Syllabus
« Geoinformation systems and databases »

Educational-qualification level - Bachelor
Specialty 193. Geodesy and Land Management
Educational program «Geodesy and Land management»
Year of study 3**, semester** 5
Mode of study: full
ECTS hours – 4,0
Language: English

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eLearn webpage	https://elearn.nubip.edu.ua/course/view.php?id=158

Course Overview:

The course "Geoinformation systems and databases" consists of topics related to fundamentals of GIS technologies and concepts of database theory; their architecture and stages of construction. The features of the hierarchical, network, relational and object-oriented database models are considered. The design of relational databases, relational algebra, functional dependencies and normalization, the basic elements of SQL and the use of ER-diagrams and UML for building database structures are studied.

Students get practical experience in designing conceptual, logical and physical data models, attribute input into database, constructing spatial components of the vector-based topological model and queries application to the spatial components.

Aim of the discipline: The course "GIS and Database" provides the opportunity to use in program 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.

The course Program and Structure

Topic	Hrs (lectures /laboratory/ individual)	Education result	Tasks	Grade
SEMANTIC MODULE I. INTRODUCTION AND CONCEPTUAL MODELING				
Theme 1. Introduction to Geoinformation science	2/4/4	**Know** basics of the geoinformation systems **Understand** the possibilities of organization of	Submitting in eLearn **Laboratory work #1:** Determination of the design boundary of the geospatial data base	5

		Information in a GIS **Recognize differences between** types of Information in a GIS	Submitting in eLearn **Laboratory work #2:** Forming a technical task for designing a geospatial database	**10**
			Submitting in eLearn **Individual work #1.1:** Analysis of publications on the basics of geoinformation systems and technologies	**5**
Theme 2. Model of spatial data: vector and object data models	2/4/4	**Know** the objects used in digital plans and maps **Be able to** ArcGIS-ArcMap tools for creating vector topological model	Submitting in eLearn **Laboratory work #3:** Create and convert geospatial data layers	**10**
			Submitting in eLearn **Laboratory work #4:** Vectorization. Part 1 Submitting in eLearn	**10**
			Submitting in eLearn **Individual work #1.2:** Creating geospatial data layers in QGIS	**5**
Theme 3. Model of spatial data. Mosaic models	2/4/4	**Know** data formats and be able to use them correctly	Submitting in eLearn **Laboratory work #5:** Vectorization. Part 2	**10**
		Apply ArcGIS-ArcMap tools for editing vector topological model	Submitting in eLearn **Laboratory work #6:** Vectorization. Part 3.	**10**
			Submitting in eLearn **Individual work #1.3:** Raster base vectorization in QGIS	**5**
Module control			Test	**30**
Total module 1	6/12/12			**100**
SEMANTIC MODULE II. MODERN TECHNOLOGY OF DATABASES				
Theme 4. Basic concepts and determination of database theory	2/2/4	**Know** basic concepts and determination of database theory	Submitting in eLearn **Laboratory work #7:** Editing vector layers. Part 1	**5**
		Analyze possibilities and application of geodatabase in land management	Submitting in eLearn **Individual work #2.1:** Overview of database design software	**5**
Theme 5. Stages of database design	2/2/12	**Know** basic stages of database design **Be able to** model basic stages of planning, conceptual design, logical planning and physical planning of database	Submitting in eLearn **Laboratory work #8:** Editing vector layers. Part 2	**7**
			Submitting in eLearn **Individual work #2.2:** Installation of software for working with databases.	**5**

		Analyze sources of information and their quality to create database	Submitting in eLearn **Individual work #2.3:** Setting up software for working with databases.	**5**
Theme 6. Database system concepts and architecture	2/4/0	**Know** database system Concepts and Architecture	Submitting in eLearn **Laboratory work #9:** Entering attribute data. Part 1	**10**
		Be able to explain Extended model **Highlight** to classification of database management systems	Submitting in eLearn **Laboratory work #10:** Entering attribute data. Part 2	**8**
Theme 7. Data modeling using the entity-relationship model	2/2/0	**Know** basic stages of data modeling using the entity-relationship model **Be able to** creating conceptual data models **Use** ER-diagrams for creating conceptual data models	Submitting on eLearn **Laboratory work #11:** Creation of a conceptual model of the database	**5**
Theme 8. Relational database design	3/4/10	**Know** basic of relation database design **Be able to** creating logical data models	Submitting on eLearn **Laboratory work #12:** Creating a logical database model. Part 1	**5**
		Use Domains, relationships, corteges, attributes for database design	Submitting in eLearn **Laboratory work #13:** Creating a logical database model. Part 2	**5**
			Submitting in eLearn **Individual work #2.4:** NoSQL database technologies	**5**
Theme 9. Normalization as way to control of database structure. Normal forms 1-3	2/2/0	**Know** functional Dependencies and Normalization for Relational Databases. **Be able to** fill the normalization **Use** Functional dependencies in normalization	Submitting on eLearn **Laboratory work #14:** Normalization. Part 1	**5**
Theme 10. Normalization. The heist normal forms	2/4/0	**Know** basic stages of normalization **Be able to** fill the Normalization (next steps)	Submitting on eLearn **Laboratory work #15:** Normalization. Part 2	**5**
			Submitting in eLearn **Laboratory work #16:** Normalization. Part 3	**10**
Module control			Test	**20**
Total module 2	14/20/26			**100**
SEMANTIC MODULE III. OPERATION WITH DATA				
Theme 11. Modern	2/4/0	**Know** basic stages of infological design	Submitting on eLearn **Laboratory work #17:**	**10**

database methodology infological design		**Highlight** infological design for land management	Creating a physical database model	
Theme 12. Relational algebra	2/4/0	**Know** relational Algebra and Relational Calculus **Be able to** realizing physical data model for land management **Use** MS Access to development of forms and queries	Submitting on eLearn **Laboratory work #18:** SQL query language. Part 1	**10**
			Submitting on eLearn **Laboratory work #19:** SQL query language. Part 2	**10**
Theme 13. Operation and query languages	6/5/7	**Know** SQL-Schema Definition, Constraints, and Queries **Be able to** use GIS and databases queries for land management **Use** ArcGIS-ArcMap to combining database and vector topological model	Submitting on eLearn **Laboratory work #20:** Calculation of secondary attributes of subject area objects. Creation of new object classes	**15**
			Submitting on eLearn **Laboratory work #21:** Client-server architecture in the formation of requests to the database	**15**
			Submitting on eLearn **Individual work #3.1:** Procedural programming languages when working with SQL.	**5**
			Submitting on eLearn **Individual work #3.2:** Functions used in SQL databases	**5**
Module control			Test	**30**
Total module 3	10/13/7			**100**
Total 5 semester				**70**
Final test			Final exam	**30**
Total course				**100**

THE COURSE POLICY

Deadline and rearrangement policy:	Deadlines are defined in e-learn course. Works being submitted after deadlines without a reason are evaluated at a lower grade. Rearrangement of module tests takes place with the permission of the lecturer in case of a specific reasons (for example, illness).
Policy of Academic Plagiarism:	Copying other materials during individual works, tests and final test (including the use of mobile devices) are forbidden. Abstracts must have correct text references to the literature used.
Policy of Attendance:	Attendance of lessons is mandatory. According to objective reasons (for instance, illness, international internship) training can take place individually (in distance form (on-line) by agreement with the dean of the faculty)

STUDENT'S RATING SCALE

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

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/