NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Geoinformatics and Aerospace Research of the Earth

APPROVED
Faculty of Land Management

May 15, 2025

CURRICULUM OF ACADEMIC DISCIPLINE
Digital Plans and Maps

Area of knowledge	19. Architecture and construction
Specialty	193. Geodesy and Land management
Academic programme	"Geodesy and Land Management"
Faculty	Land Management
Developed by:	Associate prof., PhD, Moskalenko A.A.

Kyiv – 2025

Description of the discipline "Digital Plans and Maps" introduces students to the basics of digital mapping and the possibilities of using geoinformation technologies in creating digital cartographic materials. The discipline reveals issues regarding the requirements for digital plans and maps, and methods of displaying objects on them, determining the quality of digital cartographic data, spatial data representation formats, technology for constructing digital plans and maps, and encoding cartographic information.

Within the discipline, students learn how to create and populate basic cartographic layers, create plans based on a vector model, edit spatial and attribute data, and design cartographic material with the formation of an array of topographic symbols in ArcGIS. PRO and signs for individual thematic layers.

Area of knowledge, specialty, academic programme, academic degree		
Academic degree	Bachelor	
Specialty	193 Geodesy and Land management	
Academic programme	Geodesy and Land management	
Characteristics of the discipline		
Type	Selected	
Total number of hours	120	
Number of ECTS credits	4	
Number of modules	2	
Course project (work) (if any)		
Form of assessment	Final test	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	**Part-time**
Year of study	3	
Term	6	
Lectures	15 hours.	
Practical classes and seminars	- hours.	
Laboratory classes	45 hours.	
Self-study	60 hours.	
Number of hours per week for full-time students	- hours.	

1. Aim, competences and expected learning outcomes of the discipline

Aim The course "Digital plans and maps» provides obtaining skills of GIS cartographic modeling for land management and land cadaster.

Competences acquired:

Integral competence (IC):

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

General competence (GC):

GC 01. Ability to learn and master modern knowledge.
GC 02. Ability to apply knowledge in practical situations.
GC 05. Ability to communicate in a foreign language.
GC 06. Ability to use information and communication technologies.
GC 09. Ability to interpersonal interaction.

GC 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
Special (professional) competence (SC):

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 02. Ability to apply theories, principles, methods of physical and mathematical, natural, socio-economic, engineering sciences in performing tasks 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 12. Ability to conduct technical control and assess the quality of topographic, geodetic and cartographic products.

SC 13. Ability to develop documentation on land management and land valuation, cadastral documentation, fill in the data of state land, urban and other cadastres

Expected learning outcomes (ELO):

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

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

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

ELO 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.

ELO 7. Perform surveys and survey, topographic and geodetic, cartographic, design and design and survey work in the performance of professional tasks in geodesy and land management.

ELO 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.

ELO 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.

ELO 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.

ELO 12. Develop documentation from land management, cadastral documentation and land valuation documentation with application computer technology, geoinformation systems and digital photogrammetry, to fill the state land with data, urban and other cadasters.

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

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

2. Programme and structure of the discipline

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 1. CARTOGRAPHY AND GEOINFORMATICS												
Theme 1. The main terminology in digital mapping	1-2	16	2		4		10					
Theme 2. Methods of displaying objects	3-4	22	2		10		10					
Theme 3. Standardization of geographic information	5-6	22	2		10		10					
Total by Semantic module 1		***60***	***6***		***24***		***30***					
Semantic module II. TECHNOLOGIES OF DIGITAL MAPPING												
Theme 4. Sources for digital mapping and map construction	7-8	12	2		4		6					
Theme 5. Technology of digital maps and plans design	9-10	16	2		6		8					
Theme 6. Spatial-logical relations of objects	11-12	14	2		4		8					
Theme 7. Classificatory of electronic map	13-15	18	3		7		8					
Total by Semantic module 2		***60***	***9***		***21***		***30***					
Total		**120**	**15**		**45**		**60**					

3. Topics of lectures

No.	Topic	Hours
1	The main terminology in digital mapping.	2
2	Methods of displaying objects on digital plans .	2
3	Standardization of geographic information	2
4	Sources for digital mapping and map construction	2
5	Technology of digital maps and plans design	2
6	Spatial-logical relations of objects	2
7	Classificatory of electronic map	3
Total		**15**

4. Topic of laboratory classes

No.	Topic	Hours
1 .	Working with basemap layers	2
2.	Entering attribute data	2

3 .	Creating point symbols for a digital plan	2
4 .	Creating linear symbols for a digital plan	2
5.	Signatures as a component of linear symbols of a digital plan	2
6.	Signatures as a component of polygonal symbols of a digital plan	2
7.	Creating polygonal symbols for a digital plan	2
8.	Displaying qualitative and quantitative attributes of a digital plan	2
9.	Creating localized diagrams	2
10.	Simultaneous display of multiple digital plan attributes	2
11.	Map layout	4
12.	Creating digital map layers by option	2
13.	Binding the base of the digital map by option	2
14.	Vectorization of point objects of a digital map by option	2
15.	Vectorization of linear objects of a digital map by option	2
16.	Vectorization of polygonal digital map objects by option	2
17.	Checking topological relations as a means of checking the quality of vectorization	2
18.	Editing a digital map by option	2
19.	Filling the digital map knowledge base by option	2
20.	Creating charts, reports, digital map objects by option	2
21.	Digital map layout by option	3
Total		**45**

