

Department of Geoinformatics and Aerospace Research of the Earth

«APPROVED»

Dean of the Faculty of Land management

_____ T.O. Ievsiukov

«__» _____ 2021 year

APPROVED by department of Geoinformatics
and Aerospace Research of the Earth

Protocol № 15 «11» May 2021 year

Head of department of Geoinformatics and
Aerospace Research of the Earth

_____ S.S. Kokhan

PROGRAMME

GIS IN CADASTRAL SYSTEMS

Field of knowledge	<u>19. Architecture and Construction</u>
Specialty	<u>193. Geodesy and land management</u>
Specialization	_____
Faculty	<u>Land management</u>
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Programme

discipline « GIS IN CADASTRAL SYSTEMS » for students of course training for students by Specialty 193. «Geodesy and land management»

«11» May 2021 year – 11 p

Authors: Kokhan S.S., Moskalenko A.A., Koshel A.O.

Approved by department of department of Geoinformatics and Aerospace Research of the Earth, Protocol No 15, 11 May 2021

Head of department of Geoinformatics and Aerospace Research of the Earth

“11” May 2021. _____ (S.S. Kokhan)
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Approved by the Educational Council of Faculty of the faculty of land management Protocol No 10 from “13” May 2021

“__” _____ 2020 Head _____ (T.O. Ievsiukov)
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1. Опис навчальної дисципліни / Description of the discipline
GIS in cadastral systems

Branch of knowledge, direction of education, specialty, educational-qualification level (EQL)		
Educational-qualification level	Master	
Direction		
Specialty	193. Geodesy and land management	
Specialization		
Discipline characteristics		
Type	Normative	
Total hours	120	
ECTS credits	4,0	
Thematic modules	2	
Course project (work) (if exist)		
type of examination	Exam	
Discipline parameters for full-time students and students studied by correspondence		
	full-time study	by correspondence
year of training	2	1
semester	3	1-2
lectures	- hours	6 hours
practical, seminar	- hours	4 hours
laboratory	30 hours	- hours
self-dependent work	90 hours	- hours
individual work	- hours	- hours
amount of self-dependent work per week, hours	3 hours	

2. Мета і завдання навчальної дисципліни / Purpose and tasks of the discipline GIS in cadastral systems

Discipline «GIS in cadastral systems» provides the ability to use program-technical complex in land cadaster and land management for automated, storage, display, analysis and modeling of spatial information.

Aim of the discipline is learning and gaining students the necessary theoretical knowledge and practical skills in the use of GIS in the establishment of cadastral systems and build knowledge about the development of the automated systems of Ukraine and the world, the contribution of Ukrainian and foreign scientists.

Tasks of discipline is forming the specialist and subsequent practical use of technologies of GIS in land management and land cadaster to take stock of land resources and land owners predicting the state land fund, monitor the use and protection of soil, registration and protection of the rights of citizens and businesses and more.

Students after study of the course should know:

- national and foreign experience cadastral projects of regional and national levels;
- hardware and software for cadaster;
- features of server GIS for cadastral systems;
- information about the land fund. How to display them;
- GIS and other computerized systems in the processing of inventory data;
- topological spatial objects cadastral database location.

Students after study of the course should be able:

- collect, enter, edit spatial and attribute information based on statistical forms; based Land Book; index cadastral maps; another cadastral plan; cadastral plan by categories, land tenure, land use in the context of rural (village) councils; registry of land; Register encumbrances and restrictions on land use; Data quality of soil; Data of economic valuation of land area (city); expert monetary assessment;
- create database structure geospatial data, fill the base attribute data and display the information on the map;
- conduct sampling necessary information from the database;
- use satellite imagery to create and update cartographic material;
- use GIS to take stock of land assets and land owners;
- use GIS for the purpose of landscape-ecological zoning;
- use GIS for forecasting of land assets;
- be able to use GIS for the purpose of the feasibility report on the use and protection of land resources.

