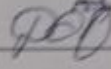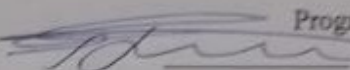NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Geoinformatics and Aerospace Research of the Earth

"CONFIRMED"

Dean of the Faculty of Land management

_____ T.O. Ievsiukov

«18» May 2023

"APPROVED"

at the meeting of the department of Geoinformatics
and Aerospace Research of the Earth
Protocol № 11 from 14 April 2023

head of Department

_____ O. P. Drozdivskyi

"REVIEWED"

Program Coordinator

_____ I.P. Kovalchuk.

PROGRAM OF THE COURSE

COMPUTER-AIDED LAND CADASTRAL SYSTEMS

Specialization	193. Geodesy and Land management
Educational program	"Geodesy and Land Management"
Faculty	Land Management
Developers	Dr. Sci., Prof. Kokhan S.S.
	Dr. Sci., Associate prof., Koshel A.O.

Kyiv – 2023

1. Descreption of the course
COMPUTER-AIDED LAND CADASTRAL SYSTEMS

Industry knowledge training direction, specialty, education level	
Educational qualification	Bachelor
Specialty	193 Geodesy and Land management
Educational program	Geodesy and Land management
Description of the course	
Type	Sample
Total number of hours	87
Number of credits ECTS	3
Number of content modules	2
Course project (work)	-
Form of Control	Final test
Descriptions of the course for full-time and distance learning	
	Full-time
Year of training	3
Semester	2
Lectures	14
Practical, seminars	-
Laboratory studies	28
Independent work	45
Individual tasks	-
Number of weekly hours for full-time study: classroom	3

2. Task and purpose of the discipline
Computer-aided land cadastral systems

Discipline " Computer-aided land cadastral systems " provides the ability to create software and hardware geoinformation complex for recording, storage, display, analysis, geodata modeling of the State Land Cadastre.

Aim

The purpose of the course is to master and acquire the necessary theoretical knowledge and practical skills in the field of geoinformation support of the state land cadastre and knowledge formation on the development of geoinformation land cadastral national systems of Ukraine and the world, the contribution of Ukrainian and foreign scientists.

Task

The task of studying the discipline is to form a specialist's theoretical knowledge and practical skills of geoinformation support of land cadastral works for planning the development of territories, inventory of land resources, forecasting the state of the land fund, control over the use and protection of soils.

As a result of studying the discipline the student must know:
- basics of building land information systems. Basic concepts of geoinformation support of land cadastre;
- regulatory and legal support and standardization of components of geographic information land cadastral systems;
- equipment and software for the implementation of geographic information land cadastre system.
- information modeling;
- models of databases and data banks;
- functions of land information systems;
- information base of the National Cadastral System (hereinafter NCS;
- the concept of creating NCS;
- basics of analysis and cartographic modeling;
- cartographic support of DZK, cartographic projections and coordinate systems;
- basics of creating land cadastral information;
- methods and techniques of geoinformation processing of land cadastral information, methods of analysis, modeling, forecasting and updating of data;

As a result of studying the discipline the student must be able to:
- use hardware and software to solve practical problems of maintaining a geographic land cadastral system;
- collect geographical information;
- define point, linear objects and objects in the form of polygons based on their attributes;
- use hardware and software geoinformation software to solve practical problems aimed at conducting information technology processes related to the use of data of the state land cadastre;
- be able to apply geographic information cadastral systems for the purpose of feasibility study of use and protection of land resources.

The discipline provides the formation of a number of competencies:
general competencies:
- ZK01. Ability to learn and master modern knowledge;
- ZK02. Ability to apply knowledge in practical situations;
- ZK05. Ability to communicate in a foreign language;
- ZK07. Ability to work autonomously;
- ZK08. Ability to work in a team;

- ZK12. The ability to exercise one's rights and responsibilities as a member of society; awareness of the value of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine;
- ZK13. The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of history, the patterns of development of the subject area, its place in the general system of knowledge about nature and society, as well as in the development of society, technology and technologies, to use various types and forms of motor activities for recreation and leading a healthy lifestyle.

special competencies:
- SK02. Ability to apply theories, principles, methods of physical and mathematical, natural, socio-economic, engineering sciences when performing tasks of geodesy and land management;
- SK03. Ability to apply regulatory and legal acts, regulatory and technical documents, reference materials in professional activity;
- SK04. Ability to choose and use effective methods, technologies and equipment for carrying out professional activities in the field of geodesy and land management; SK05. The ability to use modern information, technical and technological support to solve complex issues of geodesy and land management;
- SK06. The ability to perform remote, ground, field and camera research, engineering calculations for the processing of research results, form research results, prepare reports when solving geodesy and land management tasks;
- SK07. The ability to collect, update, process, critically evaluate, interpret, store, publish and use geospatial data and metadata regarding objects of natural and man-made origin;
- SK08. The ability to carry out professional activities in the field of geodesy and land management, taking into account the requirements of professional and civil safety, labor protection, social, ecological, ethical, economic aspects.