5. Topics of self-study

No.	Topic	Hours
1	Professional terminology for digital maps and plans	10
2	Features of relief images on digital and electronic maps	10
3	Geographic information mapping data formats	10
4	Data sources for creating digital maps and plans	6
5	Analysis of the application of digital maps and plans in various industries (based on scientific articles and publications).	8
6	Applying the rules of topological relations	8
7	Digital Maps Knowledge Base	8
Total		60

6. Methods of assessing expected learning outcomes:

- oral or written survey;
- test;
- defending laboratory works, projects;
- peer-to-peer assessment, self-assessment.

7. Teaching methods *:*

- problem-based method;
- practice oriented studying method;
- project education method;
- research based method;
- learning discussions and debates method;
- team work, brainstorm method.

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1. CARTOGRAPHY **AND GEOINFORMATION**		
Theme 1. **The main terminology in digital mapping.**		
Lecture 1	**Distinguish between** digital and electronic maps **Know** the requirements for digital maps and plans (ELO1, ELO2, ELO3, ELO4)	-
Lab 1. Working with basemap layers	**Apply ArcGIS** Pro tools to work with map layers (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 2. Entering attribute data	**Apply ArcGIS** Pro tools to work with attribute data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Self-study work 1. Professional terminology of digital maps and plans	**Understand** opportunities application digital plans and maps in to their professional activities (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Theme 2. **Methods of displaying objects**		
Lecture 2	**Know** the objects used in digital plans and maps (ELO1, ELO2, ELO3, ELO4)	-
Laboratory work 3. Creating point symbols of a digital plan	**Be able** to form an array of topographic symbols in ArcGIS Pro and symbols for individual thematic layers (including agricultural lands) **Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 4. Creating linear symbols of a digital plan	**Be able** to form an array of topographic symbols in ArcGIS Pro and symbols for individual thematic layers (including agricultural lands) **Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 5. Signatures as a component of linear symbols of a digital	**Be able** to form an array of topographic symbols in ArcGIS Pro and symbols for	**5**

plan	individual thematic layers (including agricultural lands) **Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	
Laboratory work 6. Signatures as a component of polygonal symbols of a digital plan	**Be able** to form an array of topographic symbols in ArcGIS Pro and symbols for individual thematic layers (including agricultural lands) **Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Laboratory work 7. Creating polygonal symbols of a digital plan	**Be able** to form an array of topographic symbols in ArcGIS Pro and symbols for individual thematic layers (including agricultural lands) **Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Self-study work 2. Features of relief depiction on digital and electronic maps	**Apply** visualization and design tools **Use** GIS to display objects on digital plans and maps **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Theme 3. **Standardization of geographic information**		
Lecture 3	**Know** data formats and be able to use them correctly **(**ELO1, ELO2, ELO3, ELO4**)**	**-**
Laboratory work 8. Displaying qualitative and quantitative attributes of a digital plan	**Apply ArcGIS** Pro tools to display numeric and text data **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Laboratory 9. Creating localized diagrams	**Apply ArcGIS** Pro tools to display numeric and text data **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Lab 10. Simultaneous display of multiple digital plan attributes	**Apply ArcGIS** Pro tools to display numeric and text data **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Laboratory work 11. Map layout	**Apply** ArcGIS mapping and design tools Pro for forming a plan **(**ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15**)**	**5**
Self-study work 3. Data formats for	**Analyze** data formats for creating digital	**5**

geographic information mapping	maps (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	
Module control work 1.		**30**
Total for module 1		**100**
Module 2. GEOINFORMATION **MAPPING TECHNOLOGIES**		
Theme 4. **Sources for digital mapping and map construction**		
Lecture 4	**Know** the sources of information for creating maps (ELO1, ELO2, ELO3, ELO4)	**-**
Laboratory work 12. Creating digital map layers by option	**Be able** to create basic map layers (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 13. Binding the base of a digital map by option	**Apply ArcGIS ArcGIS PRO** tools to edit vector data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Self-study work 4. Data sources for creating digital maps and plans	**Analyze** information sources and their quality to create digital maps (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Theme 5. **Technology of digital maps and plans design**		
Lecture 5	**Know** geoinformation mapping technologies **Highlight** the stages of constructing digital maps and plans (ELO1, ELO2, ELO3, ELO4)	**-**
Laboratory work 14. Vectorization of point objects of a digital map by option	**Be able** to model and implement components of geoinformation mapping **Apply ArcGIS** PRO tools - to create point vector data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 15. Vectorization of linear objects of a digital map by option	**Be able** to model and implement components of geoinformation mapping **Apply ArcGIS** PRO tools - to create linear vector data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 16. Vectorization of polygonal objects of a digital map by option	**Be able** to model and implement components of geoinformation mapping **Apply ArcGIS** PRO tools - to create polygonal vector data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Self-study work 5. Analysis of the application of digital maps and plans in various industries (based on scientific articles and publications).	**Analyze** the feasibility of creating digital maps to solve various problems (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Theme 6. **Spatial-logical relations of objects**		
Lecture 6	**Know** the spatial-logical relationships of objects	**-**

