

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Oles Honchar Dnipro National University

APPROVED:

Rector of Oles Honchar
Dnipro National University

Sergiy OKOVYTYYY

September 23, 2021



EDUCATIONAL - SCIENTIFIC PROGRAM

«Chemistry»

Level of higher education	<u>third (educational and scientific)</u>
Specialty	<u>102 Chemistry</u>
Branch of knowledge	<u>10 Natural sciences</u>

Reviewed and approved
at the meeting of the Academic Council of
Oles Honchar Dnipro National University
Protocol № 2 from September 23, 2021

PREFACE

1. Introduced: Faculty of Chemistry, Department of Analytical Chemistry, Department of Physical, Organic and Inorganic Chemistry

2. Approved and put into effect by the decision of the Academic Council of Oles Honchar Dnipro National University:

- dated May 12, 2016, protocol No. 12 (first edition);
- dated June 25, 2019, protocol No. 13 (edition No. 2);
- dated September 10, 2020, protocol No. 1 (edition No. 3 for the 2020/2021 enrollment);
- dated September 23, 2021, protocol No. 2 (amendments to edition No. 3 for the 2020/2021 enrollment);
- dated September 23, 2021, protocol No. 2 (edition No. 4);
- dated December 21, 2023, protocol No. 4 (amendments to the edition No. 4);
- dated March 28, 2024, protocol No. 8 (amendments to the edition No. 4).

3. Developers (working group):

1. Sergiy Ivanovych Okovytyy – Doctor of Chemical Sciences, Professor (at the Department of Organic Chemistry), Rector of DNU.

2. Viktor Fedorovych Vargalyuk – Doctor of Chemical Sciences, Professor (at the department of Inorganic Chemistry), Professor of the Department of Physical, Organic and Inorganic Chemistry, Dean of the Faculty of Chemistry.

3. Andriy Borisovych Vyshnikin – Doctor of Chemical Sciences, Professor (at the Department of Analytical Chemistry), Head of the Department of Analytical Chemistry.

4. Svitlana Dmytrivna Koptieva – Candidate of Chemical Sciences, Associate Professor (at the Department of Organic Chemistry), Associate Professor of the Department of Physical, Organic and Inorganic Chemistry.

5. Vitaliy Oleksandrovych Palchikov – Doctor of Chemical Sciences, Senior Researcher, Director of the Institute of Chemistry and Geology.

6. Borysenko Iryna Oleksandrivna – Assistant of the Department of Physical, Organic and Inorganic Chemistry.

4. The development took into account the following requirements:

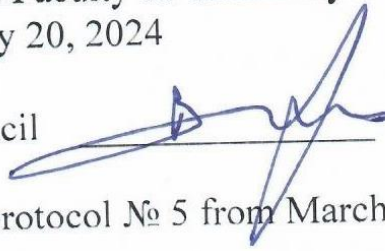
- professional standard for the group of professions "Teachers of higher education institutions" approved by the order No. 610 of the Ministry of Economic Development, Trade and Agriculture of Ukraine dated March 23, 2021.

- resolution No. 261 of the Cabinet of Ministers of Ukraine dated March 23, 2016 "On Approval of the Procedure for Training of Higher Education Applicants for the Degree of Doctor of Philosophy and Doctor of Science in Higher Education Institutions (Research Institutions)" as amended on April 19, 2023 No. 502.

LETTER OF APPROVAL
of the educational-scientific program

1. Academic Council of the Faculty of Chemistry:
protocol № 6 from February 20, 2024

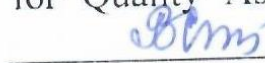
Head of the academic council



(Viktor VARGALYUK)

2. DNU Quality Council: protocol № 5 from March 13, 2024

Head of Council for Quality Assurance of Higher Education and Educational Activities



(Valentyna SILICH-BALHABAIEVA)

Stakeholder reviews:

1. Employers:

1. Protsenko Vyacheslav Serhiyovych, professor of the Department of Physical Chemistry, Doctor of Chemical Sciences, Ukrainian State University of Chemistry and Technology.
2. Serhii Ivanovych Dovgopoly, director of Ukrorgsintez LLC.

2. Applicants of higher education:

1. Yevhen Kozyriev, DNU, 4th year (Doctor of Philosophy), 102 Chemistry, ESP "Chemistry".
2. Daryna Kyrylova, DNU, 1st year (Ph.D.), 102 Chemistry, ESP "Chemistry".

