NJSC «Kazakh National Research Technical University named after K.I. Satpayev»
Institute of Metallurgy and Industrial Engineering named after O.A. Baykonurov
Chair «Mine surveying and geodesy»

EDUCATIONAL PROGRAM
Doctor of Philosophy PhD in educational program "8D07306 - Geospatial Digital Engineering"

2st edition
in accordance with the State Educational Standard of Higher Education 2018

Almaty 2021

The program is compiled and signed by the parties:

From Satbayev university:	
1. Director of the Mining and Metallurgical Institute	Rysbekov K.B.
2. Head of the Department of Mine Surveying and Geodesy	Orynbassarova E.O.
3. Chairman of the E&M Council of the Department	Nukarbekova Zh.M.
From employers:	
Director Department of Thematic Digital Mapping and Monitoring of the geographical names database of the RSE "NKGF"	Kirghizbaeva D.M.
From the partner university (if available):	
International Educational Corporation	Candidate of Technical Sciences, assoc.prof. Kuznetsova I.A.

Approved at the meeting of the Academic Council of Satbayev University
Protocol No. 3 of 25/06/2021.

Qualification:
Level 8 of the National Qualifications Framework:
8D07306 Geospatial Digital Engineering.

Professional competence: Based on the obtained theoretical and practical knowledge of the doctoral program, it forms professional competencies: To justify, choose and implement a rational way to solve a production task. Substantiate the type and type of geodetic instruments and equipment for the rational production of measurements and possess methods and techniques of working on them. To solve standard scientific tasks; to carry out educational and pedagogical activities on credit technology of training; to know the methods of teaching professional disciplines; the use of modern information technologies in the educational process; possess in-depth knowledge necessary for everyday professional and scientific activities.

Content

1 Normative references

Table 1 - List of regulatory and other documents, references to which are present in the document

№	Title of document	Storage link
1	The Law of the Republic of Kazakhstan "On Education" with amendments and additions within the framework of legislative changes to increase the independence and autonomy of universities from 04.07.18, No. 171-VI	Office Registrar (OR) http://online.zakon.kz/Document/?doc_id=30118747
2	State compulsory standard of higher education (Appendix 7 to the order of the Minister of Education and Science of the Republic of Kazakhstan dated 31.10.18, No. 604	OR http://online.zakon.kz
3	European Qualifications Framework for Higher Education	OR http://ecahe.eu/w/images/7/76/A_Framework_for_Qualifications_for_the_European_Higher_Education_Area.pdf
4	Dublin descriptors	http://ecahe.eu/w/index.php/Dublin_Descriptors
5	GOST 3.1105-2011 Unified system for technological documentation (ESTD). Forms and rules for drawing up general documents	http://online.zakon.kz/document/?doc_id=31194118
6	Satbayev University regulatory documents	Internal Audit Department

2 Abbreviations, terms and definitions used

Table 2 - Abbreviations used

Abbreviations	Full name
ECTS	European credits accumulation and transfer system
SU	NJSC Satbayev university
MES RK	Ministry of Education and Science of the Republic of Kazakhstan
PTS	Professor-teaching staff
EP	Educational program
OR	Office Registrar
WCP	Working curriculum plan EP

Table 3-Terms and definitions used in the document text

Term	Definition
Dublin descriptors (Dublin descriptors)	An integral part of the European framework for higher education qualifications describing the degree of development of competencies

Competencies (Competency)	The ability of students to apply the knowledge, skills and abilities acquired in the course of training in professional activities
Control (Audit)	Qualitative characteristics of the student assessment system
Credit technology of education (Credit Education)	Learning based on the choice and self-planning of the student learning sequence of disciplines using credit as a unified unit of measurement of the volume of educational work of the student and teacher
Matrix of Competencies (Matrix of Competencies)	Based on Dublin descriptors describing the depth of competence development within the EP
Modular training (Cycle)	Segment of mastering and the depth of mastering by a student of competencies with an intermediate completed cycle
Educational program or EP (Curriculum)	Description of the educational process based on the achievements of learning outcomes and competencies for obtaining a recognized diploma in a specific area of professional activity
Learners (students)	Persons enrolled in the undergraduate program
Assessment (Assessment)	Quantitative characteristics of the student's assessment system
Applied Bachelor general engineering (Associate Degree, Short Cycle)	Completion of the minimum undergraduate degree with at least 124 credits of theoretical study
Working curriculum plan (Curriculum)	A document containing a complete list of academic disciplines of a compulsory component and an optional component, indicating the number of credits, the sequence of study of disciplines, types of training and forms of control
Framework of Competencies (Framework of Competencies)	Based on Dublin descriptors describing the depth of competence development
Outcome results (Outcome results)	Knowledge, abilities, skills, qualifications, competence
Sub-competency (Sub-competency)	The ability of students to apply the knowledge, skills and abilities acquired in the learning process within the framework of a certain competence
Graduate (Graduate)	Persons from among the students (students) who have successfully mastered the full theoretical course of study