	(ELO1, ELO2, ELO3, ELO4)	
Laboratory work 17. Checking topological relations as a means of checking the quality of vectorization	**Be able** to apply topology rules to verify a digital plan **Analyze** the sources of quality for creating digital maps **Apply** ArcGIS-ArcMap tools to identify topology errors (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 18. Editing a digital map by variant	**Be able** to apply topology rules to control the quality of vectorization **Apply** ArcGIS tools PRO for editing vector data (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Applying the rules of topological relations	**Apply** Applying the rules of topological relations (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Theme 7. **Classificatory of electronic map**		
Lecture 7	**Know** the purpose of classifiers and codifiers (ELO1, ELO2, ELO3, ELO4)	**-**
Laboratory work 19. Filling the knowledge base of a digital map by option	**Be able** to populate the knowledge base of a digital map (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 20. Creating charts, reports, digital map objects by option	**Apply** ArcGIS mapping and design tools Pro for forming a plan (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Laboratory work 21. Digital map layout by option	**Apply** ArcGIS mapping and design tools Pro for forming a plan (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**10**
Self-study work 7 . Digital Maps Knowledge Base	**Analyze and structure** data in a digital map knowledge base (ELO7, ELO9, ELO10, ELO12, ELO 13, ELO15)	**5**
Module control work 2.		**30**
Total for module 2		**100**
Class work		**(M1 + M2)/2*0.7 ≤ 70**
Credit	**30**	
Total for year		**(Coursework + exam) ≤ 100**

8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent

74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.3. Assessment policy

Deadlines and exam retaking rules	*EXAMPLE:* works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
Academic integrity rules	*EXAMPLE:* cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	*EXAMPLE:* Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids:

- e-learning course of the discipline: https://elearn.nubip.edu.ua/course/view.php?id=108; https://elearn.nubip.edu.ua/course/view.php?id=106);
- references to digital educational resources; *https://elearn.nubip.edu.ua/course/view.php?id=108 ; https://elearn.nubip.edu.ua/course/view.php?id=106*)
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
  - Methodical guidelines for laboratory works in the discipline "Digital Plans and Maps" / A. Moskalenko, A. Gorodnycha, M. Bratinova. - K., 2025
  - Lecture notes for course «Digital plan and maps» (Конспект лекцій з дисципліни «Цифрові плани і карти» англійською мовою) / A. Moskalenko, S. Kokhan – Kyiv, 2023. – 96 p.
  - Methodological guideline for course «Digital plan and maps» (Методичні вказівки до виконання лабораторних робіт з дисципліни «Цифрові плани і карти» англійською мовою) / A. Moskalenko, S. Kokhan – Kyiv, 2021. – 104 p.
  - Кохан С.С., Москаленко А.А. Цифрові плани і карти. Навчально-методичний посібник для студентів напряму підготовки «Геодезія, картографія та землеустрій».-К.: ЦК «КОМПРИНТ», 2015.
  - Кохан С.С., Москаленко А.А., Іванюта О.О., Новиков О.І. Цифрові плани і карти. Навчально-методичний посібник для студентів напряму підготовки «Геодезія, картографія та землеустрій».-К.: ЦК «КОМПРИНТ», 2014.
- internship programmes of the discipline (if included in the curriculum).

10. Recommended sources of information

1. Antonio Ganga, Blaz Repe, Mario Elia (2023) Applications_of_GIS_and_Remote_Sensing_in_Soil_Environment_Monitorin. – MDPI. – 204p. (https://doi.org/10.3390/books978-3-0365-9478-1)
2. Основи створення інтероперабельних геопросторових даних. / Ю. О. Карпінський та ін. – Київ: КНУБА, 2023. – 302 с.

3. Huadong Guo, Michael F. Goodchild, Alessandro Annoni (2020) Manual of Digital Earth. – Springer Open. –846p. (https://doi.org/10.1007/978-981-32-9915-3)
4. ArcGIS for Environmental and Water Issues / William Bajjali. - 2018 - p.362
5. Honcu, A; Varga, R (2023) ARCGIS for mapping veteran settlements in the province of upper Moesia. JOURNAL OF ANCIENT HISTORY AND ARCHAEOLOGY. Volume10. Issue1. - Page10-21. DOI10.14795/j.v10i1.823
6. Moskalenko A. Geoinformation mapping for providing the rational use and protection of soil. Mechanization in agriculture & Conserving of the resources. 65 (2019), 186-189
7. Moskalenko A. GIS support of forming spatial decisions on land use // International Scientific Journal Mechanization in agriculture & Conserving of the resources, Vol. 67 (2021), Issue 3, p.79-81.