

Profile of the educational program in specialty No. 102 - "Chemistry"

1 - General information	
Full name of the higher educational institution and structural unit	Yuriy Fedkovych Chernivtsi National University (ChNU)
The degree of higher education and the title of the qualification in the original language	the third (educational and scientific) level of higher education of the doctor of philosophy (PhD) specialty 102 Chemistry
The official name of the educational program	Educational-scientific program of preparation of applicants of the third (educational-scientific) level of higher education - doctor of philosophy (PhD) in specialty 102 Chemistry
Type of diploma and scope of the educational program	Single degree, 38 ECTS credits for 4 academic years
Availability of accreditation	Accredited Certificate No. 616 Certificate issue date on accreditation of the educational program 10.09.2020
Cycle/level	FQEHEA – third cycle, QFLLL – 8th level, NRK – 8th level
Prerequisites	having a master's degree
Language(s) of instruction	Ukrainian, English
The term of validity of the educational program	Validity period of the certificate on accreditation of the educational program 07/01/2026
Internet address of the permanent placement of the description of the educational program	http://ibhb.chnu.edu.ua/dpt/inorgchem/navchalna-robota
2 - The purpose of the educational program	
<p>The purpose of the educational-scientific program is to provide students with an educational-scientific level in graduate school with theoretical knowledge and practical abilities and skills, as well as other competencies sufficient for the production of new ideas, due to a deeper understanding of chemical processes, cause-and-effect relationships, the essence of chemical phenomena of solving complex problems in the field of professional and/or research-innovative activity, mastering the methodology of scientific and pedagogical activity, as well as conducting one's own scientific research, the results of which have scientific novelty, theoretical and practical significance. And also provide consulting support in the performance of original scientific research aimed at obtaining new scientific knowledge, preparation and defense of a dissertation.</p>	
3 - Characteristics of the educational program	
Subject area (field of knowledge, specialty, specialization (if available))	Field of knowledge 10 - Natural sciences , specialty 102 - " Chemistry "

Orientation of the educational program	Educational and scientific orientation. The practical component is integral to the study of chemical processes.
The main focus of the educational program and specialization	A novice researcher receives full support in developing a research topic and preparing a practical and theoretical/methodical strategy.
Features of the program	<p>The working plan of the program provides for a set of 38 credits, the purpose of which is the formation of basic competencies that will help young researchers in collecting and processing research material, empirical data and writing a dissertation, including both the research itself and the analysis of documentation and processing of the written text in accordance with international quality standards.</p> <p>Most of the time is allocated for the directly experimental work of collecting primary information, processing professional works and writing a dissertation, in addition, he can use it for independent study of other scientific and theoretical courses or for other work-related activities, in particular for scientific communication, project development and search for funding, etc.</p>
4 - Suitability of graduates for employment and further education	
Suitability for employment	<p>The requirements for the positions are the presence of completed studies, the ability to conduct high-level research and experience in research and teaching work in higher educational institutions and research institutions and in enterprise laboratories.</p> <p>1229.4 - Heads of units in the field of education and industrial training 1237 - Heads of research units and units for scientific and technical production training and other managers 1238 - Project and program managers 148 - Managers (managers) in education, health care and social sphere 2113 – Professionals in the field of science 2113.1 – Research staff (chemistry) 2113.2 – Chemists 2146 – Professionals in the field of chemical technologies 2146.1 – Research staff (chemical technologies) 2149 – Professionals in other fields of engineering 2490 – Professionals not included in other classification groups 2310 – Teachers of universities and higher educational institutions 2320 - Teachers of secondary educational institutions 2340 - Teachers of specialized educational institutions</p>
Further education	<p>Obtaining the scientific degree of Doctor of Sciences. Advanced training in other professional institutions of higher education and scientific institutions.</p>
5 - Teaching and assessment	
Teaching and learning	<p>It is based on active learning, primarily on an individual large-scale research project, carefully supervised by highly qualified scientists and teachers, giving a certain responsibility to the researcher at the initial stage for the choice of research areas, subjects and organization of time. Forms of study under the program are stationary, evening and extramural.</p>

