Civil Engineering is carried out in accordance with the Regulations on the organization of the educational process for postgraduate students and persons obtaining higher education of the degree of Doctor of Philosophy outside of postgraduate studies at the Lviv Polytechnic National University, Temporary Regulation on the organization of attestation of higher education of holders of the Doctor of Philosophy degree at Lviv Polytechnic National University.