The discipline provides the formation of a number of competencies:

- general competencies:

GC06 - Ability to use information and communication technologies.

- special competencies:

SC03. Ability to apply regulations, regulatory and technical documents, reference materials in professional activities.

SC04. Ability to select and use effective methods, technologies and equipment for professional activities in the field of geodesy and land management.

SC05. Ability to use modern information, technical and technological support to solve complex issues of geodesy and land management.

SC07. Ability to collect, update, process, critically evaluate, interpret, store, publish and use geospatial data and metadata on objects of natural and man-made origin.

learning results:

LR4. To know and apply in professional activity normative-legal acts, normative-technical documents, reference materials in the field of geodesy and land management and related branches.

LR5. Apply conceptual knowledge of natural and socio-economic sciences in performing tasks of geodesy and land management.

LR9. Collect, evaluate, interpret and use geospatial data, metadata on 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.

LR14. Plan complex professional activities, develop and implement projects in the field of geodesy and land management under resource and other constraints.

**3. Програма та структура навчальної дисципліни / Program of the discipline
GIS in cadastral systems**

**SEMANTIC MODULE I. EXPERIENCE OF CADASTRAL PROJECTS REGIONAL AND
NATIONAL LEVEL BY USING GIS TECHNOLOGY**

Theme 1. GIS - technology in land cadaster. Automated land cadaster in Ukraine.

Information technology in cadastral systems. Signs of forming and using information resources in inventory systems. Geospatial data for land cadaster. GIS technology in the land cadaster, Land management and land monitoring.

Theme 2. Features of cadastral systems foreign country.

The development of cadaster system. Features of the cadastral system in Spain. Features of the cadastral systems of Denmark and Germany. Features inventory of Britain and France. Features inventory System. Features of the cadastral system in Australia. Company inventories. Modern multipurpose cadaster. Current inventory requirements. The concept of inventory future.

SEMANTIC MODULE II. OBJECT MODEL OF CADASTRAL DATABASE

Theme 3. Concepts of cadastral database

Concepts cadastral database. Basic requirements for cadastral database

Theme 4. Data on the land fund and its displaying

Data on land fund. Spatial analysis of cadastral systems.

Theme 5. Server GIS

Specifications for the inventory system. Consumers inventory information. Server GIS: ArcSDE, ArcIMS, ArcGIS Server. Comparative characteristics of GIS server products. GIS Portal

Modules and topics	Hours												
	full-time study							correspondence					
	weeks	total	including					total	including				
			l	p	lab	ind	s.w.		l	p	lab	ind	
1	2	3	4	5	6	7	8	9	10	11	12	13	
SEMANTIC MODULE I. Experience of cadastral projects regional and national level by using GIS technology													
Theme 1. GIS - technology in land cadaster. Automated land cadaster in Ukraine.	1-2	34	0		6		28						
Theme 2. Features of cadastral systems in foreign countries.	3-4	26	0		8		18						
Total by Semantic module 1		60	0		14		46						
SEMANTIC MODULE II. Object Model of cadastral database													
Theme 3. Concepts of cadastral database	5-6	18	0		4		14						
Theme 4. Data on the land fund and its displaying	7-8	21	0		6		15						
Theme 5. Server GIS	9-10	21	0		6		15						
Total by Semantic module 2		60	0		16		44						
Усього годин		120	0		30		90						

4. Теми семінарських занять / Topics of seminars lessons

№	Topic	Hours

5. Теми практичних занять / Topics of practice lessons

№	Topic	Hours

6. Теми лабораторних занять / Topics of laboratory lessons

№	Topic	Hours
1	Using GIS tools to calculate the monetary evaluation of individual plots	6
2	Construction of sanitary and coastal protection zones around objects with special regulations. Analysis zones around objects with special regulations	8
3	The selection of information from the geodatabase by location and by attributes	4
4	Data analysis using ArcGIS tools	6
5	Data analysis using ArcGIS Online tools	6
Total		30

