**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

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**Instructor**
Antonina Moskalenko, PhD, Associate Professor

**Contacts**
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**eLearn webpage**

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**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 MS Access environment, and basic receptions of development and work, with the databases in MS Access.

**The discipline provides the formation of a number of competencies:**

- **general competencies:**
  3K5 - ability to use information technologies;

- **special competencies:**
  CK4 - ability to perform professional duties in the area of geodesy and land management;
  CK7 - ability to be able to use modern geodetic, navigation, geoinformation and photogrammetric software and equipment;
  CK8 - the ability to collect, process, model and analyze geospatial data in the field and laboratory independently.

**Program results:**

3ЗP 13. Application of knowledge and understanding of the use of methods and information technologies in land management;

3ЗP 16. Application of knowledge and understanding of map development and cadastral data collection using computer technologies, geographic information systems and digital photogrammetry.

ФС 19. Formation of judgments and understanding about computer processing of survey results in geographic information systems.
### The course Program and Structure

<table>
<thead>
<tr>
<th>Topic</th>
<th>Hours (lectures / laboratory / individual)</th>
<th>Education result</th>
<th>Tasks</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5 semestr</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>SEMANTIC MODULE I. INTRODUCTION AND CONCEPTUAL MODELING</strong></td>
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</tr>
<tr>
<td>Theme 1. Introduction to Geoinformation science</td>
<td>2/4/20</td>
<td>Know basics of the geoinformation systems <strong>Understand</strong> the possibilities of organization of Information in a GIS <strong>Recognize</strong> differences between types of Information in a GIS</td>
<td>Submitting in eLearn <strong>Laboratory works:</strong> Interface of the geoinformation system. Basics of geospatial data sets <strong>Individual work:</strong> Industrial GIS</td>
<td>30</td>
</tr>
<tr>
<td>Theme 2. Model of spatial data: vector and object data models</td>
<td>2/6/10</td>
<td>Know the objects used in digital plans and maps <strong>Be able to</strong> ArcGIS-ArcMap tools for creating vector topological model</td>
<td>Submitting in eLearn <strong>Laboratory works:</strong> Creating vector data sets <strong>Individual work:</strong> Vector data model</td>
<td>25</td>
</tr>
<tr>
<td>Theme 3. Model of spatial data. Mosaic models</td>
<td>2/4/10</td>
<td>Know data formats and be able to use them correctly <strong>Apply</strong> ArcGIS-ArcMap tools for editing vector topological model</td>
<td>Submitting in eLearn <strong>Laboratory works:</strong> Editing graphical mistakes. <strong>Individual work:</strong> Mosaic data model</td>
<td>25</td>
</tr>
<tr>
<td><strong>Module control</strong></td>
<td></td>
<td>Test</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td><strong>Total module 1</strong></td>
<td>6/14/40</td>
<td></td>
<td></td>
<td>100</td>
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<tr>
<td><strong>SEMANTIC MODULE II. MODERN TECHNOLOGY OF DATABASES</strong></td>
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<tr>
<td>Theme 4. Basic concepts and determination of database theory</td>
<td>1/2/10</td>
<td>Know basic concepts and determination of database theory <strong>Analyze</strong> possibilities and application of geodatabase in land management</td>
<td>Submitting in eLearn <strong>Laboratory work:</strong> Adding of attribute data <strong>Individual work:</strong> Methods of data capture for a database</td>
<td>20</td>
</tr>
<tr>
<td>Theme 5. Stages of database design</td>
<td>1/2/5</td>
<td>Know basic stages of database design <strong>Be able to</strong> model basic stages of planning, conceptual design, logical planning and physical planning of database <strong>Analyze</strong> sources of information and their quality to create database</td>
<td>Submitting in eLearn <strong>Laboratory work:</strong> Formation of technical specifications database design. <strong>Individual work:</strong> Distributed database</td>
<td>15</td>
</tr>
<tr>
<td>Theme 6. Database system concepts and architecture</td>
<td>2/0/10</td>
<td>Know database system Concepts and Architecture <strong>Be able to</strong> explain Extended model <strong>Highlight</strong> to classification of database management systems</td>
<td>Submitting in eLearn <strong>Individual work:</strong> Extended model «Entity – relationship»</td>
<td>10</td>
</tr>
</tbody>
</table>
| Theme 7. Data modeling using the entity-relationship model | 2/4/10 | 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:** Creating conceptual model DB  
**Individual work:** Data modeling | 20 |
| --- | --- | --- | --- | --- |

| Theme 8. Relational database design | 3/4/5 | Know basic of relation database design  
**Be able to** creating logical data models  
**Use** Domains, relationships, cortege, attributes for database design | Submitting on eLearn  
**Laboratory work:** Creating logical model DB  
**Individual work:** Relational database design | 15 |

<table>
<thead>
<tr>
<th>Module control</th>
<th>Test</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total module 2</strong></td>
<td>8/12/40</td>
<td>100</td>
</tr>
</tbody>
</table>

### SEMANTIC MODULE III. DATABASE DESIGN

| Theme 9. Normalization as way to control of database structure. Normal forms 1-3 | 2/2/5 | 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  
**Individual work:** Functional dependencies | 25 |

| Theme 10. Normalization. The heist normal forms | 2/2/5 | Know basic stages of normalization  
**Be able to** fill the Normalization (next steps) | Submitting on eLearn  
**Laboratory work:** Normalization (next steps)  
**Individual work:** Transitive dependencies | 25 |

| Theme 11. Modern database methodology infological design | 2/0/10 | Know basic stages of infological design  
**Highlight** infological design for land management | Submitting on eLearn  
**Individual work:** Methodology infological design | 20 |

<table>
<thead>
<tr>
<th>Module control</th>
<th>Test</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total module 3</strong></td>
<td>6/4/20</td>
<td>100</td>
</tr>
</tbody>
</table>

### SEMANTIC MODULE IV. OPERATION WITH DATA

| Theme 12. Relational algebra | 2/6/15 | 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 physical model DB. Entering data into DataBase  
**Individual work:** Relational algebra and calculus | 40 |

| Theme 13. Operation and query languages | 2/7/10 | Know SQL-Schema Definition, Constraints, and Queries | Submitting on eLearn  
**Laboratory works:** Export data into GIS. | 40 |
**Be able to** use GIS and databases queries for land management  
**Use** ArcGIS-ArcMap to combining database and vector topological model  
**Combining database and vector topological model.**  
**Simple queries and GIS**  
**Individual works:** Language SQL: determination of data/Query processing

<table>
<thead>
<tr>
<th>Module control</th>
<th>Test</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total module 4</strong></td>
<td>8/13/25</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total 5 semester</strong></td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Final test</td>
<td>Final exam</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total course</strong></td>
<td></td>
<td>100</td>
</tr>
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</table>

**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**

<table>
<thead>
<tr>
<th>Student’s rating points</th>
<th>The Ukrainian National Grades</th>
<th>final tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>“Excellent”</td>
<td>passed</td>
</tr>
<tr>
<td>74-89</td>
<td>“Good”</td>
<td></td>
</tr>
<tr>
<td>60-73</td>
<td>“Satisfactory”</td>
<td></td>
</tr>
<tr>
<td>0-59</td>
<td>“Unsatisfactory”</td>
<td>fail</td>
</tr>
</tbody>
</table>