Program learning outcomes:
- PH2. Organize and manage the professional development of individuals and groups;
- PH3. Convey information, ideas, problems, solutions, own experience and arguments to specialists and non-specialists;
- PH4. Know and apply in professional activity regulatory and legal acts, regulatory and technical documents, reference materials in the field of geodesy and land management and related fields;
- PH5. Apply conceptual knowledge of natural and socio-economic sciences when performing tasks of geodesy and land management;
- PH9. Collect, evaluate, interpret and use geospatial data, metadata about objects of natural and man-made origin, apply statistical methods of their analysis to solve specialized problems in the field of geodesy and land management.

3. Program and structure of the discipline
COMPUTER-AIDED LAND CADASTRAL SYSTEMS
full-time study form:

Titles content modules and themes	Hours												
		Full-time form						By correspondence					
	weeks	total	including					total	including				
			l	p	lab	ind	i.w.		l	p	lab	ind	i.w.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Content module I. Basic concepts of geoinformation support of land cadastre.													
Topic 1. Objectives and content of the course. The concept of geoinformation support of land cadastre.	1-2	9	2		2		5						
Topic 2. Regulatory documents and standardization in the study of the discipline "Geoinformation land cadastral systems".	3-4	7	1		2		4						
Topic 3. Equipment and software for the implementation of geographic land cadastral system.	5-6	9	1		3		5						
Topic 4. Geoinformation modeling. Land cadastral databases. Data banks.	7-8	11	2		4		5						
Topic 5. Functions of land information systems.	9-10	9	2		3		4						
Together for the semantic module 1		45	8		14		23						
Content module II. The concept of creating geographic information land cadastral systems.													
Topic 6. Information base of geoinformation systems. The concept of creating geographic information land cadastral systems.	11-12	14	2		5		7						
Topic 7. Fundamentals of analysis and cartographic modeling. Cartographic support of SLC.	13-14	14	2		5		7						
Topic 8. Basics of creating land cadastral information. Cartographic methods of	15	14	2		4		8						

working with land cadastre. Index cadastral map (plan).											
Together for the semantic module 2	42	6		14		22					
	87	**14**		**28**		**45**					

4. Themes of seminars

№	Name of theme	Hours

5. Topics of practical classes

№	Name of theme	Hours

6. Topic of laboratory classes

№ c/o	Name of topic	Number of hours
1	**Topic 1: Creation of vector layers of an indo-cadastral map (plan).** Downloading land cadastral data (shapefiles) in the ArcGIS environment and creating new polygon layers: the boundaries of the area, the boundaries of village councils, boundaries of settlements, cadastral zones and cadastral districts.	2
2	**Topic 2: Vectorization of land cadastre data.** Vectorization of cadastral zones, quarters within the territory of the district.	6
3	**Topic 3. Creation of database structure and introduction of land cadastral attributive information.** Functions of selection of land cadastral geodata by attributes. Finding and changing cadastral geodata records in data gobag. Adding new columns to the registry. Create additional fields in the table of attributes of land cadastral geodata.	6
4	**Topic 4. Creating the layout of graphic materials.** Counts for layout: map projections, shape of the depicted territory, orientation of the image, heterogeneity of the image of neighboring territories, map legend, presence or absence of additional elements,	4

	assignment of the map.	
5	**Topic 5. Layout of graphic materials. Creation of the index-cadastral map of the district and a separate administrative-territorial unit.** Queries like a form of information search. Search, extract, replace, enter geodata using queries. Processing of the entered land cadastral geodata. Placing a cartographic image, the name of the map of the symbols, the line and other auxiliary equipment of the card within the sheet.	3
6	**Topic 6. Filling the geodatabase with attribute land cadastral geodata. Land cadastral geodata and their characteristics.** Convert CAD geodata format (.DWG (AvtoCAD)) into a shaped file (ArcGIS). Attach an attribute table to a shape file. Layout of graphic materials. Creation of a cadastral quarter plan and land plot layout.	4
7	**Topic 7. Introduction of the land cadastre geodata to the existing database** Add CAD files (.DWG (AvtoCAD)) to the project. Create objects by existing coordinates. Creation of objects by points which are added from the external tables of the results of geodetic surveys. Introduction of new data in the database of land plots.	3
Total		**28**