3 Brief description of the program

The goal of the program is to train scientific and scientific-pedagogical, highly qualified specialists with world-class competencies in the field of geodesy based on the integration of fundamental engineering and technical education with research and development.

The objectives of the EP in the direction of "Geospatial Digital Engineering" are formulated based on the conditions of the external environment and the need to position the program as a competitive educational product in the world market. They are determined by the competencies acquired by graduates in the process of mastering the program at the university, and provide consumers with information about the areas of professional training, the profile of the program and the types of professional activities for which graduates of this educational doctoral program are preparing.

Preparing a graduate for activities for continuous self-improvement and self-development, mastering new knowledge, abilities and skills in innovative areas of geodesy.

Preparation of a graduate with acquired competencies in performing calculations of elements of geodesy and cartography, design of technical solutions, participation in the development of technical specifications for topographic-geodetic, aerospace, cartographic work based on a modern educational material and technical base.

Preparation of a graduate competent in production and management, design and engineering, organizational and technological and scientific and pedagogical fields on the basis of modern teaching aids of information technology and information resources.

Preparation of a graduate as a competitive specialist in the field of geodesy, including on the basis of an increase in the international aspect in educational, scientific programs, competent in the field of advanced technologies of geodesy, the implementation and registration of the results of scientific research.

Types of work

A feature of this master's program is the preparation of graduates capable of conducting the following types of professional activities:

- pedagogical;
- research;
- organizational and managerial;
- production and technological.

Objects of professional activity

– The area of professional activity of PhD doctors in the field of "Geospatial Digital Engineering" includes production, pedagogical and research activities containing a set of tools, techniques, methods and methods of human activity aimed at effective and safe digital geospatial technology, modern high-precision instruments. Requirements for professional activity, a doctoral student must be competent:

– use of normative and legal documents in the field of geodesy, conduct a dialogue-dialogue in the state and foreign languages, using the rules of speech etiquette, read special literature without a dictionary in order to search for information, make annotations, abstracts and business letters in a foreign language;

– possession of knowledge of the methodology of organizing and conducting scientific research and skills in its implementation;

– in-depth study of methods and means of mathematical processing of the results of geodetic measurements;

– in-depth study of methods of operation of modern geodetic, photogrammetric complexes and other special equipment;

– possession of knowledge of modern, innovative processes in technical education, effective educational technologies, experience of countries in their implementation;

– possessing a holistic view of the trends and directions of development of scientific research in a specific area of interest, prospects for their commercialization, risks and opportunities;

– possession of knowledge and skills in modeling deformation processes, including forecasting.

4 Scope and content of the program

The educational program for the preparation of a Doctor of Philosophy (PhD) has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere.

The educational program for the training of a doctor in the profile assumes fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the branches of the national economy, the social sphere: education, medicine, law, art, economics, business administration and in the field of national security and military affairs.

Educational programs for doctoral studies in terms of vocational training are developed on the basis of studying the experience of foreign universities and research centers that implement accredited training programs for PhD doctors or doctors by profile.

The content of the educational program of specialized doctoral studies is established by the university independently.

The main criterion for the completeness of the educational process for the preparation of doctors of philosophy (PhD) (doctor in the profile) is the mastering of at least 180 academic credits by a doctoral student, including all types of educational and scientific activities.

The term of study in doctoral studies is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a PhD or profile, the doctoral educational program is considered fully mastered.

The training of personnel in doctoral studies is carried out on the basis of educational master's programs in two directions:

1) scientific and pedagogical with a training period of at least three years;

2) specialized with a training period of at least three years.

Objectives of the educational program:

Objective 1: The readiness of specialists for research and design work in the field of geodesy, cartography, geoinformatics, including in related fields, related to the selection of the necessary research methods, modification of existing and development of new methods based on the tasks of a specific research.

Objective 2: The readiness of specialists for production and technological activities, ensuring the introduction of new digital developments at the local level.

