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

GEOINFORMATICS, COMPUTER SCIENCE AND PROGRAMMING

Area of knowledge	19. Architecture and Construction
Specialty	193. Geodesy and Land Management
Academic programme	"Geodesy and Land Management"
Faculty	Land Management
Developed by:	Assistant Professor, PhD A. Horodnycha
	(position, academic degree, academic title)

Kyiv – 2025

Description of the academic discipline

The discipline "Geoinformatics, Computer Science and Programming" provides the formation of theoretical knowledge and skills in the use of computer technologies by land surveyors in their practical work. The basics of spatial thinking, the basics of geoinformatics, modeling of geographic objects in geoinformatics, working with vector data, familiarization with GIS and databases are considered. Students form basic ideas about geospatial information and its presentation, acquire practical skills in working with software tools, in particular Google Earth Pro .

Area of knowledge, specialty, academic programme, academic degree		
Academic degree	*Bachelor`s*	
Specialty	*193. Geodesy and Land Management*	
Academic programme	*Geodesy and Land Management*	
Characteristics of the discipline		
Type	Required	
Total number of hours	60	
Number of ECTS credits	2	
Number of modules	2	
Course project (work) (if any)	-	
Form of assessment	*Exam*	
Academic discipline indicators for full-time and part-time forms of higher education		
	Form of obtaining higher education	
	daytime	**correspondence**
Year of study	2	1
Term	3	2
Lectures	*3 hours*	*2 hours*
Practical classes and seminars	-	-
Laboratory classes	*30 hours*	-
Self-study	*3 hours*	-
Number of hours per week for full-time students	*3 hours*	-

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

"Geoinformatics, Computer Science and Programming" is studied for the first three semesters and provides the opportunity to use computer technologies by specialists in the field of geodesy and land management in their practical work.

Competences acquired:

Integral competence (IC):

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

General competence (GC):

GC01. Ability to learn and master modern knowledge.
GC02. Ability to apply knowledge in practical situations.
GC05. Ability to communicate in a foreign language.
GC06. Ability to use information and communication technologies.
GC07. Ability to work autonomously.
GC08. Ability to work in a team.

GC13. The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on understanding the 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 engineering, to use various types and forms of physical activity for recreation and leading a healthy lifestyle.

Special (professional) competence (SC):

SC04. Ability to select and use effective methods, technologies and equipment for carrying out professional activities in the field of geodesy and land management.

SC06. Ability to perform remote, ground, field and office research, engineering calculations for processing research results, formalize research results, prepare reports when solving geodesy and land management tasks.

SC07. Ability to collect, update, process, critically evaluate, interpret, store, publish and use geospatial data and metadata regarding objects of natural and man-made origin.

SC09. Ability to use tools, devices, equipment, and facilities when performing geodesy and land management tasks.

SC10. Ability to monitor and assess land.

***Expected learning outcomes (ELO*)**:

ELO01. Communicate freely in oral and written forms in the state and foreign languages on matters of professional activity.

ELO02. Organize and manage the professional development of individuals and groups.

ELO03. Communicate information, ideas, problems, solutions, own experience, and arguments to specialists and non-specialists.

ELO04. Know and apply in professional activities regulatory and legal acts, regulatory and technical documents, reference materials in the field of geodesy and land management and related industries.

ELO09. Collect, evaluate, interpret and use geospatial data, metadata regarding 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.

ELO10. Select and apply tools, equipment, facilities, and software necessary for remote, terrestrial, field, and desk-based research in the field of geodesy and land management.

ELO11. Organize and perform remote, ground, field and office work in the field of geodesy and land management, document the results of the work, and prepare relevant reports.

ELO15. Develop and make effective decisions regarding professional activities in the field of geodesy and land management, including under conditions of uncertainty.

2. Program and structure of the discipline

– full-time study period

Modules and topics	Number of hours												
	full-time							part-time					
	weeks	total	including					total	including				
			l	p	lab	ind	s.st		l	p	lab	ind	s.st.
Module 1. Fundamentals of Geoinformatics													
Topic 1. From geography to geoinformatics	1-2	6	2		4			1	1				
Topic 2. Basics of spatial thinking	3-4	21	2		4		15						
Topic 3. Domains of geographic information	5-6	8	2		6								

Total by module 1	**35**		**6**		**14**		**15**	**1**	**1**				
Module 2. Modeling geographic objects in geoinformatics													
Topic 1. Geographical fields and objects as the main entities of geographical space	7-8	4	2		4			1	1				
Topic 2. Vector and object models of spatial data	9-10	6	2		4								
Topic 3. Mosaic spatial data models	11-12	6	2		4								
Topic 4. From geoinformatics to GIS and databases	13-15	7	3		4								
Total by module 2	**25**		**9**		**16**		**0**						
Total hours	**60**		**15**		**30**		**15**	**2**	**2**				