7. Самостійна робота /Task for independent work of students

№	Topic	Hours
1	Professional terminology for GIS in cadastral systems	6
2	GIS - technology in land cadaster. Automated land cadaster in Ukraine.	10
3	Experience in cadastral projects regional and national levels using GIS technology	12
4	Features cadastral systems in foreign countries.	6
5	World experiences to build and use cadaster and registry	12
6	Concepts of cadastral database	4
7	Models of cadastral databases	10
8	Data on the land fund and its displaying	5
9	Use of GIS in various industries	10

10	Server GIS	5
11	Comparison of database models architecture used in cadastral systems	10
Total		90

8. Control Questions, Tests.

1. What is cadastral geodatabase?
2. What are the main classes of spatial cadastral objects of geodatabase?
3. Can you characterize the spatial data?
4. What are attributes in the geodatabase of cadastral data?
5. What are the functions of full-featured GIS?
6. What are the components of ArcInfo?
7. What are spatial tools used for working with spatial data?
8. Classification and basic properties of geoimages.
9. Comparison of representation of spatial data in ArcInfo.
10. What is a dataframes?
11. Schemes of classification in ArcInfo.
12. Transactions in vector data models.
13. The spatial queries. Building SQL-queries.
14. Raster models and classes of problems solved with their help in ArcInfo.
15. Characteristics of the base location.
16. Visualization of surfaces with layers TIN.
17. Shape files in ArcInfo.
18. What is object topology?
19. Give the comparative characteristic of GIS and other automated systems: computer aided design, automated systems research, automated reference-information systems, documentation for automated systems.
20. Describe the organization of data in GIS.
21. Spatial analysis. The types of analysis.
22. Schemes classification of geoinformation analysis.
23. Mapping characters. Methods output of the analysis. Principles of Graphic Design.
24. Expert systems to meet the challenges of GIS.
25. Baseline data models used in GIS.
26. Relational models in GIS.
27. Model "entity-relationship" in GIS.
28. The accuracy of the coordinate and attribute data in GIS.
29. Generalization in GIS.
30. Conduct and current state of the state land cadaster and land cadaster information.
31. State of SLC and land cadaster documentation.
32. Conduct automated system of land cadaster documentation.
33. The legal and organizational basis for improving maintenance of land cadaster documentation.
34. Expert systems to meet the challenges of GIS.
35. Baseline data models used in GIS.
36. Relational models in GIS.
37. The accuracy of the coordinate and attribute data in GIS.
28. Generalization in GIS systems.
39. The spatial queries. Building SQL-queries.
40. Raster models and classes of problems solved with their help in ArcInfo.
41. Characteristics of the base location.

9. Methods of teaching

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

The main methods of control of knowledge and skills students have to study the subject " GIS in cadastral systems " 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. Distribution of grades received by students during study

Student's evaluation takes place according to "Про екзамени та заліки НУБіП України" dated 27/02/2019. The protocol №7 of Table 1.

The national grade	Total points for all the educational activities
EXCELENT	90-100
GOOD	74-89
SATISFACTORILY	60-73
UNSATISFACTORILY	0-59

Student's rating of course mastering R_{course} it is determined in points and made 100 points. Course ratings calculate as: $R_{COURSE} = R_{EDU} + R_{Final\ Test}$ (Course ratings = Education work rating + Final Test Rating)

70% (70 points) of the R_{COURSE} is the R_{EDU}

30% (30 points) of the R_{COURSE} is the $R_{Final\ Test}$.

R_{COURSE} equal 100 points (100 %).