Objective 3: The readiness of specialists to search for and receive new information necessary to solve professional problems in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

Objective 4: The readiness of specialists for scientific, informational, ideological and problem communications in a professional environment and in an audience of non-specialists with a clear and deep justification of their position, engage in organizational, managerial and service activities, be aware of the responsibility for making their professional decisions.

Objective 5: The readiness of specialists for self-study and continuous professional development throughout the entire period of scientific or professional activity.

5 Requirements for applicants

Persons with a Master's degree and work experience of at least 1 (one) year or who have completed residency training are admitted to doctoral studies.

Enrollment in the number of doctoral students is carried out by the admissions committees of universities and scientific organizations based on the results of the entrance exam for the groups of doctoral studies and a certificate confirming proficiency in a foreign language in accordance with the common European competences (standards) of proficiency in a foreign language.

When enrolling in universities, doctoral students independently choose an educational program from the corresponding group of educational programs.

The enrollment of persons for the targeted training of doctors of philosophy (PhD) under the state educational order is carried out on a competitive basis.

The procedure for admitting citizens to doctoral studies is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of the contingent of doctoral students is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. Citizens of the Republic of Kazakhstan are provided with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance" the doctoral student must have all the prerequisites necessary for mastering the relevant professional doctoral curriculum. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the doctoral student is allowed to master them on a paid basis. In this case, doctoral studies begin after the doctoral student has fully mastered the prerequisites.

6 Requirements for completing studies and obtaining a diploma

Persons who have mastered the educational program of doctoral studies and defended their doctoral dissertation, with a positive decision of the dissertation councils of a university with a special status or the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, based on the results of the examination, are awarded the degree of Doctor of Philosophy (PhD) or Doctor of Science in profile and issued a state diploma with an attachment (transcript).

Persons who have received a PhD degree, to deepen scientific knowledge, solve scientific and applied problems on a specialized topic, carry out a postdoctoral program or conduct research under the guidance of a leading scientist chosen by the university.

6.1 Requirements for key competencies of doctoral graduates:

1) have an idea:

– about the main stages of development and the change of paradigms in the evolution of science;

– on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences;

– about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;

– on the scientific concepts of world and Kazakh science in the relevant field;

– on the mechanism of implementation of scientific developments in practice;

– about the norms of interaction in the scientific community;

– about the pedagogical and scientific ethics of the scientist-researcher.

2)) know and understand:

– modern trends, directions and patterns of development of domestic science in the context of globalization and internationalization;

– methodology of scientific knowledge;

– achievements of world and Kazakh science in the relevant field;

– (to understand and accept) the social responsibility of science and education;

– perfect foreign language for scientific communication and international cooperation;

– scientific foundations of the application of geospatial data for the design, development and creation of a database.

3) be able to:

– organize, plan and implement the process of scientific research;

– analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;

– analyze and process information from various sources;

– to conduct an independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;

– generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;

– to choose and effectively use modern research methodology;

– to plan and predict their further professional development;

– to apply modern systems of accumulation, processing, storage, transmission and analysis of geodetic information to solve applied and research problems in the field of geodesy;

– model geospatial data for problem solving.

4) have skills:

– critical analysis, assessment and comparison of various scientific theories and ideas;

– analytical and experimental scientific activities;

– planning and forecasting research results;

– oratory and public speaking at international scientific forums, conferences and seminars;

– scientific writing and scientific communication;

– planning, coordinating and implementing research processes;

– a systematic understanding of the field of study and demonstrate the quality and effectiveness of the selected scientific methods;

– participation in scientific events, fundamental scientific domestic and international projects;

– leadership management and team leadership;

– responsible and creative attitude to scientific and scientific-pedagogical activities;

– conducting patent search and experience in transferring scientific information using modern information and innovative technologies;

– protection of intellectual property rights to scientific discoveries and developments;

– free communication in a foreign language.

5) be competent:

– in the field of scientific and scientific-pedagogical activity in conditions of rapid renewal and growth of information flows;

– in carrying out theoretical and experimental scientific research;

– in the formulation and solution of theoretical and applied problems in scientific research;

– in conducting a professional and comprehensive analysis of problems in the relevant area;

– in matters of interpersonal communication and human resource management;

– in matters of university training of specialists;

– in the examination of scientific projects and research;

– in ensuring constant professional growth.

6.2 Requirements for SRWD student under the Ph.D. program (PhD):

1) compliance with the main problems of the educational program of doctoral studies, on which the doctoral dissertation is being defended;

2) is relevant and contains scientific novelty and practical significance;

3) is based on modern theoretical, methodological and technological achievements of science and practice;

4) is based on modern methods of data processing and interpretation using computer technology;

5) carried out using modern scientific research methods;

6) contains research (methodological, practical) sections on the main protected provisions.

