

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Geoinformatics and Aerospace Research of the Earth

«APPROVED»

Dean of the Faculty of Land management

_____ T.O. Ievsiukov

« » _____ 2021 year

APPROVED by department of
Geoinformatics and Aerospace Research
of the Earth

Protocol №15 from «11» May 2021 year

Head of department of Geoinformatics and
Aerospace Research of the Earth

_____ S.S. Kokhan

SYLLABUS

DIGITAL PLANS AND MAPS

Field of knowledge	<u>19. Architecture and Construction</u>
Specialty	<u>193. Geodesy and land management</u>
Specialization	_____
Faculty	<u>Land management</u>
Authors	<u>Dr. Sci., Prof. Kokhan S.S.</u>

1. Description of the discipline
Digital plans and maps

Branch of knowledge, direction of education, specialty, educational-qualification level (EQL)		
Educational-qualification level	Bachelor	
Direction		
Specialty	193. Geodesy and land management	
Specialization		
Discipline characteristic		
Type	Selected	
Total hours	90	
ECTS credits	3	
Thematic modules	2	
Course project (work) (if exist)		
type of examination	Final test	
Discipline parameters for full-time students and students studied by correspondence		
	full-time study	by correspondence
year of training	3	
semester	6	
lectures	15 hours.	
practical, seminar	- hours.	
laboratory	45 hours.	
self-dependent work	30 hours.	
individual work	- hours.	
Number of classroom hours (for full-time students) per week	4 hours.	

2. Purpose and tasks of the discipline

Digital plans and maps

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

Tasks of discipline is forming the specialist and subsequent practical use of technologies of GIS mapping in particular technologies of digital mapping knowledge and provide skills for collecting geographic information and work on a computer in ArcGIS environment, and GIS cartographic modeling.

Students after study of the course should know:

- main terminology in digital mapping;
- sources of digital mapping and map construction;
- hardware and software;
- technologies of digital mapping;
- cartographic data and attribute input
- metadata;
- standards;
- objective composition of electronic map;
- classificatory of electronic map

Students after study of the course should be able:

- preparing geographic data for computing and analyzing;
- to provide skills for collecting geographic information;
- GIS cartographic modeling;
- to create cartographic signs and symbols depending on the scale of maps.
- understand and use the geo-information cycle and the main concepts in geo-information science.

The discipline provides the formation of a number of competencies:

- general competencies:

GC06 - Ability to use information and communication technologies.

- special competencies:

SC03. Ability to apply regulations, regulatory and technical documents, reference materials in professional activities.

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

SC05. Ability to use modern information, technical and technological support to solve complex issues of geodesy and land management.

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

learning results:

LR4. 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.

LR5. Apply conceptual knowledge of natural and socio-economic sciences in performing tasks of geodesy and land management.

LR9. 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.

LR14. Plan complex professional activities, develop and implement projects in the field of geodesy and land management under resource and other constraints.

**3. Program and structure of the discipline:
Digital plans and maps, full-time study**

**SEMANTIC MODULE I.
CARTOGRAPHY AND GEOINFORMATICS**

Theme 1. The main terminology in digital mapping

Basic concepts and definitions (digital map, databases and banks of data, digital elevation models, etc.). Classification of digital maps. Mapping information. Mapping image. Digital mapping information. Requirements for digital maps.

Theme 2. Methods of displaying objects

Geometric objects which use on digital plans and maps. Using tools for display and design of maps. Methods of displaying objects on digital plans and maps.

Theme 3. Standardization of geographic information

National standards. International standards (ISO 19100 - geographical information). Spatial data representation formats.

**SEMANTIC MODULE II.
TECHNOLOGIES OF DIGITAL MAPPING**

Theme 4. Sources for digital mapping and map construction

Types of information sources. Astronomical-geodetic and cartographic sources. Use of remote sensing data. Analysis of map as a data source.

Theme 5. Technology of digital maps and plans design

Structuring stages of digital maps and plans designing. Processing of primary information. Modeling and implementation of geodatabase. Data entry.

Theme 6. Classification of electronic map

Classification of objects and their attributes. The list of attributes, their values and codes.