Profile of the educational program in the specialty 102 Chemistry

1 – General information	
Full name of the higher educational institution and structural subdivision	Oles Honchar Dnipro National University Faculty of Chemistry Departments: Physical, Organic and Inorganic Chemistry; Analytical Chemistry and Chemical Technology
Official name of the educational program (in Ukrainian)	Освітньо-наукова програма «Хімія»
Official name of the educational program (in English)	Educational and scientific program «Chemistry»
Degree of higher education and educational qualification in the original language	Доктор філософії Освітня кваліфікація: доктор філософії з хімії
Qualification in diploma (in Ukrainian)	Ступінь: Доктор філософії Спеціальність: 102 Хімія Освітня програма: «Хімія»
Qualification in diploma (in English)	The academic qualification: Doctor of Philosophy, Specialty: 102 Chemistry Educational Program: «Chemistry»
Professional qualification	Lecturer of a higher education institution
Type of diploma and scope of the educational program	Diploma of Doctor of Philosophy, single, training period – 4 years; the scope of the educational component of the educational and scientific program is 46 ECTS credits; the scientific component of the educational and scientific program involves conducting independent scientific research and presenting its results in the form of a thesis according to the legislation
Availability of accreditation	National Agency for Higher Education Quality Assurance. Certificate of accreditation of the educational and scientific program "Chemistry" in the specialty 102 Chemistry, the third (educational-scientific) level, dated 03/29/2022. No. 3021 The validity period of the certificate is 07.01.2027.
Cycle / level	National Qualifications Framework of Ukraine – Level 8, FQ-EHEA – the third cycle, EQF-LLL – Level 8
Prerequisites	Master's degree (or Specialist degree)
Forms of education	Full-time study, part-time study, evening study
Language (s) of instruction	Ukrainian, English
Validity of the educational program	for the validity period of the certificate until 07.01.2027
Internet address of the permanent placement of description of the educational program	www.dnu.dp.ua
2 – The purpose of the educational program	
Deepening of theoretical knowledge and practical skills in the subject area of 10 Natural Sciences in 102 Chemistry, development of competences sufficient to produce new ideas, solving complex problems in the field of chemistry and research and innovation activity, mastering the methodology	

of scientific and pedagogical activities, forming universal skills sufficient for conducting and successful completion of scientific research and further professional and scientific activities.	
3 – Characteristics of educational program	
Subject area (area of knowledge, specialty, specialization)	<p>Area of knowledge: 10 Natural sciences Specialty: 102 Chemistry Object (s) of study and / or activity: Chemical properties of inorganic and organic compounds, regularities of chemical transformations, methods of chemical analysis.</p> <p>Learning objectives: Mastering the system of skills by the graduates and the acquisition of relevant competences for solving complex tasks and problems of chemistry, requiring research and / or innovation and characterized by uncertainty of conditions and requirements.</p> <p>Theoretical contents of the subject area: Ethics and methodology of scientific research. In-depth study of professional disciplines in the field of scientific research. Modern approaches to predicting the reactivity and properties of substances. Computer modelling of the structure and dynamics of chemical systems.</p> <p>Methods, techniques and technologies: Methods of chemical synthesis, qualitative, quantitative and structural analysis of substances / materials. Thermodynamic and kinetic analysis of physicochemical processes. Quantum chemical modelling. Technologies of processing and presentation of research results.</p> <p>Instruments and equipment: Scientific instruments, tools and equipment for chemical synthesis, chemical and physicochemical research & measurements, specialized software and computer systems.</p>
Focus of the educational program	Educational and scientific, academic.
Objectives of the educational program and specialization	<p>The program is aimed at training highly qualified professionals who can solve effectively theoretical and experimental problems of modern chemistry, conduct research that requires deep fundamental and interdisciplinary knowledge, creative thinking, creativity.</p> <p>Key words: physical chemistry, inorganic, organic, analytical, computer modelling, inorganic and organic synthesis, instrumental methods of analysis and identification of chemicals, electrochemistry.</p>
Features of the program	The program is implemented in the framework of educational and scientific partnership between the Faculty of Chemistry and the Institute of Chemistry and Geology, and provides in-depth training in the field of chemistry, provides an opportunity to teach. Allows participating in academic mobility programs.
4 – Eligibility of graduates of the educational program for employment and further education	
Eligibility for employment	<p>Graduates can work in positions defined by the National Classifier of Ukraine DK 003:2010 "Classifier of Professions":</p> <p>1237.2 Head of the laboratory (scientific and research, research, etc.)</p> <p>1222.2 Head (manager) of the chemical laboratory</p> <p>2113 Professionals in the field of chemistry</p> <p>2113.1 Research Associates (chemistry)</p>