6.3 Requirements for organizing practices:

The practice is carried out with the aim of developing practical skills in scientific, scientific, pedagogical and professional activities.

The educational program of doctoral studies includes:

1) teaching and research practice - for students under the Ph.D. program;

2) industrial practice - for students under the program of specialized doctoral studies.

During the period of pedagogical practice, doctoral students, if necessary, are involved in conducting classes in undergraduate and graduate programs.

The research practice of a doctoral student is carried out with the aim of studying the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as consolidating practical skills, applying modern methods of scientific research, processing and interpreting experimental data in the dissertation research.

The industrial practice of a doctoral student is carried out in order to consolidate the theoretical knowledge gained in the training process and improve the professional level.

The content of research and industrial practice is determined by the topic of the doctoral dissertation.

7 Working curriculum plan of the educational program

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
Non-profit Joint Stock Company "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATBAYEV"

SATBAYEV UNIVERSITY

Approved By
Rector of the Non-profit Joint Stock Company KazNRTU named after
M.Zh.Beremtayev
"25" 06 2021

WORKING CURRICULUM

Education Program 8D07306- "Geospatial digital engineering"
Group of Educational Programs D123 - "Geogeziy"
enrolment for 2021- 2022 academic year

Academic Degree: Doctor of Philosophy (PhD)
Term of study: 3 years

year of study	Code	Name of course	Cycle	Total Credits	Total hours	kc/lab/pr	SRS (including SRSP), in hours	Prerequisites	Code	Name of course	Cycle	Total Credits	Total hours	kc/lab/pr	SRS (including SRSP), in hours	Prerequisites
		1 semester								2 semester						
1	MET322	Research methods	BD IC	5	150	2/0/1	105		AAP345	Doctoral student research work, including internships and doctoral dissertations	DSRW	24			105	
	LNG305	Academic writing	BD IC	5	150	2/0/1	105		AAP350	Pedagogical practice	BD	10				
	MAP326	Mathematical modeling of deformation processes	BD OC	5	150	1/0/2	105									
	MAP327	Geoinformation analysis for scientific research	PS OC	5	150	1/0/2	105									
	MAP328	Theory of the figure of the Earth	PS OC	5	150	1/0/2	105									
		In total		25						In total		34				
		3 semester								4 semester						
2	AAP345	Doctoral student research work, including internships and doctoral dissertations	DSRW	24					AAP346	Doctoral student research work, including internships and doctoral dissertations	DSRW	25				
	AAP349	Research scientific training	PS	10												
		In total		34						In total		25				
		5 semester								6 semester						
3	AAP346	Doctoral student research work, including internships and doctoral dissertations	DSRW	25					AAP346	Doctoral student research work, including internships and doctoral dissertations	DSRW	25				
									ECA303	Writing and defending doctoral dissertation	FA	12				
		In total		25						In total		37				
										In all		180				

Number of credits for the whole period of study	
Cycles of disciplines	Credits
The cycle of general education	0
A cycle of basic disciplines (BD IC, BD OC)	25
A cycle of principal subjects (PS IC, PS OC)	28
All on the theoretical classes:	53
DSRW	115
Registration and defense of the master's thesis (IIa)(MT)	12
In total:	180

Decision of the Academic KazNRTU named after K.Satpayev # 3, dated 25 06 2021
Decision of the Academic Board of the Institute _____ Protocol No. ___ of "___" _____ 20__
Vice-Rector for Academic Affairs B.A.Zhautikov
Director of the Institute of Geology, Oil and Mining A. Syzdykov
Head of the Department " Mine surveying and geodesy" E. O. Orynbassarova

MODULAR CURRICULUM

Education program **8D07306- "Geospatial digital engineering"**

Form of education: Full-time Duration: 3 years Academic degree: Doctor of philosophy PhD