7. Topics of independent work

№	Topic name	Number of hours
1	The main characteristic of the modern multi-purpose cadastre	8
2	Registration and cadastral survey as basic components modern land cadastre	7
3	Components that are subject to registration (rights, deeds and property objects) in the NKS	8
4	Components of spatial data infrastructure	7
5	Historical origins and features of the modern stage of land cadastre creation in Ukraine	7
6	Tasks and features of the formation of the urban cadastre	8

8. Individual tasks

TASK 1
The purpose of creation and functional purpose of geoinformation land cadastral systems.
Software platforms for LIS development.
TASK 2
The main functions and composition of geographic information support of cadastral systems.
The essence of entering cartographic data in the LIS.
TASKS 3
Characteristics of the object in geoinformation land cadastral systems.

Principles of construction of geoinformation land cadastral systems.

TASK 4

Land information systems: prerequisites and functions.

The composition of the index map of the state land cadastre.

TASK 5

The concept of geographic land cadastral systems. Prerequisites, goals and basic principles of creation.

Errors of digitization of cartographic data.

TASK 6

Technical support of geoinformation land cadastral systems.

Input and output data of geoinformation land cadastral systems, their suppliers and consumers.

TASK 7

Architecture of geoinformation land cadastral systems.

Information support of geographic information land cadastral systems of the basic level.

TASK 8

Composition and content of attributive data of geoinformation land cadastral systems.

Errors in digitizing map data.

TASK 9

Prerequisites for the creation and functions of geographic land cadastral systems.

Basic level geographic information cadastral systems software.

TASK 10

The essence and basic concepts of informatization.

Input and output data of geoinformation land cadastral systems, their suppliers and consumers.

TASKS 11

The concept of geographic land cadastral systems. Prerequisites, goals and basic principles of creation.

The structure of software and information support of geoinformation land cadastral systems of the basic level.

TASK 12

The main directions, forms, state and prospects of informatization in land management.

Methods of entering cartographic data into the land information system.

TASKS 13

The concept of geographic land cadastral systems. Prerequisites, goals and basic principles of creation.

Raster data formats and their use in LIS.

TASKS 14

Input and output data of geoinformation land cadastral systems, their suppliers and consumers.

Attribute data input technology.

TASK 15

Functions of geoinformation land cadastral systems.

Errors of digitization of cartographic data.

TASK 16

The main functions and composition of information support of geoinformation land cadastral systems. Information database of geoinformation land cadastral systems.

Use of cartographic models for feasibility study and rational use of land.

TASKS 17

Problems of legal support of creation and functioning of geoinformation land cadastral systems.

Principles of entering and editing attribute data.

TASK 18

The purpose of creation and functional purpose of geoinformation land cadastral systems.

Input and output data of geoinformation land cadastral systems, their suppliers and consumers.

TASKS 19

Functions of geoinformation land cadastral systems.

Principles of entering and editing cartographic data.

TASK 20

The essence and basic concepts of informatization, its effectiveness.

The purpose of creation and functional purpose of geoinformation land cadastral systems.

TASKS 21

Software and information support of geoinformation land cadastral systems.

Vector data model. Their characteristics and use.

TASKS 22

The main functions and composition of information support of geoinformation land cadastral systems. Information database.

Digital cadastral maps. Their purpose and use.

TASKS 23

Geographic information systems in the land cadastre: requirements and prospects for application.

The essence of spatial analysis in LIS. Analysis of cartographic data.

TASKS 24

Basic concepts of land information system. Functions, subsystems.

Principles of construction of geoinformation land cadastral systems.

TASK 25

Input and output data of geoinformation land cadastral systems, their suppliers and consumers.

Spatial analysis and cartographic modeling of LIS. Attribute data analysis.

TASK 26

Principles of creation and functioning of distributed databases.

Geospatial data for the state land cadastre. Blocks of land cadastral data on agricultural lands.

TASKS 27

Requirements for land cadastre databases.

The place of GIS and data of remote sensing of the Earth in geoinformation land cadastral systems.

TASKS 28

Information connections of geoinformation land cadastral systems.

Organization of automated registration of land holdings, land uses and real estate on their territory. Organization of processing of accounting for the quantity and quality of land.

TASKS 29

The concept of land cadastral data.