Assessment	The overall assessment is formed on the basis of credit-examination sessions, graduate student certifications (twice a year) and preliminary research defense. The final evaluation and awarding of the diploma is an open dissertation defense.
6 – Software competencies	
Integral competence	The ability to solve complex problems in the field of professional, including research and innovation activities, which involves a deep rethinking of the existing and creation of new integral knowledge and/or professional practice
General competences (CG)	<ul style="list-style-type: none"> • Criticality and self-criticism skills, the ability to review publications and presentations, participate in international scientific discussions, expressing and defending one's own position. The ability to evaluate and ensure the quality of the work performed. (ZK1) • Justification and modeling of the research task on current problems from a scientific point of view. Formation of a systematic scientific worldview, professional ethics and a general cultural outlook. The ability to identify relevant problems and frame them in such a way as to advance and transform scientific knowledge and understanding. Ability to develop and manage projects. (ZK2) • Quality and ethical obligations. Knowledge of the standards and types of thinking required for scholarly research and publication, including critical awareness and intellectual honesty. (ZK3) • Communication. Ability to write and speak at a professional level using appropriate scientific terminology, both in the national language and in a foreign language (English). (ZK4) • Ability to work autonomously; the ability to manage one's own time, to distinguish the main and secondary in source, scientific material; education in the young researcher of relevant psychological traits - purposefulness, resilience, etc., in order to present the final version of the dissertation by the specified deadline. (ZK5) • Interpersonal skills. Cooperation in Ukrainian and international scientific circles, the ability to present one's research issues at the appropriate level in the environment of both scientists and non-specialists. (ZK6)
Professional competences of the specialty (FC)	<ul style="list-style-type: none"> • Knowledge base. Deep knowledge of chemical processes and phenomena, detailed knowledge of a special area of research. (FC1) • Information management. The ability to determine and deeply analyze scientific information in the field of chemistry from various sources, to compare the obtained data for their reliability and objectivity. (FC2) • Document analysis. Ability to find, select and interpret scientific materials in primary sources, databases and professional literature. (FC3) • Individual research. The ability to plan one's own research and, based on it, make a contribution to the development of chemical science. (FC4) • Ability to plan, organize and conduct a research chemical experiment. (FC5) • Ability to plan and carry out the educational process in institutions of higher education, reasonably choose and effectively use educational technologies, methods and teaching tools in order to ensure the planned personal and professional level of development. (FC6)
7 – Program learning outcomes	

	<ul style="list-style-type: none"> • The ability to combine (synthesize) and discuss publications within the limits of one's own research problem and outside it. (PRN1) • The ability to scientifically develop and present the results of research activities in a scientific environment. (PRN2) • Ability to carry out a completed original research based on the use of modern methods in scientific work. (PRN3) • Ability to present research results in scientific and non-scientific contexts, orally and in writing, in the form of scientific seminars, conferences. (PRN4) • Ability to present the results of own research in a foreign language. (PRN5) • Ability to prepare material on relevant scientific issues for publication of scientific articles, monographs, educational literature. (PRN6) • Awareness and ability to engage intellectually with the latest research in a specialized area of study. (PRN7) • Ability to use accounting information from Ukrainian and foreign archives, library catalogs and the latest ICT resources to locate sources and literature useful for one's own research. (PRN8) • The ability to choose and implement in practice promising scientific cooperation for the chosen direction of research. (PRN9) • Ability to use modern equipment and research methods to solve scientific problems. (PRN10)
8 – Resource support for program implementation	
Staff support	<p><u>of Chemistry and Food Safety of the ChNU</u>, which is responsible for the training of students of higher education, and by teachers from other faculties and institutes (economic - the Department of Economic Theory, Management and Administration ; the Faculty of Foreign Languages - the Department of Foreign Languages for Natural Sciences Faculties; the Institute of FTKN - the Department of Mathematical Problems of Management and Cybernetics ; the Philosophical and Theological Department - the Department of Philosophy).</p>
Material and technical support	<p>The available laboratory equipment of the chemical departments <u>of the Institute of biology, chemistry and bioresources</u> of the ChNU allows for the synthesis and research of substances and various physical indicators of semiconductor macro- and nanocrystals:</p> <ul style="list-style-type: none"> • automated installations for low- and high-temperature measurements of electrical conductivity and the Hall effect; • automated installations of differential thermal analysis (DTA) for carrying out measurements according to the standard scheme and under the control of the vapor pressure of the component; • author's computerized installation for layer-by-layer application of films (PPN-1); • a set of equipment for growing single crystals; • installations for chemical and chemical-dynamic polishing and etching of crystals; • gamma spectrometric installation AMA-03F • dosimeters-radiometers SRP-88 and Search MKC-07 • wide-profile microscope, equipped with a video camera; • metallographic MMR microscope equipped with a video camera; • microhardness tester PM-2 • Atomic force microscope NT-206 • Hewlett Packard gas chromatograph • C-115M atomic absorption spectrophotometer with a set of