The cycle	code	Name of disciplines	Semester	Acad. credits	lec.	lab.	prac	IWS	Type of control	Chair
Profile training module (30 credits)										
Basic disciplines (BD)										
University component										
BD 1.1.1	MET321	Research methods	1	6	2	0	1	3	Exam	
BD 1.2.1	LNG304	Academic writing	1	6	2	0	1	3	Exam	
Choice component										
BD 1.2.2	MAP3232	Mathematical modeling of deformation processes of engineering structures	1	6	2	0	1	3	Exam	
Practice-oriented module										
BD	AAP350	Pedagogical practice	2	10					Report	
Major disciplines (MD)										
Choice component										
MD 1.3.1	MAP3242	Geomatics in Geospatial Data Research	1	6	2	0	1	3	Exam	
MD 1.3.2	MAP3212	Modern geodetic methods for creating a coordinate base	1	6	2	0	1	3	Exam	
Practice-oriented module										
MD	AAP349	Research scientific training	3	10					Report	
Research Module										
DSRW	AAP345	Doctoral student research work, including internships and doctoral dissertations	2	24					Report	
DSRW	AAP345	Doctoral student research work, including internships and doctoral dissertations	3	24					Report	
DSRW	AAP346	Doctoral student research work, including internships and doctoral dissertations	4	25					Report	

DSRW	AAP346	Doctoral student research work, including internships and doctoral dissertations	5	25					Report	
DSRW	AAP346	Doctoral student research work, including internships and doctoral dissertations	5	25					Report	
Final attestation module										
FA	ECA303	Writing and defending doctoral dissertation	6	12						
		Total		**185**						

8 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The third level descriptors within the Comprehensive Qualifications Framework of the European Higher Education Area (EC-EHEA) reflect learning outcomes that characterize the student's abilities:

1) demonstrate a systematic understanding of the field of study, mastering the skills and research methods used in the field of geodesy;

2) Demonstrate the ability to think, design, implement and adapt an essential research process with a scientific approach;

3) contribute with their own original research to expand the boundaries of the scientific field, which deserves publication at the national or international level;

4) critically analyze, evaluate and synthesize new and complex ideas;

5) communicate their knowledge and achievements to colleagues, the scientific community and the general public;

6) to promote, in an academic and professional context, the technological, social or cultural development of a knowledge-based society.

General human, social and ethical competences (GHSEC)	
G-1	Have an understanding of the pedagogical and scientific ethics of the scientist-researcher
G-2	Have an understanding of the norms of interaction in the scientific community
G-3	Know and understand the methodology of scientific knowledge
G-4	Ability to critically use the methods of modern science in practice
G-5	Generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge
Special and management competencies (SMC)	
S-1	To independently manage and control the processes of work and educational activities within the framework of the strategy, policy and goals of the organization, discuss problems, argue conclusions and competently operate with information
S-2	Organize the activities of the production team, make organizational and managerial decisions in the context of different opinions and assess the consequences of decisions made
S-3	Conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis
S-4	Willingness to lead and participate in the preparation of projects in the field of geodesy for various purposes
S-5	Ability to generate and implement scientific ideas in the field of geomatics using programming languages
Professional competence (PC)	

PC-1	Analyze the state of a scientific and technical problem and determine the goals and objectives of designing robotic and mechatronic systems based on the study of world experience
PC-2	To develop and improve theoretical and methodological approaches to the integrated use of geodetic, gravimetric and satellite technologies
PC-3	To develop a methodology for conducting theoretical and experimental research using modern systems for accumulation, processing, storage, transmission and analysis of geodetic information for solving applied and research problems in the field of geodesy
PC-4	Build mathematical models to analyze and optimize geospatial data
PC-5	Create geodetic bases for various purposes using modern measurement methods
PC-6	Apply the scientific foundations of geospatial data to design, develop and create a database

9 ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Supplement is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma will be required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

10 Matrix of competencies of the educational program 8D07306 "Geospatial digital engineering"

Discipline index	Name of disciplines	P1	P2	P3	P4	P5	P6	G1	G2	G3	G4	G5	S1	S2	S3	S4	S5
LNG305	Academic writing							x				X					
MET322	Research methods									X	X	X			X		
MAP326	Mathematical modeling of deformation processes of engineering structures	X			X		X						X		X		
MAP327	Geoinformation analysis for sciencific research		X	X			X									X	X
MAP328	Teory of the figure of the Earth		X			X								X			
ECA303	Writing and defending a doctoral dissertation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

11 Brief descriptions of disciplines
Scientific research methods
CODE – MET322
КРЕДИТ – 5 (2/0/1)

PURPOSE AND TASKS OF THE COURSE

The purpose of the discipline is to develop doctoral students' skills and abilities in the field of methodology of scientific knowledge. The objectives of studying this discipline are: - Mastering the methodological foundations of scientific knowledge and creativity; - Gaining knowledge in the field of similarity and modeling of physical processes, computational experiment; - mastering the technique of setting up an optimal experiment and processing measurement results.