The concept of creating geographic information land cadastral systems.

TASK 30

Architecture of geoinformation land cadastral systems.

AIS and the possibility of their use in land management.

EXAMPLE OF TEST TASKS FROM THE DISCIPLINE
«COMPUTER-AIDED LAND CADASTRAL SYSTEMS»

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE			
EQ «Bachelor» Specialty - 193 Geodesy and Land management	Department of Geoinformatics and Aerospace Research of	EXAM TICKET No. 1 from the discipline	Approve Chief of the department

	the Earth 2023-2024 educational year	**COMPUTER-AIDED LAND CADASTRAL SYSTEMS**	_____ __ (підпис) Kokhan S.S. 2023 p.

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Exam questions

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1. Main accounting objects of cadastral databases.
2. Functions of the NCS.

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Test tasks of various types

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Name the term that is described by the following definition: "... the provision of GIS is the networked means of modern information technology, including computers, devices for storing information, its input-output and transmission, as well as office equipment.	
Information support includes:	1. unified forms of incoming and outgoing documents 2. formalized information languages for description and data manipulation 3. a unified system of data classification and coding 4. general and software
Name the specialized GIS that provide input, control, storage, accumulation, updating, search, transformation, processing, display, mapping, analysis and modeling of spatial data about the land fund.	
What does the term "data frame" mean?	1. A set of attributes 2. Method of sequential coding 3. This is a way of grouping layers that are displayed together 4. Quadrotree method
What does information processing technology include?	1. Development of the database structure 2. A system of methods and methods of automated collection, accumulation, storage, search, processing, transformation, issuance and transmission of information 3. Information service for consumers of land data 4. Development of the structure of environmental monitoring
An object of the real world, characterized by a certain location on Earth and defined in an established system of space-time coordinates	1. Geospatial object 2. ATU boundaries 3. Land plot 4. Land
Open GIS provides:	1. dynamic integration of data from various sources 2. support for geodata processing using Internet technology 3. integration with office automation systems 4. floating license
Which LIS are allocated according to territorial characteristics:	1. national level 2. basic and city level 3. village level 4. regional level
What software components are included in the ArcGIS geoinformation system:	1. Desktop products ArcGIS Desktop 2. ArcSDE (a gateway for working with geodatabases stored in database management systems) and ArcIMS (Internet GIS) 3. CartaLinks 4. IDRISI
LIS databases include:	1. Databases of cartographic and attributive data and databases of biographical data 2. Non-spatial characteristics of objects 3. Topology 4. Quantitative and qualitative attributes

9. Teaching Methods

In conducting lectures appropriate to use verbal teaching methods: explanation, narration, discussion, educational debate, with a combination of visual learning methods: illustration, showing.

In carrying out laboratory work should be used such as verbal learning method of instruction on the combination of visual learning methods of illustration and demonstration, the aspect of these studies is that they facilitate communication theory and practice, providing students acquiring skills using standard and specialized software , application of information

technology to cadastral and form students' initial skills of research activities. Laboratory work in the laboratory are equipped computers.

10. Forms of control

Content module number	Section disciplines	The topic of the lecture	Topic of practical (laboratory) lesson	Form of knowledge control
I	Basic concepts of geoinformation provision of the land cadastre	Topic 1. Tasks and content of the course. The concept of geoinformation provision of the land cadastre.	Creation of vector layers of index-cadastral map (plan).	Protection of laboratory work / assessment of modular control work
		Topic 2. Normative and legal documents and standardization when studying the discipline "Geo-information land and cadastral systems".	Vectorization of cadastral zones, quarters and levels of KOATUU.	
		Topic 3. Equipment and software for the implementation of the geo-informational land cadastral system.	Layout of graphic materials.	
		Topic 4. Geoinformation modeling. Land cadastral databases. Data banks.		
		Topic 5. Functions of land information systems.	Creation of an index-cadastral map of the district and a separate administrative-territorial unit.	
II	The concept of creating geo-informational land cadastral systems	Topic 6. Information base of geoinformation systems. The concept of creating geo-informational land cadastral systems.	Filling the geodatabase with attributive land cadastral data.	Protection of laboratory work / assessment of modular control work
		Topic 7. Basics of analysis and cartographic modeling. Cartographic support of SLC.	Entering land cadastral data into the existing database.	
		Topic 8. Basics of creating land cadastral information. Cartographic methods of working with the land cadastre. Index cadastral map (plan).		

The main methods of control of knowledge and skills students have to study the subject are: oral examination, written and practical test, standardized control in the form of modular test papers, assessment for individual learning task, the final test.