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	11	2		4		5						
Theme 2. Methods of displaying objects	3-4	19	2		12		5						
Theme 3. Standardization of geographic information	5-6	19	2		8		5						
Total by Semantic module 1		45	6		24		15						
Semantic module II. TECHNOLOGIES OF DIGITAL MAPPING													
Theme 4. Sources for digital mapping and map construction	7-8	13	2		6		5						
Theme 5. Technology of digital maps and plans design	9-12	17	4		8		5						
Theme 6. Classificatory of electronic map	13-15	15	1		7		5						
Total by Semantic module 2		45	9		21		15						
Total		90	15		45		30						

4. Topics of seminar lessons

№	Topic	Hours

5. Topics of practical lessons

№	Topic	Hours

6. Topics of laboratory lessons

№	Topic	Hours
1	Work with layers of basic map	2
2	Construction of digital symbols (points) for maps and various scales	2
3	Construction of digital symbols (lines) for maps and various scales	4
4	Construction of digital symbols (polygons) for maps and various scales	6
5	Objectives and their attributes. Data coding.	4
6	Map composition	4
7	Creating digital map by variant	4
8	Editing digital map by variant	2
9	Filling the knowledge base of digital maps by variant	4
10	Creating digital map by variant in ArcGIS Online	4
11	Editing digital map by variant in ArcGIS Online	3
12	Map composition in ArcGIS Online	4
Total		45

7. Topics of Self-dependent work

№	<i>Topic</i>	Hours
1	Professional terminology of digital maps and plans	5
2	Cartographic symbols. Representation of relief	5
3	Geoinformation mapping data formats	5
4	Data sources for creating digital maps and plans	5
5	Analysis of the use of digital maps and plans in various sectors (according to scientific articles and publications)	5
6	The knowledge base of digital maps	5
Total		30

8. Control Questions

1. Interaction of cartography and geoinformatics.
2. Relief image.
3. Sources of information for maps and plans, characteristics of their informativeness.
4. Methods of using digital maps.
5. Geoinformation mapping.
6. Virtual mapping.
7. Geoimages. Types of geoimages.
8. Graphic images.
9. Theory of geoimages.
10. Generalization of geoimages.
11. Digital cartographic information.
12. Requirements for digital cards.
13. Geoeconometrics - definition and use.
14. Electronic atlases.
15. Mathematical and cartographic modeling.
16. The concept of cartographic modeling.
17. The concept of digital map.
18. Graphic representation of objects.
19. Classification of digital maps.
20. Cartographic image. Digital cartographic information.
21. Requirements for digital cards.
22. Sources of information for creating maps.
23. Cartography and geoinformatics.
24. Hardware and software for digital cartography.
25. Data formats.
26. Network technologies and the Internet
27. Digital mapping technologies.
28. Technology of entering cartographic data
29. Digitization of maps and plans.
30. The most common mistakes in digitization.
31. Raster scanning. Factors influencing the choice of technological link
32. Metadata as “data about data”.
33. Basic provisions for the creation of electronic maps of the area.
34. Description of the structure of information and object composition of the electronic map of the area.
35. Classifiers and codifiers. Classifier of topographic information.

36. Electronic map of the area, the basic requirements for its creation.

9. Methods of teaching

In conducting lectures appropriate to use verbal teaching methods: explanation, narration, discussion, educational debate, with a combination of visual learning methods: illustration, showing.

In carrying out laboratory work should be used such as verbal learning method of instruction on the combination of visual learning methods of illustration and demonstration, the aspect of these studies is that they facilitate communication theory and practice, providing students acquiring skills using standard and specialized software, application of information technology to cadastral and form students' initial skills of research activities. Laboratory work in the laboratory are equipped computers.

10. Forms of control

The main methods of control of knowledge and skills students have to study the subject " Digital plans and maps" are: oral examination, written and practical test, standardized control in the form of modular test papers, assessment for individual learning task, the final test.

The total value of these methods is to make the best possible to ensure timely and comprehensive feedback between students and teachers, by which establishes how students perceive and learn the material.