	<p>lamps for determination of more than 40 chemical elements - 2 devices.</p> <ul style="list-style-type: none"> ● ellipsometer LEF-3m-1 ● spectrometer KFK-3 (UV and visible range); ● spectrophotometer MDR-2 (UV - visible - near IR region); ● spectrophotometer OceanOptics USB-650; ● spectrophotometer OceanOptics USB-2000 (visible - near IR region); ● Analyzer MilkotesterMaster ECO with attachments for ● determination of electrical conductivity and pH ● pH meters laboratory pH-150MI with combined electrodes ESC-10603/7 (ESK-10301/7) ● Refractometer digital manual BrixMilwaukee MA87• ● computerized ionometer I-160m. ● digital conductometers BANTE 520, Voltcraft ● digital potentiometers pH-150, LIDA, Voltcraft ● automated gas-liquid chromatographs LHM-80 ● Rotary evaporator RE-2000E ● a computer network consisting of 20 PCs ● laboratory instrument for technological operations; <p>The department has extensive relations with a number of scientific organizations of Ukraine and abroad, including access to the unique equipment of the MANSID center (Suceava, Romania), centers of collective use of equipment at LNU named after Ivan Franko and PNU named after V. Stefanyka</p> <p>All departments of the Institute of Biology, Chemistry and Bioresources are fully equipped with personal computers (over 50 pieces of technical equipment are installed in the institute in total), which are connected to a local network and connected to the Internet. At the graduate department, as well as in computer classes, there are WiFi wireless communication modules, which makes it possible to work in the network on portable PCs.</p>
<p>Informational and educational and methodological support</p>	<p>The university has access to Web databases of Science and Scopus. The scientific publication Visnyk ChNU, Series "Chemistry" is published, which is included in the list of the Ministry of Education and Culture. Work is underway to transfer it to category B.</p> <p>Periodically, a test subscription to the resources of world publishing houses of scientific periodicals and books is carried out. In particular, in 2020, such a subscription is valid for Wiley and Springer publications. Provision of textbooks, study aids, reference and other educational literature through library and department funds.</p> <p>The presence of an electronic resource of the educational institution, which contains educational and methodical materials from educational disciplines in the Moodle distance learning system.</p> <p>The ChNU scientific library constantly subscribes to specialized journals of the chemical profile of Ukrainian publishers. It also has a large fund of educational and teaching-methodical literature. Modern textbooks purchased as part of international projects are used to teach graduate students.</p>
<p>9 – Academic mobility</p>	
<p>National credit mobility</p>	<p>-</p>
<p>International credit mobility</p>	<p>International mobility is carried out within the framework of agreements</p>

	under the Erasmus+ program. Targeted agreements have been concluded with Charles University in Prague, University of Limerick (Ireland). Postgraduate students can also participate in exchanges announced under university-wide agreements.
Education of foreign students of higher education	The possibility of training foreign applicants is foreseen. All members of the project group and teachers speak English at a level not lower than B1 and have completed internships abroad.

**List of components of the educational-professional/scientific program
and their logical sequence**

Code n/a	Components of the educational program (Educational subjects, course projects (works), practices, qualification work)	Number of credits	Form summary _ control
1	2	3	4
Mandatory OP components			
Cycle of disciplines of general training			
OK 1.	Philosophy and methodology of science	4	Test
OK 2.	Academic writing and rhetoric of foreign language communication*	6	Assessment, exam
OK 3.	Organization of scientific activity:		
OK 3.1.	Project management	3	Test
OK 3.2.	Processing of experiment results	3	Test
Cycle of professional training disciplines			
OK 4.	Natural studies (scientific seminars on the topics of dissertation research)	4	Exam
OK 5.	Latest trends in modern chemistry	4	Exam
Cycle of practical training			
OK 6.	Assistant teaching practice	4	Test
The total volume of mandatory components:		28	
Selective OP components *			

Cycle of subjects of free choice of a graduate student			
VB 1.	Solid state chemistry	5	Exam
VB 2.	Technology and application of semiconductor materials	5	Exam
VB 3.	Synthesis and research methods of low-dimensional systems	5	Exam
VB 4.	Surface phenomena and dispersed systems	5	Exam
VB 5.	Atomic absorption spectroscopy for natural sciences	5	Exam
VB 6.	Nano photocatalysis	5	Exam
VB 7.	Kinetics of organic reactions	5	Exam
VB 8.	Methods of subtle organic synthesis	5	Exam
The total amount of sample components:		10	
GENERAL SCOPE OF THE EDUCATIONAL PROGRAM		38	

* two disciplines are selected from this list or a discipline from the "Master's" OP

<http://ibhb.chnu.edu.ua/dpt/inorgchem/navchalna-robota>

Form of attestation of applicants of higher education

Attestation of persons who obtain the degree of doctor of philosophy is carried out by a permanent or one-time specialized academic council of a higher education institution or scientific institution accredited by the National Agency for Quality Assurance of Higher Education, based on the public defense of scientific achievements in the form of a dissertation. The volume of the dissertation is 5-8 author's sheets.

The recipient of the Doctor of Philosophy degree has the right to choose a specialized academic council.

