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 – 7,0
Language: English

Instructor	Antonina Moskalenko, PhD, Associate Professor Oleg Drozdivskiy, PhD, Associate Professor
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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-technical complex for automated recording, storing, displaying, analyzing, modeling of spatially coordinated information and creating databases.

Tasks of discipline is forming as the specialist and subsequent practical use of technologies of GIS and databases is the task of study of discipline, in particular, geodatabase knowledge and practical skills of work on a computer in database environment, and basic receptions of development and work, with the databases in database.

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**
5 semestr				
SEMANTIC MODULE I. INTRODUCTION AND CONCEPTUAL MODELING				
Theme 1. Introduction to Geoinformation science	**2/4/10**	**Know** basics of the geoinformation systems **Understand** the possibilities of organization of Information in a GIS **Recognize differences between** types of Information in a GIS	Submitting in eLearn **Laboratory works:** Creation of layers of geospatial data Determination of the design boundary of the geospatial data base	**25**

			Individual work: Analysis of publications on the basics of geoinformation systems and technologies	
Theme 2. Model of spatial data: vector and object data models	**2/6/15**	**Know** the objects used in digital plans and maps **Be able to** ArcGIS-ArcMap tools for creating vector topological model	Submitting in eLearn **Laboratory works:** Vectorization. Part 1 Vectorization. Part 2 Vectorization. Part 3. **Individual work:** Creating geospatial data layers in QGIS	**30**
Theme 3. Model of spatial data. Mosaic models	**2/4/15**	**Know** data formats and be able to use them correctly **Apply** ArcGIS-ArcMap tools for editing vector topological model	Submitting in eLearn **Laboratory works:** Editing vector layers. **Individual work:** Raster base vectorization in QGIS	**25**
Module control			Test	**30**
Total module 1	**6/14/40**			**100**
SEMANTIC MODULE II. MODERN TECHNOLOGY OF DATABASES				
Theme 4. Basic concepts and determination of database theory	**1/2/10**	**Know** basic concepts and determination of database theory **Analyze** possibilities and application of geodatabase in land management	Submitting in eLearn **Laboratory work:** Forming a technical task for designing a geospatial database **Individual work:** Overview of database design software	**15**
Theme 5. Stages of database design	**1/2/0**	**Know** basic stages of database design **Be able to** model basic stages of planning, conceptual design, logical planning and physical planning of database **Analyze** sources of information and their quality to create database	Submitting in eLearn **Laboratory work:** Entering attribute data. Part 1 Entering attribute data. Part 2	**20**
Theme 6. Database system concepts and architecture	**2/0/30**	**Know** database system Concepts and Architecture **Be able to** explain Extended model **Highlight** to classification of database management systems	Submitting in eLearn **Individual work:** Installation of software for working with databases Setting up software for working with databases.	**10**
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	Submitting on eLearn **Laboratory work:** Creation of a conceptual model of the database	**10**

		Use ER-diagrams for creating conceptual data models		
Theme 8. Relational database design	**3/4/0**	**Know** basic of relation database design **Be able to** creating logical data models **Use** Domains, relationships, corteges, attributes for database design	Submitting on eLearn **Laboratory work:** Creating a logical database model. Part 1 Creating a logical database model. Part 2	**15**
Module control			Test	**30**
Total module 2	**8/12/40**			**100**
SEMANTIC MODULE III. DATABASE DESIGN				
Theme 9. Normalization as way to control of database structure. Normal forms 1-3	**2/2/18**	**Know** functional Dependencies and Normalization for Relational Databases. **Be able to** fill the normalization **Use** Functional dependencies in normalization	Submitting on eLearn **Laboratory work:** Normalization. Part 1 **Individual work:** NoSQL database technologies	**30**
Theme 10. Normalization. The heist normal forms	**2/2/0**	**Know** basic stages of normalization **Be able to** fill the Normalization (next steps)	Submitting on eLearn **Laboratory work:** Normalization. Part 2	**20**
Theme 11. Modern database methodology infological design	**2/2/0**	**Know** basic stages of infological design **Highlight** infological design for land management	Submitting on eLearn Submitting on eLearn **Laboratory work:** Normalization. Part 3	**20**
Module control			Test	**30**
Total module 3	**6/4/20**			**100**
SEMANTIC MODULE IV. OPERATION WITH DATA				
Theme 12. Relational algebra	**4/6/20**	**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 works:** Creating a physical database model SQL query language. Part 1 **Individual work:** Procedural programming languages when working with SQL	**25**
Theme 13. Operation and query languages	**6/7/17**	**Know** SQL-Schema Definition, Constraints, and Queries **Be able to** use GIS and databases queries for land management	Submitting on eLearn **Laboratory works:** SQL query language. Part 2 Calculation of secondary attributes of subject area objects.	**45**

		Use ArcGIS-ArcMap to combining database and vector topological model	Creation of new object classes Client-server architecture in the formation of requests to the database **Individual works:** Functions used in SQL databases	
Module control			Test	**30**
Total module 4	**10/13/25**			**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's rating points	**The Ukrainian National Grades**	
	exams	**final tests**
90-100	"Excellent"	passed
74-89	"Good"	
60-73	"Satisfactory"	
0-59	"Unsatisfactory"	fail

RECOMMENDED SOURCES OF INFORMATION

1. 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.
2. Кохан С.С., Москаленко А.А., Іванюта О.О. Geoinformation systems and databases (methodological guideline for laboratory classes) для студентів напряму підготовки «Геодезія, картографія та землеустрій» - К.: ЦК «КОМПРИНТ», 2014.
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. Geographic information systems / M. Van Meirvenne, Svitlana Kokhan, roman Ananchenko, NAUU, 2003
7. 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.

8. Інформатика та комп'ютерна техніка: Навч.-метод. посібник / За заг. ред. О.Д. Шарапова. – К.: КНЕУ, 2002.

9.Sikha Bagui, Richard Earp. Database design using Entity-Relationship Diagrams, CRC Press, RBoca Raton, Florida, 2000.

10. A Moskalenko (2021) GIS support of forming spatial decisions on land use. Mechanization in agriculture & Conserving of the resources 67 (3), 79-81.

11. ISO/TS 19104:2008 «Geographic information – Terminology».

12. ISO 19107:2003 «Geographic information - Spatial schema».

13. ISO 19108:2002 «Geographic information - Temporal schema»

14. ISO 19110:2005 «Geographic information - Methodology for feature cataloguing»

15. ISO 19115 «Geographic information - Metadata»

16. eLearn webpage - https://elearn.nubip.edu.ua/course/view.php?id=1554

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

18. Мулеса О.Ю. Інформаційні системи та реляційні бази даних. Навч. посібник. – Електронне видання, 2018. –118 с.

19. Геоінформаційні системи (ГІС). Портал знань. Електронні навчальні курси. Дистанційне навчання. Режим доступу - http://www.znannya.org/?view=gis

20. Стандарти та специфікації відкритого геопросторового консорціуму OGC, http://www.opengeospatial.org/standards