The purpose determines the choice of control methods, it should be borne in mind that these methods can be applied in all kinds of control - only complete applications allows regularly and objectively identify the dynamics of the formation of knowledge and skills of students. Each control method has its advantages and disadvantages, scope of application, none of them can not be the only one able to diagnose all aspects of the learning process. So:

- to control the absorption of lectures: oral questioning, written modular test papers, current testing score for an individual learning task, the final test.

- for the monitoring and evaluation of laboratory work: practical test and evaluation of each laboratory work..

11. Distribution of grades received by students during study

Student's evaluation takes place according to "Про екзамени та заліки НУБіП України" dated 27/12/2019. The protocol №5 of Table 1.

The national grade	Total points for all the educational activities
EXCELENT	90-100
GOOD	74-89
SATISFACTORILY	60-73
UNSATISFACTORILY	0-59

Student's rating of course mastering R_{course} it is determined in points and made 100 points. Course ratings calculate as: $R_{COURSE}=R_{EDU}+ R_{Final Test}$ (Course ratings = Education work rating + Final Test Rating)

70% (70 points) of the R_{COURSE} is the R_{EDU}

30% (30 points) of the R_{COURSE} is the $R_{Final Test}$.

R_{COURSE} equal 100 points (100 %).

Ratings of education work consist of attending a lecture, mastering of theoretical material, executing and passing laboratory works, and control theoretical knowledge.

$$R_{EDU} = R_{Lect} + R_{Lab} + R_{Self} + R_{Contr.}$$

Evaluation criteria for an attending of a lecture R_{Lect}

Student will have a **maximal grade** for an attending a lecture, if he/she presents on a lecture, participates actively in the discussion of theme of lecture, answer a lecturer question, gives examples, assiduously conducts the compendium of lecture.

Student will have a **minimum (sufficient) grade (0,6 to maximal)** for a lecture, if he/she is late for the lecture less than 5 minutes, inattentive (but keeps discipline), passive in discussion of theme, doesn't give examples, but can formulate basic concepts of a lecture. Student will have a **0,6 grade**, if he/she didn't appear on a lecture with reasonable excuse, but has conducts the compendium of lecture and can formulate the basic concepts of lecture.

Student will have **grade from 0 to minimum**, if he/she is late for the lecture more than 5 minutes, can't define the basic concepts of lecture, but has the compendium of lecture, inattentive (but keeps discipline).

If student skipped lecture with reasonable excuse and doesn't have the compendium of lecture, student will have **grade equal 0**.

If student skipped lecture without reasonable excuse, disturbs discipline, doesn't have the compendium of lecture, student will have penalty grade.

Evaluation criteria for the mastering control of theoretical materials $R_{Contr.}$

The written work has a **maximal grade**, if it has written answer to the questions contained in the examination card. Answer should be in the compressed form, logically and consistently, contains a definitions, basic descriptions, principles and receptions of implementation, charts, examples, the indicated application domain in speciality area, etc.

The written work has a **minimal grade (0,6 to maximal)**, if it has main definition and descriptions, indicates principles and receptions of implementation, gives some examples, etc and gives written answer (even inexact) to all questions contained in the examination card.

Rating for laboratory work R_{LAB}

Student will have a **maximal grade** for fulfillment of a laboratory work, if he/she presents on a lesson, participates actively in implementation of laboratory work, executes the task fully and gets the expected result, can explain a logical sequence and phased of actions, answers a control questions of teacher.

Student will have a **minimum (sufficient) grade (0,6 to maximal)** for a laboratory work, if he/she is late for the lesson less than 5 minutes, inattentive (but keeps discipline), executes the task fully, but with some teacher help, and gets the expected result, gives insufficient answer a control questions of teacher.

Student will have **grade from 0 to minimum**, if he/she executes the task partly, (but executes the task more than 75%), or doesn't get the expected result, gives inexact answer.

If student skipped laboratory work with reasonable excuse, student has to rework this lesson in other time. Student should arrange time with a teacher, because task uses license software.

If student skipped laboratory work without reasonable excuse or didn't finish task in the set time, student gets a penalty.

