COURSE OVERVIEW

The discipline " Mathematical statistics for geodates " ensures that students master the fundamentals of using mathematical and statistical methods and applied processing of geodata and indicators regarding the state of land relations based on the use of modern computer technologies.

The task of studying the discipline is the formation of a specialist in theoretical knowledge and practical skills of geostatistics, mathematical and statistical apparatus of geospatial data processing methods and their properties. In particular, the tasks use spectral properties of spatial objects, derived products (vegetation indices, leaf surface area) with corresponding cartographic projections, which require constant transformations and their further practical use on the basis of geoinformation technologies in the GIS analysis of data and indicators regarding the state of land relations and land cadastral data.

The discipline provides the formation of a number of competencies:
- *general competencies (GK)*:
• GK01. Ability to learn and master modern knowledge;
• GK02. Ability to apply knowledge in practical situations;
• GK07. Ability to work autonomously;
• GK12. The ability to exercise one's rights and responsibilities as a member of society; awareness of the value of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine;
• GK13. The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of history, the 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 technologies, to use various types and forms of motor activities for recreation and leading a healthy lifestyle.
- *special competencies (SC)*:
• SC01. The ability to apply fundamental knowledge to analyze phenomena of natural and man-made origin when performing professional tasks in the field of geodesy and land management;

• SC02. Ability to apply theories, principles, methods of physical and mathematical, natural, socio-economic, engineering sciences when performing tasks of geodesy and land management;

• SC03. Ability to apply regulatory and legal acts, regulatory and technical documents, reference materials in professional activity;

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

• SC05. The ability to use modern information, technical and technological support to solve complex issues of geodesy and land management;

• SC06. The ability to perform remote, ground, field and camera research, engineering calculations for the processing of research results, form research results, prepare reports when solving geodesy and land management tasks;

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

Program results:

• PH2. Organize and manage the professional development of individuals and groups;

• PH3. Convey information, ideas, problems, solutions, own experience and arguments to specialists and non-specialists;

• PH4. Know and apply in professional activity regulatory and legal acts, regulatory and technical documents, reference materials in the field of geodesy and land management and related fields;

• PH5. Apply conceptual knowledge of natural and socio-economic sciences when performing tasks of geodesy and land management;

• PH9. Collect, evaluate, interpret and use geospatial data, metadata about 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.

THE COURSE PROGRAM AND STRUCTURE

Topic	Hrs (lectures /laboratory/ individual)	Education result	Tasks	Grade
3 semestr				
CONTENTS MODULE I. THE BASIS OF THE THEORY OF THE POSSIBILITY AND THE BASIC STATISTICAL INDICATORS.				
Topic 1. The main provisions of probability theory and mathematical statistics	2/7	Know the basic concepts and definitions. Introduction to the basics of probability theory and the formation of an understanding of the term "statistics". Understand the difference between probability theory and reality. Know the rules of action with probable	Execution of the laboratory and its delivery (including in elearn). L/w 1 Performing independent work (including in elearn).	20

			I/w 1	5
		events and the probabilities of their implementation.		
Topic 2. Elementary analysis of geodata and indicators on the state of land relations	2/7	Understand the basics of elementary statistical analysis. Know the basic statistical analysis on the example of geodata and indicators on the state of land relations in relation to the number of owners and land users of land plots and their areas. Be able to work with tables, graphs and charts.	Execution of the laboratory and its delivery (including in elearn). L/w 2 Performing independent work (including in elearn). I/w 1	20 5
Topic 3. Basic statistical models. Basic statistics of data and indicators on the state of land relations	2	Understand the concepts of statistical models and their types. Develop basic statistical models based on geodata and indicators on the state of land relations in relation to rating. Know the classification and ranking of basic system features. Understand the concept of geodata grouping. Make statistical and variational series. Know the basic statistical characteristics of land management objects and factors and their calculation. Perform the distribution of land cadastral geodata, know the types of distribution and their characteristics.	Execution of the laboratory and its delivery (including in elearn). L/w 3	20
Модульний контроль 1			Тест	30
Всього Модуль 1				100
CONTENTS MODULE II. BASED ON STATISTICAL ANALYSIS OF LAND-MANAGEMENT GEODATA.				
Topic 4. Methods of statistical evaluation of averages	2/0/20	Know the types of land cadastral databases and geodata banks. Distinguish geoinformation modeling in automated	Execution of the laboratory and its delivery (including in elearn).	