BRIEF DESCRIPTION OF THE COURSE

The concept of methodology as a system of principles and methods of organization, construction of theoretical and practical activities. The concept of "activity". Structural components of activity. Scientific foundations of the methodology of science. Scientific knowledge and scientific research. Science as a social institution. General laws of the development of science. The structure of scientific knowledge. Scientific profiles and their relationship with extra-scientific professional (including teaching) activities. Opportunities for changing the scientific profile of a professional activities. Criteria for the scientific character of knowledge. Classification of scientific knowledge. Theoretical and empirical research, their relationship. Fundamental and applied research. Forms of organization of scientific knowledge.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

doctoral student should know:

- features of the choice of the direction of scientific research and the stages of its implementation;
- tasks and methods of theoretical research;
- classification, types and objectives of experimental research; - information support of scientific research;

A doctoral student must be able to:

- to analyze the trends of modern science, to determine the promising directions of scientific research in the subject area of professional activity, the composition of research papers, which determine their factors;
- to use experimental and theoretical research methods in professional activities;
- to adapt modern achievements of science and science-intensive technologies to the educational and self-educational process;

- work with natural science literature of different levels (popular science publications, periodicals), including in foreign languages.

must own:

- modern methods of scientific research in the subject area;
- ways of comprehending and critical analysis of scientific information; - skills to improve and develop their scientific potential.

Academic writing
CODE – LNG305
CREDIT – 5 (2/0/1)

PURPOSE AND TASKS OF THE COURSE

The aim of the course "Academic writing" is the formation of professional competence and the expansion of communicative competence associated with analytical textual activity; the formation of students' skills of linguistic and pragmatic thinking, the ability to analyze expressive units of the language and competently select the desired unit, depending on the goals and conditions of communication. The aim of the course is to improve the ability to write scientific articles for subsequent publication in international scientific journals.

The objective of the course is to acquaint with the peculiarities of academic genres (annotations, abstract, analytical review, as well as messages about a scientific event (conference)); define the main goals of analytical word processing; teach to analyze texts on professional topics.

BRIEF DESCRIPTION OF THE COURSE

The Academic Writing course teaches effective academic writing using practical examples and exercises. Academic writing skills are required for academic staff and university students for publications in foreign scientific journals, participation in international scientific conferences, master's or doctoral studies at a foreign university within the framework of academic mobility programs.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

The doctoral student should know:

- the goals and objectives of analytical processing of texts in the modern information space;
- genre and stylistic characteristics of annotation, abstract, analytical review, scientific communication;
- the principles of the communicative organization of annotation and abstract; - rules for writing reviews; be able to:
- conduct a stylistic analysis of scientific, scientific and technical and popular science texts,
- to determine the stylistic and genre affiliation of the text in the sphere of professional information;
- highlight the style-forming elements of texts,
- carry out a semantic analysis of the text and highlight its keywords;
- determine the means of speech expression;

- transfer the content of texts in the form of annotations, abstracts, reviews; own:
- methods of semantic analysis of the text;
- the method of communicative analysis of the text; - genres of annotation and abstract.

Mathematical modeling of deformation processes of engineering structures
CODE – MAP326
CREDIT – 5 (1/0/2)

BRIEF DESCRIPTION OF THE COURSE

As part of the doctoral course, he will master the practical use of future highly qualified specialists based on the systematization and integration of pedagogical, professional knowledge, skills and value orientations, ready for scientific, scientific, methodological and teaching activities in the field of mathematical modeling of deformation processes of engineering structures.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

After completing the course, the student must demonstrate the ability to analyze, synthesize and design mathematical modeling of deformation processes in engineering structures, as well as calculate costs.

A doctoral student must **be able to**:

- to choose and apply experimental and theoretical theoretical research methods in professional activity:
- to develop new technologies for performing geodetic stake out works using modern technologies for the construction of engineering structures;
- apply the knowledge gained to carry out projects to create digital three-dimensional models of objects, processes and phenomena based on geodetic and other data.

At the end of the course, the student **should know**:

- methodology, specific methods and techniques of research work;
- basic concepts and information about geosystems, geophysical fields and geomodeling and a technological scheme for monitoring the movement of the earth's crust;
- the basics of mathematical modeling for the creation and analysis of digital three-dimensional models of technological objects, processes and phenomena using geodetic data.

Geoinformation analysis for sciencific research
CODE – MAP327
CREDIT – 5 (1/0/2)

PURPOSE AND TASKS OF THE COURSE

The goal of mastering the discipline " Geoinformation analysis for sciencific research" is - obtaining knowledge by doctoral students about methods of collecting, processing and visualizing geospatial data (structure, connections, dynamics, functioning in space-time) through computer modeling based on databases and geographical knowledge, in other words, geographical information systems (GIS).