Rating for self-work R_{Self}

Student will have a **maximal grade** for defence of a self-work, if he/she clear define a theoretical grounds of the topic, gives examples, can account for the sequence of actions implementation, can apply theoretical knowledges in practice.

Student will have a **minimum (sufficient) grade (0,5 to maximal)** defence of a self-work, if he/she gives insufficient answer, doesn't give examples or gives one with complication.

Student will have **grade from 0 to minimum** for defence of a self-work, if he/she gives inexact answer, doesn't give main definitions.

Rating of additional work R_{add} and rating of penalty $R_{penalty}$ has an influence on rating of educational work.

Maximal rating of additional work makes 10% from rating of course (that is 10 points). It's determined by a lecturer. Rating of additional work given to student after department decision for implementation of work, that don't foreseen by a working curricula of the course, but increase student's level of skill.

5% (4 points) of the rating of education work is rating of penalty. Rating of penalty has negative quantity and it decreases rating of education work. Rating of penalty was determined by a lecturer. It's entered department decision for a student, who was mastering material of the module too late, wasn't following the executive schedule and had omitted lesson from time to time, etc.

Students have to have more than 60 % points from rating of educational work for admitting to final test. It's meaning, that student should to do next minimal list of work:

- to execute all laboratory works;
- to don't get punitive measure of lecturer.

Rating evaluation of the final test is proposed as a test tasks.

Rating evaluation system of educational work for the substance modules

	Type of work	Module			Course		
		point by work	percent by		total	percent by modules	total
			work	module			
Module # 1	Lectures	100	6 %	70 %	100	35 %	100
	Laboratory work #1	100	7 %				
	Laboratory work #2	100	10 %				
	Laboratory work #3	100	10 %				
	Laboratory work #4	100	10 %				
	Laboratory work #5	100	7 %				
	Laboratory work #6	100	10 %				
	Self-work	100	10 %				
Module test / control	100	30 %	30 %				
Module # 2	Lectures	100	8 %	70 %	100	35 %	
	Laboratory work #7	100	17 %				
	Laboratory work #8	100	20 %				
	Laboratory work #9	100	13 %				
	Self-work	100	12 %				
	Module test / control	100	30%	30 %			
Final test		100				30 %	

12. Textbooks

1. 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.

2. 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.

13. Recommended literature

Basic:

1. ArcGIS for Environmental and Water Issues / William Bajjali. - 2018 - p.362
2. Manual of Digital Earth / Huadong Guo, Michael F. Goodchild, Alessandro Annoni – Springer Open 2020. – p.846 (<https://doi.org/10.1007/978-981-32-9915-3>)
3. Geoinformation mapping for providing the rational use and protection of soil / A Moskalenko // Mechanization in agriculture & Conserving of the resources 65 (Issue 5), 186-189
4. Quantitative Land Suitability Mapping for Crop Cultivation // Kokhan, A Moskalenko, O Drozdivskyi // Communications - Scientific Letters of the University of Zilina, 77-83
5. Бондаренко Е.Л. Геоінформаційне еколого-географічне картографування.– К.: Фітосоціоцентр, 2007.–272 с
6. Геоінформаційні системи і бази даних : монографія. – Кн. 2 / В. І. Зацерковний, В. Г. Бурачек, О. О. Железняк, А. О. Терещенко. – Ніжин : НДУ ім. М. Гоголя, 2017. – 237 с
7. Козаченко Т. І. Геоінформаційне картографування малих підприємств України [Електронний ресурс] / Т. І. Козаченко, Т. С. Цокало // Вісник геодезії та картографії. - 2009. - № 4. - С. 17-27. - Режим доступу: http://nbuv.gov.ua/UJRN/vgtk_2009_4_5
- 8.
9. Лященко А. А. Сервіс – орієнтована архітектура кадастрових геоінформаційних систем та кадастрових геопорталів / А. А. Лященко, Ж. В. Форосенко, А. Г. Черін // Вісн. геодезії та картографії. – 2011. – № 1. – С. 35 – 42.
10. Черняга П. Г. Використання ГІС-технологій в землевпорядному проектуванні / П. Г. Черняга, С. В. Булакевич // Сучасні досягнення геодезичної науки та виробництва: зб. наукових праць. – Львів: «Львівська політехніка», 2005. – С. 290–294.
11. Черняга П. Г. Використання ГІС-технологій для виконання моніторингу сільськогосподарських земель та управління угіддями / П. Г. Черняга, О. В. Басовець // Сучасні досягнення геодезичної науки та виробництва – вип I (17), 2009. – С. 204-208.