3. Topics of lectures

№	Topic	Hours
1	From geography to geoinformatics	2
2	Basics of spatial thinking	2
3	Domains of geographic information	2
4	Geographical fields and objects as the main entities of geographical space	2
5	Vector and object spatial data models	2
6	Mosaic spatial data models	2
7	From geoinformatics to GIS and databases	3
	Total	**15**

4. Topics of laboratory classes

№	Topic	Hours
1	Getting to know the Google interface Earth Pro	2
2	Configuring Google Earth Pro software	2
3	Search and organize geographic search results using Google tools Earth Pro	2
4	Geometric Primitives on Google Earth Pro: Types, Creating, and Customizing Styles. Part 1.	2
5	Geometric Primitives on Google Earth Pro: Types, Creating, and Customizing Styles. Part 2.	2
6	Working with 4D data in Google Earth Pro.	2
7	Cartometric operations in Google Earth Pro, video presentation of work results	2
8	Basics of working with QGIS	2
9	Working with map layers. Part 1	2
10	Working with map layers. Part 2	2
11	Getting information about layer objects	2
12	Search for objects by attribute data	2
13	Cartometric operations	2
14	Map Layout. Part 1	2
15	Map Layout. Part 2.	2
	Total	**30**

5. Topics of self-study

№	Topic	Hours
1	Maps.visicom.ua – Ukrainian geospatial data portal	15
	Total	**15**

6. Methods and means of diagnosing learning outcomes:

– oral or written survey;
– discussions;
– speech with presentations;

– testing;
– defense of laboratory work;
– defense of essays.

7. Teaching methods *:*

– problem-based learning;
– practice-oriented learning;
– case method;
– visual method;
– flipped classroom;
– learning through research;
– video method;
– independent work.

8. Results assessment.

The knowledge of a higher education applicant is assessed on a 100-point scale and is converted into a national assessment in accordance with the current "Regulations on Examinations and Tests at the NULES of Ukraine"

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1. Fundamentals of Geoinformatics		
Topic 1. From geography to geoinformatics		
Laboratory work 1. Getting to know the Google interface Earth Pro	**Know** the prerequisites for the development of geoinformatics as a science and the basic techniques of Google's work Earth Pro **Be able** to customize the interface and set settings for working with the Google application Eatrh Pro **Apply** practical skills in working with software tools. ELO01; ELO04; ELO15	**8**
Laboratory work 2. Configuring Google Earth Pro Software		**7**
Topic 2. Basics of spatial thinking		
Laboratory work 3. Searching and organizing search results for geographic objects using Google tools Earth Pro	**Know** the basics of spatial thinking **Be able** to search and organize search results for geographic objects using Google tools Earth Pro **Apply** geometric primitives to represent objects and their display styles. ELO01; ELO02; ELO03; ELO09; ELO10; ELO11	**5**
Laboratory work 4. Geometric Primitives in Google Earth Pro: Types, Creating, and Styling. Part 1.		**5**
Self-study 1. Maps.visicom.ua – Ukrainian geospatial data portal		**15**
Topic 3. Domains of geographic information		
Laboratory work 5. Geometric Primitives in Google Earth Pro: Types, Creating, and Customizing Styles. Part 2.	**Know** the domains of geographic information **Be able** to work with 4D data in Google Earth Pro **Apply** practical skills in performing cartometric operations in Google Earth Pro. ELO01; ELO03; ELO09; ELO10; ELO11	**10**
Laboratory work 6. Working with 4D data in Google Earth Pro.		**10**
Laboratory work 7. Cartometric operations in Google Earth Pro, video presentation of the results of the work		**10**
Modular test 1.		**30**
Total by module 1		**100**

Module 2. Modeling **geographic objects in geoinformatics**		
Topic 1. Geographical fields and objects as the main entities of geographical space		
Laboratory work 8. Basics of working with QGIS	**Know** the essence of definitions of geographic fields and geographic objects **Be able** to customize the interface and set parameters for working with the QGIS program **Apply** practical skills in working with layers in QGIS. ELO01; ELO02; ELO03; ELO09; ELO10; ELO11	**15**
Topic 2. Vector and object models of spatial data		
Laboratory work 9. Working with map layers. Part 1	**Know** the advantages and disadvantages of representing spatial data through vector data models **Be able** to get information about layer objects. ELO01; ELO02; ELO03; ELO04; ELO15	**5**
Laboratory work 10. Working with Map Layers. Part 2		**5**
Laboratory work 11. Obtaining information about layer objects		**10**
Topic 3. Mosaic spatial data models		
Laboratory work 12. Searching for objects by attribute data	**Know** the advantages and disadvantages of representing spatial data through mosaic data models **Be able** to search for objects by attribute data **Apply** practical skills in performing cartometric operations. ELO02; ELO03; ELO04; ELO15	**10**
Laboratory work 13. Cartometric operations		**10**
Topic 4. From geoinformatics to GIS and databases		
Laboratory work 14. Map layout. Part 1	**Know** the basic concepts of geospatial information and its representation in GIS **Be able** to develop simple layouts **Apply** basic techniques for spatial data presentation ELO09; ELO10; ELO11; ELO15	**10**
Laboratory work 15. Map layout. Part 2.		**5**
Modular test 2.		**30**
Total by module 2		**100**
Educational work		**(M1 + M2)/2*0.7 ≤ 70**
Exam	**30**	
Total per course		**(Coursework + exam) ≤ 100**