BRIEF DESCRIPTION OF THE COURSE

As part of the course, the student will master the practical use of software for processing geospatial data and the Python programming language for solving geomatics problems. Basic knowledge and skills in the field of geomatics, as well as methods of processing, data analysis will be presented.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

A doctoral student **must be able to:**

-formalize the task; choose the necessary theoretical and instrumental means for the development and research of the results obtained in the course of modeling;

-compose, test, debug and modernize the developed models;

-use a mathematical-statistical approach to spatial problems, including methods from geographic information systems and packages for statistical data processing.

must know:

- basic approaches to organizing the processing of spatial measurements.

-the process of creating information systems of mathematical models;

-popular programming systems;

-programming methods and methods for developing effective algorithms for solving applied problems;

- the main stages of the process of developing mathematical models, possible various methods of their creation and posing questions to which the models can give an answer;

own:

- knowledge in the field of geoinformatics and modern geoinformation technologies:

-methods and technologies for processing spatial geographic, including aerospace information;

Teory of the figure of the Earth
CODE - MAP328
CREDIT – 5 (1/0/2)

PURPOSE AND TASKS OF THE COURSE

The purpose of teaching the discipline " Teory of the figure of the Earth" is to teach future specialists the basics of theoretical and practical knowledge about the means and methods of setting high-precision geodetic measurements on the ground when creating, developing and reconstructing satellite geodetic networks and geodetic networks for special purposes.

BRIEF DESCRIPTION OF THE COURSE

The aim of teaching the discipline " Teory of the figure of the Earth" is to teach future specialists the basics of theoretical and practical knowledge: about the means and methods of setting high-precision geodetic measurements on the ground in the creation, development and reconstruction of state geodetic networks and geodetic networks for special purposes; on the methods and methods of mathematical processing of the results of field geodetic measurements in the gravitational field of the Earth in order to determine the planned-height position of points in various coordinate systems and heights; about the geometry of the earth's ellipsoid; on the shape, size and gravitational field of the Earth, on the reduction problem, on the organization of geodetic monitoring of geodynamic processes, on the assignment of geocentric and reference coordinate systems.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Students will know:

- Methods for constructing state geodetic and special high-precision networks, methods for designing them, creating and fixing them on the ground;
- means and methods for setting high-precision geodetic measurements on the ground when building geodetic reference networks;
- methods for determining the shape of the Earth and its gravitational field;
- methods of mathematical processing of high-precision planned and high-altitude networks;
- determination of fundamental geodetic constants;
- assignment of geocentric and reference coordinate systems, determination of their mutual position and distribution on the territory of states, regions and the Earth's surface as a whole;
- determination of the parameters of geodynamic phenomena.

Students will be able to:

- design and preliminary assessment of the accuracy of geodetic reference networks;

- high-precision measurements of horizontal angles, zenith distances, high-precision geometric leveling; carry out appropriate measurements using modern instruments;

- mathematical processing of the results of high-precision geodetic measurements using complex software.

Teaching practice
CODE - AAP350
Credit-10

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of pedagogical practice: formation and development of professional skills of a doctoral student as a teacher of Higher education; mastering the basics of pedagogical skills, skills and abilities of independent conduct of educational work.

Doctoral students as future teachers of Higher education should be guided in the problems of organizing educational work, searching for new innovative approaches to teaching and educating students in the conditions of institutions of higher professional education in accordance with the trends and directions of development of modern education.

Tasks of pedagogical practice:

- to form a clear understanding of the planning of the content of the educational process of the Department;;
- improvement of analytical and professional activity of teachers;
- improve the skills of conducting training sessions with students;
- improve the skills of developing educational and methodological literature;
- to form an adequate self-assessment, responsibility for the results of their work.

BRIEF DESCRIPTION OF THE COURSE

Pedagogical practice of doctoral students is a practical training of future teachers, conducted in conditions as close as possible to the professional activity of a teacher. In the process of teaching practice, the professional and personal development of future teachers is activated. During the practice, doctoral students make and implement a plan of educational activities with a group of students, develop and conduct a system of classes that reflect the completed segment of the educational process based on the content of specialized disciplines, demonstrate their knowledge of modern technologies and teaching methods.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

To perform the program of pedagogical practice, the doctoral student must have knowledge in the field of pedagogy and technology of vocational training, psychology of adult education.