Additional:

1. Національний стандарт України «ДСТУ ISO 19101:2009 Географічна інформація. Еталонна модель (ISO 19101:2002, IDT)»// 2009-10-15.
2. СОУ ISO 19136:2009 "Обмінний формат геопросторових даних на основі географічної мови розмітки GML (ISO 19136:2007)" // 30.09.2010.
3. СОУ 742-33739540 0011:2010 "Комплекс стандартів База топографічних даних Каталог об'єктів і атрибутів" // 30.09.2010.
4. СОУ ISO 19113 "Комплекс стандартів База топографічних даних Принципи оцінки якості топографічних даних" // 30.09.2010.
5. СОУ 742-33739540 0012:2010 "Комплекс стандартів. База топографічних даних. Правила кодування та цифрового опису векторних даних" Том 2 // 30.09.2010.
6. СОУ 742-33739540 0012:2010 "Комплекс стандартів База топографічних даних Правила кодування та цифрового опису векторних даних" Том 2 // 30.09.2010.
7. СОУ 742-33739540 0012:2010 "Комплекс стандартів База топографічних даних Правила кодування та цифрового опису векторних даних" Том 1 // 30.09.2010.
8. СОУ ISO 19113 "Комплекс стандартів База топографічних даних Принципи оцінки якості топографічних даних" // 30.09.2010.
9. СОУ 742-33739540 0010:200 "Комплекс стандартів База топографічних даних Загальні вимоги" // 29.09.2010.
10. ISO 19103 – Мова концептуальної схеми.
11. ISO 19107 – Просторова схема.

12. ISO 19133 – Сервіси спостереження та навігація на основі інформації про місцезнаходження.

13. ISO 19136 – Geography mark up language.

14. Information resources:

1. **eLearn webpage** - <https://elearn.nubip.edu.ua/course/view.php?id=106>
2. Карпінський Ю. О., Лященко А. А. Режим доступу: [Http://ena.lp.edu.ua:8080/Bitstream/ntB/10582/1/37.pdf](http://ena.lp.edu.ua:8080/Bitstream/ntB/10582/1/37.pdf)
3. Global Earth Observation System of Systems (GEOSS) [Електронний ресурс] // [сайт] / Режим доступу: <http://www.epa.gov/geoss/> – назва з екрану.
4. Grass GIS. [Електронний ресурс] // [сайт] / Режим доступу: <http://grass.osgeo.org/> – назва з екрану.
5. The ArcGIS Book [Електронний ресурс] // [сайт] / Режим доступу: <https://learn.arcgis.com/en/arcgis-book/> – назва з екрану.
6. Каталог програмного забезпечення MapInfo Professional [Електронний ресурс] // [сайт] / Режим доступу: <http://www.geoguide.com.ua/software/software.php?part=pitney&art=mapinfo> – назва з екрану.
7. КБ ПАНОРАМА. Геоінформаційні технології. [Електронний ресурс] // [сайт] / Режим доступу: <http://www.panorama.vn.ua> – назва з екрану.
8. ER-Mapper [Електронний ресурс] // [сайт] / Режим доступу: http://www.tvis.com.ua/index.php?option=com_content&view=article&id=103&Itemid=184 – назва з екрану.
9. Платформа ArcGIS. [Електронний ресурс] // [сайт] / Режим доступу: http://www.ecomm.kiev.ua/index.php?option=com_content&task=view&id=35&Itemid=109 – назва з екрану
10. Платформа ArcGIS. [Електронний ресурс] // [сайт] / Режим доступу: http://www.ecomm.kiev.ua/index.php?option=com_content&task=view&id=35&Itemid=109 – назва з екрану.