Ratings of education work consist of attending a lecture, mastering of theoretical material, executing and passing laboratory works, and control theoretical knowledge.

$$R_{EDU} = R_{Lect} + R_{Lab} + R_{Self} + R_{Contr.}$$

Evaluation criteria for an attending of a lecture R_{Lect}

Student will have a **maximal grade** for an attending a lecture, if he/she presents on a lecture, participates actively in the discussion of theme of lecture, answer a lecturer question, gives examples, assiduously conducts the compendium of lecture.

Student will have a **minimum (sufficient) grade (0,6 to maximal)** for a lecture, if he/she is late for the lecture less than 5 minutes, inattentive (but keeps discipline), passive in discussion of theme, doesn't give examples, but can formulate basic concepts of a lecture. Student will have

a **0,6 grade**, if he/she didn't appear on a lecture with reasonable excuse, but has conducted the compendium of lecture and can formulate the basic concepts of lecture.

Student will have **grade from 0 to minimum**, if he/she is late for the lecture more than 5 minutes, can't define the basic concepts of lecture, but has the compendium of lecture, inattentive (but keeps discipline).

If student skipped lecture with reasonable excuse and doesn't have the compendium of lecture, student will have **grade equal 0**.

If student skipped lecture without reasonable excuse, disturbs discipline, doesn't have the compendium of lecture, student will have penalty grade.

Evaluation criteria for the mastering control of theoretical materials R_{Contr} .

The written work has a **maximal grade**, if it has written answer to the questions contained in the examination card. Answer should be in the compressed form, logically and consistently, contains a definitions, basic descriptions, principles and receptions of implementation, charts, examples, the indicated application domain in speciality area, etc.

The written work has a **minimal grade (0,6 to maximal)**, if it has main definition and descriptions, indicates principles and receptions of implementation, gives some examples, etc and gives written answer (even inexact) to all questions contained in the examination card.

Rating for laboratory work R_{LAB}

Student will have a **maximal grade** for fulfillment of a laboratory work, if he/she presents on a lesson, participates actively in implementation of laboratory work, executes the task fully and gets the expected result, can explain a logical sequence and phased of actions, answers a control questions of teacher.

Student will have a **minimum (sufficient) grade (0,6 to maximal)** for a laboratory work, if he/she is late for the lesson less than 5 minutes, inattentive (but keeps discipline), executes the task fully, but with some teacher help, and gets the expected result, gives insufficient answer a control questions of teacher.

Student will have **grade from 0 to minimum**, if he/she executes the task partly, (but executes the task more than 75%), or doesn't get the expected result, gives inexact answer.

If student skipped laboratory work with reasonable excuse, student has to rework this lesson in other time. Student should arrange time with a teacher, because task uses license software.

If student skipped laboratory work without reasonable excuse or didn't finish task in the set time, student gets a penalty.

Rating for self-work R_{Self}

Student will have a **maximal grade** for defence of a self-work, if he/she clear define a theoretical grounds of the topic, gives examples, can account for the sequence of actions implementation, can apply theoretical knowledges in practice.

Student will have a **minimum (sufficient) grade (0,5 to maximal)** defence of a self-work, if he/she gives insufficient answer, doesn't give examples or gives one with complication.

Student will have **grade from 0 to minimum** for defence of a self-work, if he/she gives inexact answer, doesn't give main definitions.

Rating of additional work R_{add} and rating of penalty $R_{penalty}$ has an influence on rating of educational work.

Maximal rating of additional work makes 10% from rating of course (that is 10 points). It's determined by a lecturer. Rating of additional work given to student after department decision for implementation of work, that don't foreseen by a working curricula of the course, but increase student's level of skill.

5% (4 points) of the rating of education work is rating of penalty. Rating of penalty has negative quantity and it decreases rating of education work. Rating of penalty was determined by a lecturer. It's entered department decision for a student, who was mastering material of the module too late, wasn't following the executive schedule and had omitted lesson from time to time, etc.

Students have to have more than 60 % points from rating of educational work for admitting to final test. It's meaning, that student should to do next minimal list of work:

- to execute all laboratory works;

- to don't get punitive measure of lecturer.
- Rating evaluation of the final test** is proposed as a test tasks.