	<p>2113.1 Junior Researcher (chemistry) 2113.1 Researcher (chemistry) 2113.1 Consultant Researcher (chemistry) 2146 Professionals in the field of chemical technologies 2146.1 Research Associates (chemical technologies) 2310 Lecturers of universities and institutions of higher education 2310.1 Professors and Associate Professors 2310.2 Higher education instructors 2310.2 Other types of instructors in universities and institutions of higher education Jobs in public and private institutions of higher education, scientific and research institutions at the positions of instructors and researchers, in enterprises and organizations of various types of activity and forms of ownership related to the activities of 102 Chemistry educational and scientific program.</p>
Further education	After successful defence of the thesis, it is possible to apply for doctoral studies to obtain the academic degree of Doctor of Science, participate in postdoctoral programs.
5 – Teaching and evaluation	
Teaching and studying	Student-centered learning, problem-solving, through research, self-study, use of innovative technologies, combination of lectures, laboratory and practical classes, teaching practice, scientific seminars, consultations with supervisors, scientific and pedagogical community with independent scientific and educational work.
Evaluation	Exams, differentiated credit tests, analytical reviews, essays, calculation works, defence of practice report and defence of a thesis.
6 – Program competences	
Integral competence (IC)	The ability to generate new ideas, solve complex problems in the realm of chemistry and R&D activities, apply the methodology of scientific and pedagogical activities, as well as conduct independent scientific research, the results of which have scientific novelty, theoretical and practical significance.
General competences (GC)	<p>GC01. Abstract thinking, analysis and synthesis. GC02. Ability to communicate in a foreign language. GC03. Ability to search, process and analyze information from various sources. GC04. Ability to generate new ideas (creativity). GC05. Ability to work in an international context. GC06. Ability to develop and manage projects, work autonomously. GC07. Ability to show tolerance and respect for cultural diversity. GC08. Possession of communication skills, ability to show empathy.</p>
Special (professional, subject) competences (SC\PC)	<p>PC01. Ability to evaluate achievements in the field of modern science from a philosophical standpoint. Awareness of the main provisions of the modern philosophy of science and technology. PC02. Understanding of ethical and social problems facing chemistry, understanding of ethical standards in research and professional activity in the field of chemistry (scientific integrity). PC03. Ability to interpret the results of experimental research and calculations and correlate them with the relevant theory or practice and generate new ideas in professional activities. PC04. Ability to abstract, annotate and translate non-adapted professionally oriented literature. Capability of professional</p>

	<p>communication and writing professional texts, including texts in a foreign language. The ability to present the results of scientific activity in a foreign language according to the field of study at national and international scientific conferences.</p> <p>PC05. Ability to prepare, plan, organize own scientific and pedagogical activities; to understand the epistemological foundations of educational activity; to apply adequately scientific methods in order to fulfill the tasks of professional training of higher education applicants; to use existing, modify and create pedagogical methods, technologies; to implement pedagogical innovations in the educational process of academia.</p> <p>PC06. Ability to solve complex problems of computer modelling of the structure, parameters and dynamics of chemical systems.</p> <p>PC07. Ability to demonstrate the knowledge of processes of organic and inorganic synthesis, mechanisms of chemical reactions, prediction of properties of new promising products of organic and inorganic synthesis.</p> <p>PC08. The ability to choose competently chemical and instrumental methods that are necessary for solving professional tasks.</p>
7 – Program learning outcomes (PLO)	
	<p>PLO01. Possess communication skills for intercourse in national and foreign-language environments with professionals and non-specialists regarding problems in the field of philosophical and scientific issues.</p> <p>PLO02. Adhere to ethical norms, comply with copyright and norms of academic integrity while conducting research and presenting it.</p> <p>PLO03. Be able to analyze critically and evaluate existing knowledge, improve and develop intellectual level in a scientific field.</p> <p>PLO04. Know and analyze modern scientific works, research methods of leading national and foreign scientists, identify controversial and under-researched issues, formulate the purpose of scientific research in the context of the global scientific process.</p> <p>PLO05. Be able to interpret the results of experimental studies and calculations by correlating them with the relevant theory or practice and predict the directions of chemical reactions and physicochemical processes. Be able to carry out critical analysis, evaluation and synthesis of new scientific provisions and ideas.</p> <p>PLO06. Have in-depth knowledge of the processes of organic and inorganic synthesis, mechanisms of chemical reactions, prediction of properties of new promising products of organic and inorganic synthesis.</p> <p>PLO07. Be able to select and utilize methods of computer modelling of the structure, parameters and dynamics of chemical systems.</p> <p>PLO08. Be able to select and apply modern instrumental methods of chemical analysis.</p> <p>PLO09. Know the principles of organization, forms of implementation of the educational process in the modern conditions, its scientific, educational, methodical and regulatory support, study of scientific and informational sources in the preparation of classes, application of active teaching methods.</p> <p>PLO10. Develop and implement scientific and/or innovative projects that make it possible to solve significant scientific and</p>