8.2. Scale for assessing student's knowledg

Higher education applicant rating, points	Assessment according to the national system (exams/credits)
90-100	perfectly
74-89	good
60-73	satisfactorily
0-59	unsatisfactorily

8.3. Assessment policy

Deadlines and exam retaking rules	Works submitted after the deadline without good reason will be given a lower grade. Modules can be retaken with the permission of the lecturer if there are good reasons (for example, sick leave).

Academic Integrity Policy	Cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct text references to the literature used
Attendance Policy	at classes is mandatory. For objective reasons (e.g. illness, international internship), studies may be conducted individually (online upon agreement with the dean of the faculty).

9. **Educational and methodological support:**

- electronic educational course of the academic discipline (on the educational portal of the NUBiP of Ukraine eLearn - *https://elearn.nubip.edu.ua/enrol/index.php?id=707*);
- lecture notes and their presentations (in electronic form - *https://elearn.nubip.edu.ua/enrol/index.php?id=707*);
- textbooks, study guides, workshops;
- methodological materials for studying the academic discipline for full-time and part-time higher education students.

- Methodical instructions for teaching practice in the discipline "Geoinformatics, Computer Science and Programming" (2nd year) / L. Primak, A. Moskalenko. – Kyiv, 2023. – 68 p.
- Methodical instructions for teaching practice in the discipline "Geoinformatics, Computer Science and Programming" (1st year) / A. Moskalenko, O. Shykula, I. Shkvyr. – Kyiv, 2022. – 64 p.
- Lecture notes on the discipline "Geoinformatics". Part 1 (for students of the direction of training "Geodesy, cartography and land management") / O. Shykula, I. Shkvyr, A. Moskalenko, T. Gez. – Kyiv, 2015. – 241 p.
- Lecture notes on the discipline "Geoinformatics". Part II (for students of the direction of training "Geodesy, Cartography and Land Management") / O. Shykula, I. Shkvyr, A. Moskalenko. – Kyiv, 2015. – 305 p.

10. **Recommended sources of information**

Main:

1. Sandra L. Arlinghaus, Joseph J. Kerski, Ann Evans Larimore, Matthew Naud. Spatial Thinking in Environmental Contexts. Maps. Maps, Archives, and Timelines. 1st Edition. 2023. 248
2. Bolstad P., Manson S. GIS Fundamentals: A First Text on Geographic Information Systems. 7th Edition. 2022. 764 p.
3. Pavlysh V., Glinenko L., Shakhovska N. Fundamentals of Information Technologies and Systems. Lviv: Lviv Polytechnic. 2018. 620p.
4. Karpinsky Yu., Lyashchenko A., Lazorenko N., Kin D. Fundamentals of creating interoperable geospatial data. Kyiv. KNUBA. 2023.302 p.

Auxiliary:

5. James Holler. The Microsoft Office 365 Bible: The Most Updated and Complete Guide to Excel, Word, PowerPoint, Outlook, OneNote, OneDrive, Teams, Access, and Publisher from Beginners to Advanced. 2022. 359 p.
6. Alexander M., Kusleika D. Microsoft Excel 365 Bible. Wiley 2022. 1072
7. Ellen Lupton, Jennifer Cole Phillips. Graphic Design. New Basics. Kyiv: ArtHuss. 2019. 262 p.

8. Berinato S. Good Diagrams. Tips, Tools, and Exercises for Better Data Visualization. Kyiv: ArtHuss. 2022. 288 p.
9. Mark Lutz. Python. Programmer's Handbook. Kyiv: Naukovyi svit. 2023. 294 p.
10. Paul Berry. Head First. Python: An Easy-to-Understand Reference. Kharkiv: 2021. 624 p.
11. Shipulin V. D. Basic principles of geoinformation systems: a textbook. Kharkiv: KhNAMG, 2010. 313 p.
12. Moodle Documentation. URL: https://docs.moodle.org/403/en/Main_page
13. Word help & learning. URL: https://support.microsoft.com/en-us/word
14. Excel help & learning. URL: https://support.microsoft.com/en-us/excel
15. Python Language Reference. URL: https://docs.python.org/uk/3/reference/index.html
16. Online IDE - Code Editor, Compiler, Interpreter. URL: https://www.online-ide.com/
17. Google Earth Help. URL: https://support.google.com/earth/?hl=en#topic=7364880
18. QGIS User Guide. URL: https://docs.qgis.org/3.28/en/docs/user_manual/index.html