Rating evaluations system of educational work for the substance modules

	Type of work	Module			Course	
		point by work	percent by		point by work	percent by
			work	module		
Module # 1	Laboratory work #1	100	20 %	70 %	100	35 %
	Laboratory work #2	100	20 %			
	Self-work	100	30 %			
	Module test / control	100	30 %	30 %		
Module # 2	Laboratory work #3	100	8 %	70 %	100	35 %
	Laboratory work #4 (part1)	100	8 %			
	Laboratory work #4 (part2)	100	8 %			
	Laboratory work #5 (part1)	100	8 %			
	Laboratory work #5 (part2)	100	8 %			
	Self-work	100	30 %			
	Module test / control	100	30 %	30 %		
Final test		100				30 %

12. Textbooks

1. Географічні інформаційні системи в кадастрових системах (методичні вказівки до виконання лабораторних робіт) – Київ: ЦП «КОМПРИНТ», 2018. – 40 с.
2. GIS in Cadastral Systems (навчально-методичний посібник) / Кохан С.С., Москаленко А.А., Кошель А.О., Дьоміна І.І.) – Київ: ЦП «КОМПРИНТ», 2020. – 88 с.

13. Recommended literature

Basic:

1. ArcGIS for Environmental and Water Issues / William Bajjali. - 2018 - p.362
2. Manual of Digital Earth / Huadong Guo, Michael F. Goodchild, Alessandro Annoni – Springer Open 2020. – p.846 (<https://doi.org/10.1007/978-981-32-9915-3>)
3. Геоінформаційні системи і бази даних : монографія / В. І. Зацерковний, В. Г. Бурачек, О. О. Железняк, А. О. Терещенко. – Ніжин : НДУ ім. М. Гоголя, 2014. – 492 с.
4. Геоінформаційні системи і бази даних : монографія. – Кн. 2 / В. І. Зацерковний, В. Г. Бурачек, О. О. Железняк, А. О. Терещенко. – Ніжин : НДУ ім. М. Гоголя, 2017. – 237 с
5. Автоматизація державного земельного кадастру: підручник / М.Г. Ступень, Р.М. Курильців, Р.Б. Таратула, С.С. Радомський. – Львів, 2011. – 312 с.
6. Географічні інформаційні системи: Посібник/ За ред. М. Ван Мерввіна, С.С.Кохан.-К.: НАУ. 2003.-206 с.
7. Національний стандарт України «ДСТУ ISO 19101:2009 Географічна інформація. Еталонна модель (ISO 19101:2002, IDT)»// 2009-10-15.
8. COU ISO 19136:2009 "Обмінний формат геопросторових даних на основі географічної мови розмітки GML (ISO 19136:2007)" // 30.09.2010
9. COU 742-33739540 0012:2010 "Комплекс стандартів База топографічних даних Правила кодування та цифрового опису векторних даних" Том 2 // 30.09.2010

Additional:

10. Де Мерс М. Географические информационные системы: Основы.- М.: Дата+. 1999. -501 с.
11. Основи геоінформаційних систем. Методологія. В.М.Самойленко. Навчальний посібник. –К.: Ніка-Центр.-2003.-276 с.

12. Цветков В.Я. Геоинформационные системы и технологии. – М.: Агропромиздат. 1994.- 200с.
13. Єршов В.П., Гора І.М. Автоматизовані земельні інформаційні системи. Учбовий посібник. –К.: НАУ. 1999.- 196 с.

14. Information resources:

14. eLearn webpage - <https://elearn.nubip.edu.ua/course/view.php?id=1597>
15. ПС рішення [Електронний ресурс]. – Режим доступу: <http://ndiasb.kiev.ua/ua/teren.php>
16. Законодвчтво україни [Електронний ресурс]. – Режим доступу: <http://rada.gov.ua>