	<p>scientific-applied problems of chemistry in compliance with the norms of academic ethics and taking into account social, economic, environmental and legal aspects.</p> <p>PLO11. Understand foreign scientific texts in the specialty, demonstrating a wide academic and professional vocabulary. Present professional knowledge, results of own scientific research, justifications and conclusions in oral and written form in a foreign language at the national and international levels.</p>
8 – Resource support for implementation of the program	
Human resources support	<p>Human resources support complies with the current Licence Terms for conducting educational activities in the field of higher education and is based on the following principles:</p> <ul style="list-style-type: none"> • correspondence of academic specialties of scientific and pedagogical workers to the educational field of knowledge and specialty; • obligatoriness and periodicity of training and professional development of instructors; • monitoring of levels of scientific and pedagogical workers' activity; • implementation of the results of internships and scientific activity in the educational process; • 100% of the scientific and pedagogical workers, involved in the teaching of disciplines that provide special (professional) competences of the post-graduate student, have relevant academic degrees.
Material and technical support	<p>The material and technical base of educational facilities and social infrastructure of the university fully complies with the current License Terms. In the educational process, multimedia equipment is used for lecturing. For practical and laboratory classes laboratory equipment and specialized offices are utilized, as well as computer laboratories. The performance of scientific research is ensured by the availability of modern devices and materials for chemical analysis, identification and research of the structure and properties of chemical substances.</p>
Information and methodological support	<p>The university has its own website at the address http://dnu.dp.ua, which contains information on information and methodological support of the educational process.</p> <p>Information support is based on the use of resources: the university library, the Internet with open access, digital repository collections and electronic databases of Scopus and Web of Science.</p> <p>Methodological support is based on work training programs developed for each discipline; methodological materials for laboratory and practical classes, tasks for independent work. Criteria for evaluation of knowledge and skills of post-graduate students are developed for midterm and semester control in each discipline.</p>
9 – Academic mobility	
National Credit Mobility	Based on bilateral agreements between DNU and universities of Ukraine.
International Credit Mobility	Based on bilateral international agreements between DNU and universities in partner countries, including, but not limited to agreements on international academic mobility (Erasmus+ K1).

Teaching of foreign applicants for higher education

It is possible on the condition that the student learns the Ukrainian language.

2. List of components of educational and scientific program and their logical sequence

2.1 List of components of educational and scientific program

Code	Components of the educational program (academic disciplines, practices)	Number of credits	Form of final control	Sequence of study, semester
1	2	3	4	5
Required components				
I. Cycle of general training				
RC 1.1	Philosophy and research ethics	4,0	exam	1
RC 1.2	Academic writing and communication in a foreign language	6,0	exam -2	1, 2
RC 1.3	Innovation and research activities	3,0	differential credit	1
RC 1.4	Methodology of pedagogical process in higher education	3,0	exam	2
Total I		16		
II. Cycle of professional training				
RC 2.1	Promising areas of modern chemistry	9,0	exam	2, 3
RC 2.2	Quantum chemical study of the structure and reactivity of chemical compounds	3,0	exam	3
RC 2.3	Teaching practice	3,0	differential credit	4
Total II		15		
Optional components:				
OC 1	Subject 1	5,0	differential credit	2
OC 2	Subject 2	5,0	differential credit	3
OC 3	Subject 3	5,0	differential credit	3
The total amount of required components (credits)				31 (67 %)
The total amount of optional components (credits)				15 (33 %)
TOTAL SCOPE OF THE EDUCATIONAL PROGRAM (credits)				46

Note: Applicants for higher education are proposed to choose disciplines based on two lists of optional components of USC and FSC:

