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
«21» May 2024

"APPROVED"
at the meeting of the department of Geoinformatics and Aerospace Research of the Earth
Protocol № 12 from «16» May 2024
Acting head of Department
_____ A.A. Moskalenko

"REVIEWED"
Program Coordinator
Geodesy and Land Management
_____ I.P. Kovalchuk.

PROGRAM OF THE COURSE
GEOINFORMATION SYSTEMS AND DATABASES

Branch of knowledge	19. Architecture and construction
Specialization	193. Geodesy and Land management
Educational program	"Geodesy and Land Management"
Faculty	Land Management
Developers	Associate prof., PhD, Moskalenko A.A.
	PhD, Primak L.V.
	Denysiuk B.I.

Kyiv – 2024

Description of the discipline Geoinformation systems and databases

Branch of knowledge, direction of education, specialty, educational-qualification level (EQL)		
Educational qualification level	Bachelor	
Specialty	193 Geodesy and Land management	
Educational program	Geodesy and Land management	
Characteristics of the course		
Type	Normative	
Total hours	120	
ECTS credits	4,0	
Thematic modules	3	
Course project (work) (if exist)		
type of examination	Exam	
Indicators of the course for full-time and part-time forms of study		
	full-time study	by correspondence
year of training	3	
semester	5	
lectures	30 hours	
practical, seminar	- hours	
laboratory	45 hours	
self-dependent work	45 hours	
amount of inclass work per week, hours	5 hours	

1. Purpose, objectives, and competencies of the course

Purpose of the discipline: The discipline "GIS and databases" forms in students the ability to use in production software and technical complexes for automated accounting, storage, display, analysis, modeling of spatially coordinated information and the creation of databases in the field of land management, cadaster, geodesy and cartography.

Objectives of course the task of studying the discipline is the formation of a specialist's theoretical knowledge and practical skills in working with databases, the ability to organize the collection and selection of necessary data, the use of GIS for managing land resources when solving the tasks of land management, cadaster, geodesy and cartography.

Acquisition of competencies:

Integrated competency (IC)

IC. The ability to solve complex specialized problems of geodesy and land management

- general competencies:

GK 01. Ability to learn and master modern knowledge.

GK 02. Ability to apply knowledge in practical situations.

GK 05. Ability to communicate in a foreign language.

GK 06. Ability to use information and communication technologies.

GK 07. Ability to work autonomously.

GK 08. Ability to work in a team.

GK 13. Ability to preserve, multiply moral, cultural, scientific values and achievements of society based on understanding of history, 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 technology. activities for recreation and healthy living

- professional (special) competencies (PC):

SC 01. Ability to apply fundamental knowledge to analyze phenomena of natural and man-made origin in the performance of professional tasks in the field of geodesy and land management.

SC 03. Ability to apply regulations, regulatory and technical documents, reference materials in professional activities.

SC 04. Ability to choose and use effective methods, technologies and equipment for professional activities in the field of geodesy and land management.

SC 05. Ability to use modern information, technical and technological support to address complex issues of geodesy and land management.

SC 06. Ability to perform remote, ground, field and in-house research, engineering calculations for processing research results, prepare research results, prepare reports in solving problems of geodesy and land management.

SC 07. Ability to collect, update, process, critically evaluate, interpret, store, publish and use geospatial data and metadata on objects of natural and man-made origin.

SC 08. 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, environmental, ethical, economic aspects.

SC 09. Ability to use tools, instruments, equipment, facilities in the performance of geodetic and land management tasks.

SC 10. Ability to monitor and evaluate land.

Program learning outcomes (PLO)

LR 1. Fluent in oral and written forms in state and foreign languages on professional matters.

LR 2. Organize and manage the professional development of individuals and groups.

LR 3. Communicate information, ideas, problems, solutions, personal experience and arguments to specialists and non-specialists.

LR 4. 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.

LR 9. 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.

LR 10. Choose and apply tools hardware, hardware and software supplies needed for remote, ground, field and in-house research in in the field of geodesy and land management.

LR 11. Organize and execute remote, ground, field and camera works in the field of geodesy and land management, draw up the results of work, prepare relevant reports.

LR 13. Plan and execute geodetic, topographic and cadastral surveys, process the results in geographic information systems.

LR 14. Plan a complex professional activity, develop and implement projects in the field of geodesy and land management under conditions resource and other constraints.

LR 15. Develop and adopt effective decisions on professional activities in the field geodesy and land management, including under conditions uncertainty.