Pedagogical practice equips doctoral students with the necessary experience of professional and pedagogical activity and involves mastering the following professional and pedagogical skills:

- navigate the organizational structure and regulatory documentation of the vocational education institution;
- to be guided in the theoretical foundations of the science of the subject being studied;
- didactically transform the results of modern scientific research in order to use them in the educational process;;
- independently design, implement, evaluate and adjust the educational process;;
- use modern innovations in the process of professional training;
- master the methods of self-organization of activity and improvement of the teacher's personality ; ;
- build relationships with colleagues, find, make and implement management decisions in their scientific and pedagogical practice ; ;
- master the conduct of various types of classes with students in a given academic discipline;
- master the culture of speech and communication.

Research work of a doctoral student including passing an internship and completing a doctoral dissertation

CODE - AAP345

CREDIT – 24

PURPOSE AND OBJECTIVES OF THE COURSE

The objectives of the research internship are:

- formation of professional and research competencies that contribute to the qualified conduct of scientific research within the chosen topic of the dissertation research;
- study of the latest theoretical, methodological and technological achievements of domestic and foreign science;
- consolidation of practical skills and application of modern methods of scientific research, analysis, processing and interpretation of experimental data in the dissertation research.

The main task of the research practice is the acquisition of doctoral students ' experience in conducting research and mastering such skills as:

- identification and formulation of current scientific problems;
- development of research and development programs, organization of their implementation;
- development of research methods and tools and analysis of their results;
- development of organizational and managerial models of processes, phenomena and objects, evaluation and interpretation of results;
- search, collection, processing, analysis and systematization of information on the research topic;
- practical participation in the research work of research teams;
- preparation of scientific reviews, reports, publications.

BRIEF DESCRIPTION OF THE COURSE

Research practice is a mandatory component of the doctoral program and is a type of practical activity related to the conduct of scientific research within the chosen topic of dissertation research, the preparation of scientific publications and the analytical part of the dissertation work.

Research practice of doctoral students is aimed at deepening and systematization of theoretical and methodological training of doctoral students, as well as at the formation and development of research competencies necessary for the analysis of modern scientific achievements, the use of research methods in solving practical scientific problems.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

To prepare for a scientific study, a doctoral student should study:

- methods of research and experimental work;
- rules of operation of research equipment;
- methods of analysis and processing of experimental data;
- physical and mathematical models of processes and phenomena related to the object under study;
- information technologies in scientific research, software products related to the professional sphere;
- requirements for the design of scientific and technical documentation;
- the procedure for implementing the results of scientific research and development.

At the same stage, the doctoral student develops a methodology for conducting the experiment.

Conducting an experimental study.

At this stage, the doctoral student assembles an experimental setup, installs the necessary equipment, develops a computer program, and conducts an experimental study.

Processing and analysis of the results obtained.

At this stage, the doctoral student conducts statistical processing of experimental data, draws conclusions about their reliability, analyzes them, and checks the adequacy of the mathematical model.

Innovative activity.

The doctoral student analyzes the possibility of implementing the research results, using them to develop a new or improved product or technology. Prepares an application for a patent, for participation in the competition of scientific works, an article for publication.

12 Writing and defending a doctoral dissertation
CODE – ECA303
CREDIT –12

PURPOSE AND TASKS OF THE COURSE

The purpose of the doctoral dissertation is to assess the scientific-theoretical and research-analytical level of the doctoral student, the formed professional and managerial competencies, the readiness to independently perform professional tasks and the compliance of its preparation with the requirements of the professional standard and the educational program of doctoral studies.

BRIEF DESCRIPTION OF THE COURSE

Doctoral dissertation is a scientific work of a doctoral student, which is an independent study, in which theoretical provisions are developed, the totality of which can be qualified as a new scientific achievement, or a scientific problem is solved, or scientifically grounded technical, economic or technological solutions are set forth, the implementation of which makes a significant contribution to development the country's economy.

Doctoral dissertation is the result of the research / experimental research work of a doctoral student, carried out during the entire period of study of a doctoral student.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

– The defense of a doctoral dissertation is the final stage of the master's preparation. A master's thesis must meet the following requirements:

– The topic of the dissertation should be related to priority areas of development of science and / or government programs or programs of fundamental or applied research.

– The content of the thesis, the goals and objectives, the scientific results obtained must strictly correspond to the topic of the thesis.

– The dissertation is carried out in compliance with the principles of independence, internal unity, scientific novelty, reliability and practical value.