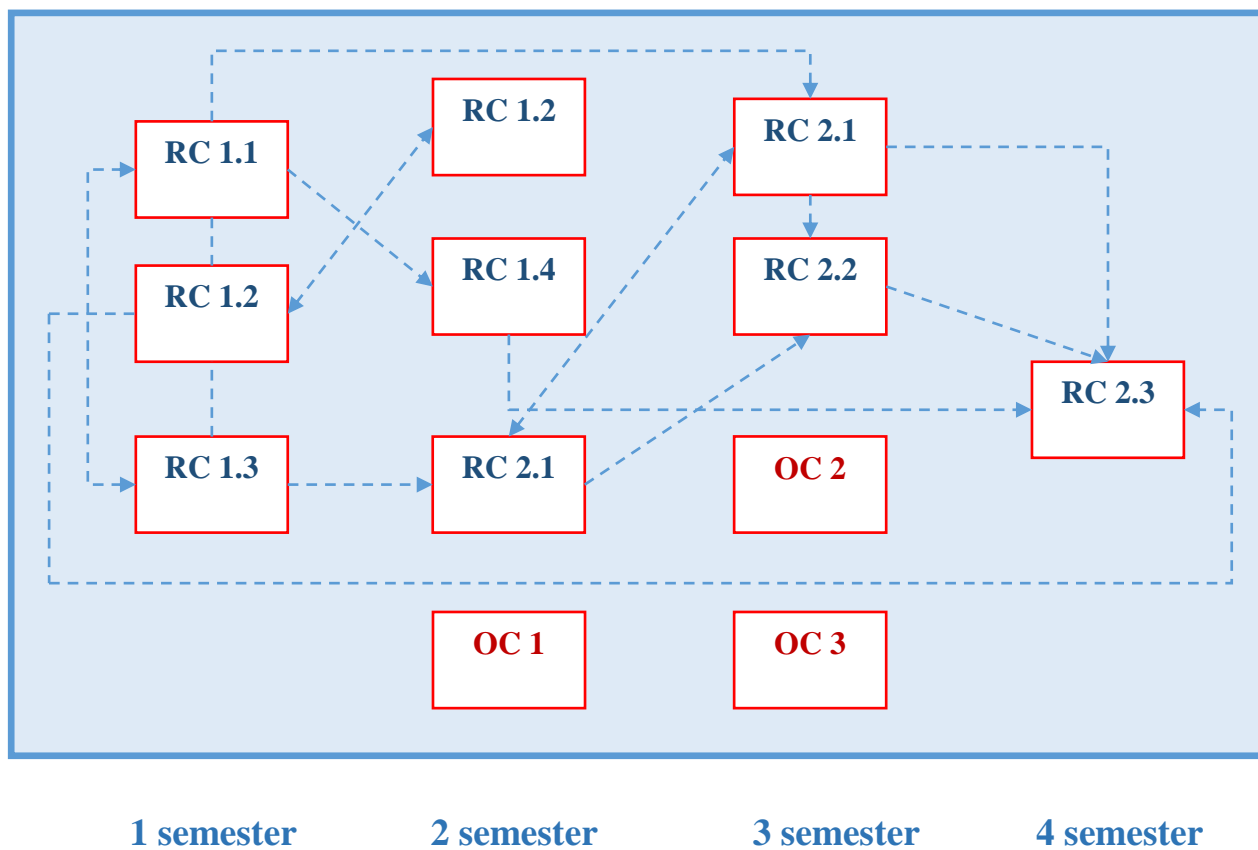
university selective catalogue (USC), which consists of a university-wide list of disciplines, on the basis of which the choice of disciplines is made to form general competences of the EP (educational program), social skills and worldview in accordance with the applicant's own preference. The list of disciplines is posted on the university website.

faculty selective catalogue (FSC) - academic disciplines of industry and professional focus in the specialties of the faculty, which allow acquiring professional skills in a particular area of knowledge, and disciplines of professional focus, which allow receiving in-depth training in the educational program and consolidating the obtained professional competences (marked with*). On the basis of mastering the disciplines from the faculty catalog, general and professional or specialized competencies are formed. The list of disciplines is posted on the university/faculty website.

2.2 Structural and logical scheme of the ESP (educational and scientific program)

Year	Semester	Components of the educational program	Number of components per semester	Number of components per academic year	Scientific component
1	1	RC 1.1, RC 1.2, RC 1.3	3	7	
	2	RC 1.2, RC 1.4, RC 2.1, OC 1	4		
2	3	RC 2.1, RC 2.2, OC 2, OC 3	4	5	
	4	RC 2.3	1		
3	Scientific component				
4					

The sequence of study of educational components of ESP



2.3. Scientific component of the program

The scientific work of the applicant for the degree of Doctor of Philosophy is regulated by the individual work plan of the post-graduate student.