2. Program and structure of the course for: complete full-time (part-time) form of study;

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. Basics of Geoinformation systems and tecnologies												
Theme 1. Introduction to Geoinformation science	1	10	2		4		4					
Theme 2. Model of spatial data: vector and object data models	2	10	2		4		4					
Theme 3. Model of spatial data. Mosaic models	3	10	2		4		4					
Total by Semantic module 1		***30***	**6**		**12**		**12**					
SEMANTIC MODULE II. Modern technology of databases, Normalization												
Theme 4. Basic concepts and determination of database theory	4	8	2		2		4					
Theme 5. Stages of database design	5	16	2		2		12					
Theme 6. Database system concepts and architecture	6	6	2		4							
Theme 7. Data modeling using the entity-relationship model	7	4	2		2							
Theme 8. Relational database design	8	16	2		4		10					
Theme 9. Normalization as way to control of database structure. Normal forms 1-3	9	4	2		2							
Theme 10. Normalization. The heist normal forms	10	6	2		4							
Total by Semantic module 1		***60***	***14***		***20***		***26***					
SEMANTIC MODULE IV. Operation with data												
Theme 11. Modern database methodology infological design	11-12	6	2		4							
Theme 12. Relational algebra	13	6	2		4							
Theme 13. Operation and query languages	14-15	18	6		5		7					
Total by Semantic module 2		***30***	**10**		**13**		**7**					
Усього годин		**120**	**30**		**45**		**45**					

3. Laboratory class topics

№	Topic	Hours
1	Determination of the design boundary of the geospatial data base	2
2	Forming a technical task for designing a geospatial database	2
3	Create and convert geospatial data layers	2
4	Vectorization. Part 1	2
5	Vectorization. Part 2	2
6	Vectorization. Part 3.	2
7	Editing vector layers. Part 1	2
8	Editing vector layers. Part 2	2
9	Entering attribute data. Part 1	2
10	Entering attribute data. Part 2	
11	Creation of a conceptual model of the database	2
12	Creating a logical database model. Part 1	2
13	Creating a logical database model. Part 2	2
14	Normalization. Part 1	2
15	Normalization. Part 2	2
16	Normalization. Part 3	2
17	Creating a physical database model	4
18	SQL query language. Part 1	2
19	SQL query language. Part 2	2
20	Calculation of secondary attributes of subject area objects. Creation of new object classes	2
21	Client-server architecture in the formation of requests to the database	3
Total		**45**

4. Independent work topics

№	Topic	Hours
1	Analysis of publications on the basics of geoinformation systems and technologies	4
2	Creating geospatial data layers in QGIS	4
3	Raster base vectorization in QGIS	4
4	Overview of database design software	4
5	Installation of software for working with databases.	6
6	Setting up software for working with databases.	6
7	NoSQL database technologies	10
8	Procedural programming languages when working with SQL	3
9	Functions used in SQL databases	4
Total		**45**

5. Means of diagnosing learning outcomes:

- exam;
- module tests;
- essays;
- defence of laboratory work.

6. Teaching methods:

- verbal method (lecture, discussion, interview, etc.);
- practical method (laboratory, practical classes);
- visual method (illustration method, demonstration method);
- work with educational and methodical literature (summarizing, summarizing, annotating, reviewing, writing an abstract);
- video method (remote, multimedia, web-oriented, etc.);
- independent work (task performance).

7. Evaluation methods.

- exam;
- oral or written survey;
- modular testing;
- abstracts, essays;
- defence of laboratory works;
- presentations and speeches at scientific events.

8. **Distribution of points received** by students of higher education. The assessment of the knowledge of a higher education student takes place on a 100-point scale and is translated into national assessments according to the table. 1 of the current "Regulations on examinations and assessments at NUBiP of Ukraine"

Student rating, points	National grade based on exam results
90-100	**Excellent**
74-89	**Good**
60-73	**Satisfactory**
0-59	**Unsatisfactory**

In order to determine the rating of a student (listener) in the discipline $\mathbf{R_{dis}}$ (up to 100 points), the rating from the exam $\mathbf{R_{ex}}$(up to 30 points) is added to the rating of a student's academic work $\mathbf{R_{aw}}$ (up to 70 points): $\mathbf{R_{dis} = R_{aw} + R_{ex}}$ **.**

9. Educational and methodological support

- electronic educational course of the educational discipline (on the educational portal of NUBiP of Ukraine eLearn - https://elearn.nubip.edu.ua/course/view.php?id=158);
- abstracts of lectures and their presentations (in electronic form - https://elearn.nubip.edu.ua/course/view.php?id=158);
- textbooks, training aids, workshops;
- methodical materials on the study of the academic discipline for students of higher education full-time and part-time forms of higher education

- ✓ Москаленко А.А., Примак Л.В., Заячківська Б.Б., Денисюк Б.І. Геоінформаційні системи і бази даних (методичні вказівки до виконання лабораторних робіт для студентів спеціальності 193. Геодезія і землеустрій) – К: Компринт – 2023 – с.188.
- ✓ Кохан С.С., Москаленко А.А., Іванюта О.О. Geoinformation systems and databases (a series of lectures) для студентів напряму підготовки «Геодезія, картографія та землеустрій» - К.: ЦК «КОМПРИНТ»,2014.