The total value of these methods is to make the best possible to ensure timely and comprehensive feedback between students and teachers, by which establishes how students perceive and learn the material.

The purpose determines the choice of control methods, it should be borne in mind that these methods can be applied in all kinds of control - only complete applications allows regularly and objectively identify the dynamics of the formation of knowledge and skills of

students. Each control method has its advantages and disadvantages, scope of application, none of them can not be the only one able to diagnose all aspects of the learning process. So:

- To control the absorption of lectures: oral questioning, written modular test papers, current testing score for an individual learning task, the final test.

- - For the monitoring and evaluation of laboratory work: practical test and evaluation of each laboratory work.

11. Ratio between national and ECTS values and rating from the discipline

The student's knowledge is assessed on a 100-point scale and translated into national assessments according to the table. 1 "Regulations on Examinations and Credits at NUBiP of Ukraine" (from April 26, 2023, protocol No. 10)

Student rating, points	The assessment is national for the results of the assembly	
	exams	credits
90-100	excellent	Enrolled
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactorily	Not counted

To determine the student's (student's) rating for mastering the RDYS discipline (up to 100 points), the obtained rating from the certification (up to 30 points) is added to the student's (student's) rating for the RHP educational work (up to 70 points): R ДИС = R HP + R AT .

12. Methodological Support

1. Automation of the state land cadastre: methodical manual. S.S. Kokhan, A.O. Koshel, I.M. Shkyr. Kyiv, 2014. 46 p.

2. Koshel A.O., Kokhan S.S., Novikov O.I. Synopsis of lectures on the discipline "Automated land and cadastral systems": comp. lecture Kyiv: CP "COMPRINT", 2015. 20 p.

13. Suggested Reading

Basic

1. Land Code of Ukraine: Law of Ukraine dated October 25, 2001 No. 2768-III. URL: http://zakon3.rada.gov.ua/laws/show/2768-14. (date of application: 26.03.2021).
2. On the State Land Cadastre: Law of Ukraine dated 07.07.2011 No. 3613-VI. URL: http://zakon3.rada.gov.ua/laws/show/3613-17, free. – (date of application: 24.04.2021)
3. Enemark, S. (2008). Environment and Land Administration - Focus on Rights, Restrictions and Responsibilities, FIG Com 7, International Symposium, Verona.
4. ESRI Parcel Fabric (2015) ArcGIS Help 10.3, http://desktop.arcgis.com/en/desktop/latest/manage-data/editing-parcels/what-is-a-parcel-fabric-.htm
5. INSPIRE Data Specification on Cadastral Parcels (2014) Technical Guidelines 3.1. URL: http://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_CP_v3.1.pdf

6. Parcel Fabric Section (2015) Operational Documents, Integrated Land Management Bureau, BC. URL: http://apps.gov.bc.ca/pub/pip/jsp/operationalpage/operdoc.jsp
7. ISO 19152 (2012) Geographic information - Land Administration Domain Model (LADM), ISO TC 211/SC, International Organization for Standardization, http://www.iso.org/iso/catalogue_detail.htm%3Fcsnumber%3D51206.
8. National standard of Ukraine "DSTU ISO 19101:2009 Geographical information. Reference model (ISO 19101:2002, IDT)" 2009-10-15.
9. SOU ISO 19136:2009 "Exchange format of geospatial data based on the geographic markup language GML (ISO 19136:2007)" // 30.09.2010
10. SOU 742-33739540 0012:2010 "Complex of standards Topographic data base Rules for coding and digital description of vector data" Volume 2 // 09/30/2010

Support

1. Mondal S, Bandyopadhyay J, Chakravarty D (2015) Land Information System using cadastral techniques, Mining Area of Raniganj, Barddhaman district, India. Int J Remote Sens Appl (IJRSA) 5:45–53
2. Mondal, S., Chakravarty, D., Bandyopadhyay, J. et al. GIS based Land Information System using Cadastral model: A case study of Tirat and Chalbalpur rural region of Raniganj in Barddhaman district. Model. Earth Syst. Environ. 2, 120 (2016).

14. Information Resources

1. Law of Ukraine "On the National Infrastructure of Geospatial Data" dated May 19, 2020. 2020, No. 38, p. 7, article 1237, act code 99063/2020.
2. Cadastral surveys and records of land rights. URL: http://www.fao.org/3/v4860e/v4860e03.htm
3. Legislation of Ukraine [Electronic resource]. URL: http: http://rada.gov.ua