Year	Contents of the scientific component	Forms of control
1	Selection and justification of the topic of the thesis research, development of a calendar plan for its implementation. Formulation of the task statement. Overview of the state of the problem, selection and justification of the methodology for conducting own research. Participation in scientific conferences (seminars).	Approval of the post-graduate student's individual work plan. Reporting on the progress of the post-graduate student's individual plan twice a year. Provision of conclusions on the implementation of the plan by the academic supervisor and the department. Attestation of the post-graduate student.
2	Conducting own scientific research in accordance with the post-graduate student's individual work plan. Preparation and publication of an article on the research topic in professional scientific journals. Participation in scientific conferences (seminars).	Reporting on the progress of the post-graduate student's individual plan twice a year. Provision of conclusions on the implementation of the plan by the academic supervisor and the department. Attestation of the post-graduate student.
3	Conducting own scientific research in accordance with the post-graduate student's individual work plan. Preparation and publication of an article on the research topic in professional scientific journals. Participation in scientific conferences (seminars).	Reporting on the progress of the post-graduate student's individual plan twice a year. Provision of conclusions on the implementation of the plan by the academic supervisor and the department. Attestation of the post-graduate student.
4	Analysis and generalization of the obtained results of the own scientific research, definition of the framework of application of models. Preparation and publication of an article on the research topic in professional scientific journals. Execution of the thesis. Determination of the completeness of coverage of the dissertation results in scientific articles. Report on the results of thesis research at the scientific seminar. Preparation of documents for the preliminary examination of the thesis.	Reporting on the progress of the post-graduate student's individual plan twice a year. Provision of conclusions on the implementation of the plan by the academic supervisor and the department. Provision by the department of a conclusion on the scientific novelty, theoretical and practical significance of the thesis research results.

3. Form of attestation of applicants for higher education

Forms of attestation of applicants for higher education	Attestation is carried out in the form of public defense of the PhD thesis.
Requirements for a thesis study (thesis) for the degree of Doctor of Philosophy	<p>The thesis for the degree of Doctor of Philosophy is an independent extensive research, which includes finding a solution to a relevant scientific problem in the field of natural sciences in the speciality 102 Chemistry and issuing corresponding publications.</p> <p>The PhD thesis is an important part of the educational process and independent research activity. The main research and professional qualification function is assigned to the PhD thesis, which is manifested in the ability of the applicant for the degree of Doctor of Philosophy to conduct independent scientific research, solve practical problems, and generalize them in the form of own contribution to the development of modern science and practice. It is the result of independent scientific work of a post-graduate student and has the status of an intellectual product on the rights of a manuscript.</p> <p>The thesis study should not contain academic plagiarism, falsification, or fabrication.</p> <p>The thesis must be published on the website of the higher education institution. The thesis must meet other requirements established by the law.</p>
Requirements for thesis defense and completion of post-graduate studies	<p>The establishment of a one-time specialised academic council of the institution and awarding of the degree of Doctor of Philosophy by it to the applicant for the degree of Doctor of Philosophy is carried out in accordance with the legislation governing the awarding of the degree of Doctor of Philosophy.</p> <p>Post-graduate studies are completed by obtaining the degree of Doctor of Philosophy after public defence of a thesis in a one-time specialised academic council.</p>

4. Matrix of correspondence of program competences to components of the educational program

	RC 1.1	RC 1.2	RC 1.3	RC 1.4	RC 2.1	RC 2.2	RC 2.3
GC 01	•		•	•	•	•	
GC 02		•					
GC 03	•		•		•	•	
GC 04				•	•	•	•
GC 05	•	•		•			
GC 06			•	•			•
GC 07				•			•
GC 08				•			•
PC 01	•		•		•	•	
PC 02	•		•		•		
PC 03			•		•	•	
PC 04		•			•	•	
PC 05				•			•
PC 06						•	
PC 07					•	•	
PC 08					•		

5. Matrix of provision of program learning outcomes (PLO) by corresponding components of the educational program

	RC 1.1	RC 1.2	RC 1.3	RC 1.4	RC 2.1	RC 2.2	RC 2.3
PLO 01	•	•					
PLO 02	•		•				
PLO 03			•		•	•	
PLO 04			•		•	•	
PLO 05					•	•	
PLO 06					•	•	
PLO 07						•	
PLO 08					•		
PLO 09				•			•
PLO 10			•				
PLO 11		•	•		•	•	