- ✓ Назаренко Н.М., Москаленко А.А. Навчально-методичний посібник «Геоінформаційні системи і бази даних» - Видавничий центр НУБіП, 2010

10. Recommended sources of information

Basic:

1. Основи створення інтероперабельних геопросторових даних. / Ю. О. Карпінський та ін. – Київ: КНУБА, 2023. – 302 с.
2. Основи геоінформаційних систем і бази даних: підручник /О.Є. Поморцева; Харків. нац.ун-т міськ.гос-ва ім. О. М. Бекетова. – Харків, 2022 – 346с.
3. Allen Taylor. SQL For Dummies, 9th edition. 2020 – 544p.
4. Database Systems: A Practical Approach to Design, Implementation, and Management Third Edition / Thomas Connolly, Carolyn Begg. 2014 – 1440 p.
5. Ekmasri, R. and Navatane, S.B. Fundamentals of Database Systems, 7th ed., Addison-Wesly, Reading, Boston, MA, 2017
6. 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.

Additional:

7. A Moskalenko (2021) GIS support of forming spatial decisions on land use. Mechanization in agriculture & Conserving of the resources 67 (3), 79-81.
8. What is GIS? - https://www.esri.com/en-us/what-is-gis/overview
9. Стандарти та специфікації відкритого геопросторового консорціуму OGC, http://www.opengeospatial.org/standards
10. Географічна інформація. Еталонна модель: ДСТУ ISO 19101:2009. – [Чинний від 2011-07-01] – К.: Держспоживстандарт України, 2011. – 44 с.
11. Географічна інформація. Сервіси: ДСТУ ISO 19119:2017 (ISO:19119:2016, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
12. Географічна інформація. Метадані – XML-схема реалізації: ДСТУ ISO/TS 19139:2017(ISO/TS 19139:2007, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
13. Географічна інформація. Мова концептуальних схем: ДСТУ ISO 19103:2017 (ISO 19103:2015, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
14. Географічна інформація. Просторова схема: ДСТУ ISO 19107:2017 (ISO 19107:2003, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
15. Географічна інформація. Правила для прикладної схеми: ДСТУ ISO 19109:2017 (ISO 19109:2015, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
16. Географічна інформація. Просторова прив`язка за географічними ідентифікаторами: ДСТУ ISO 19112:2017 (ISO 19112:2003, IDT) – [Чинний від 2017-10-01]. – Київ: Держспоживстандарт України, 2017.

17. Географічна інформація. Схема для геометрії і функцій покриття: ДСТУ ISO 19123:2017 (ISO 19123:2005, IDT). – [Чинний від 2017-10-01] – К: ДП «УкрНДНЦ».
18. Географічна інформація. Правила моделювання геопросторових даних ДСТУ 8774:2018 – [Чинний від 2019-07-01] – К: ДП «УкрНДНЦ».
19. СОУ 742-33739540 0010:2010 КС БТД Загальні вимоги – Київ: Мінприроди України, 2010.
20. СОУ 742-33739540 0014:2010 КС БТД Вимоги до якості топографічних даних – Київ: Мінприроди України, 2010.
21. ISO 19115-1:2014 Geographic information – Metadata – Part 1: Fundamentals.
22. ISO 19157:2013 Geographic information — Data quality.
23. ISO/IEC 13249-3:2016 Information technology – Database languages – SQL multimedia and application packages – Part 3: Spatial.
24. ISO/IEC 2382:2015 Information technology – Vocabulary.
25. OGC SFA – Simple feature access – Part 1: Common architecture. 2010.
26. OGC SFA-S – Simple feature access – Part 2: SQL option, 2010.
27. Dia [Електронний ресурс]. – Режим доступу: http://dia-installer.de/

"APPROVED"
Academic Council of the Faculty of Land Management
Protocol No. 9 by May 21, 2024

The head of the academic council _____Taras IEVSIUKOV