			land cadastral systems.	L/w 4	15
Topic 5. Statistical models of geodata and indicators on the state of land relations based on samples	2/0/20		Understand the concept of the general population and the sample on the example of geodata and indicators on the state of land relations for land valuation. Understand the concepts of repetition and repetition, imaginary repetition. Understand the concept of dimensional reduction and the choice of the most informative features. Know the basic ways of organizing the sample. Be able to perform point and interval estimates.	Execution of the laboratory and its delivery (including in elearn). L/w 5	15
Topic 6. Fundamentals of statistical analysis of sample geodata	2/8/20		Understand the concept of correlation and correlation analysis of geodata and indicators on the state of land relations. Perform regression analysis of estimated indicators. Perform analysis of variance - one-, two- and multifactor.	Execution of the laboratory and its delivery (including in elearn). L/w 6 Performing independent work (including in elearn). I/w 3	10 ... 5
Topic 7. Multidimensional models of geodata	3/8/15		Know the basics of cluster analysis. Conduct factor analysis and principal components method. Perform discriminant analysis and canonical analysis. Analyze compliance and multidimensional scaling of geodata and indicators on the state of land relations. Execution of the laboratory and its delivery (including in elearn). Performing independent work (including in elearn).	Execution of the laboratory and its delivery (including in elearn). L/w 7 L/w 8 Performing independent work (including in elearn). I/w 4	10 10 ... 5
Модульний контроль 2				Тест	30

Всього Модуль 2				100
Всього за 2 модулі	15/30/75	-	-	70
Залік	30	-	-	30
Всього за курс				100

THE COURSE POLICY

Deadline and recompilation policy:	Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Rearrangement of modules takes place with the permission of the lecturer if there are good reasons (for example, hospital).
Academic Integrity Policy:	Write-offs during tests and exams are prohibited (including the use of mobile devices). Abstracts, presentations must have correct text references to the literature used.
Visiting policy:	Attendance is mandatory. For objective reasons (for example, illness, international internship) training can take place individually (in online form in consultation with the dean of the faculty).

STUDENT'S RATING SCALE

Student rating, points	National grade based on exam results	
	exams	**credits**
90-100	excellent	passed
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	not passed

RECOMMENDED SOURCES OF INFORMATION

Basic:

1. Hartmann, K., Krois, J., Rudolph, A. (2023): Statistics and Geodata Analysis using R (SOGA-R). Department of Earth Sciences, Freie Universitaet Berlin.
2. Viktor Barkovskyi, Nina Barkovskaya, Oleksiy Lopatin. Probability theory and mathematical statistics. Center for educational literature. 2019. 494 p.
3. Probability, Random Variables, Statistics, and Random Processes: Fundamentals & Applications. Wiles and Sons Inc. 2019. 416 p.
4. Geostatistical Functional Data Analysis (1st ed.). Wiley. Retrieved from https://www.perlego.com/book/3056372/geostatistical-functional-data-analysis-pdf (Original work published 2021)
5. Rogerson, P.A., 2014. Statistical methods for geography: a student's guide. Sage.
6. Schabenberger, O. and Gotway, C.A., 2004. Statistical methods for spatial data analysis. CRC press.
7. Kang-Tsung Chang (2015) Introduction to Geographic Information Systems, Eighth Edition, McGraw Hill.
8. Deterministic and Geostatistical Interpolation Methods sections, Geospatial Analysis: Web site, M. J. de Smith, M. F. Goodchild, P. A. Longley. 2021. URL: http://www.spatialanalysisonline.com/HTML/index.html.

Support:

9. Methodological guidelines "Statistical methods in land management". A.O. Koshel, O.I. Novikov. - Kyiv, 2018. - 44 p.
10. Steven S. Skiena. The Data Science Design Manual. Computer Science Department Stony Brook University. 2017. 453 p.
11. Senyo P.S. Probability theory and mathematical statistics. - K.: Center of educational literature, 2004.
12. Adamov, V.E. Economics and statistics: Textbook. Ed. S.D. Ilyenkova. M.: Finances and Statistics, 2019. 287p.
13. The State Statistics Service of Ukraine. URL: www.ukrstat.gov.ua
14. The State Service of Ukraine for Geodesy, Cartography and Cadastre. URL: https://land.gov.ua/
15. Eurostat. URL: https://ec.europa.eu/eurostat