"APPROVED"
Deputie Head
(vice-rector for scientific and pedagogical work)

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DATA VISUALIZATION AND VISUAL ANALYTICS
syllabus of the discipline

Area of Education	all
Speciality	all
Educational level	second (master's)
Educational program	all

Type of discipline	**selective**
Language of teaching, training and evaluation	**Ukrainian, English**

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The syllabus has been approved by the Department of Economic Theory, Statistics and Forecasting
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**Letter of renewal and re-approval of the syllabus
of the academic discipline**

Academic year	Date of the session of the department - developer of syllabus	Protocol number	The signature of the head of the department

1. Introduction

Annotation of the discipline:

The field of visualization of information was the result of research on the interaction between man and computer, computer science, graphs, design, psychology and business methods. It is increasingly used as the most important component of research, digital libraries, for intellectual and financial data analysis, market research, production control, and more. Visualization of information is aimed at creating new and more visible approaches to the transmission of abstract information in intuitive ways.

One of the most pressing challenges faced by leading companies today is the processing and analysis of large volumes of structured and unstructured data in order to improve the quality of business decisions made. Data analysis is an integral part of all applied research and problem solving in the economy. Among the most fundamental approaches to data analysis, a special focus is given to visualization of information, or, in other words, visual analysis of data, which relies mainly on cognitive skills of analysts, and also contributes to the disclosure of unstructured effective ideas that are limited only by human imagination and creativity. The analyst must apply various sophisticated techniques in order to be able to interpret any socioeconomic process through data visualization.

Visual analysis is a fast-growing, promising area that combines the benefits of graphical visualization and the power of analytical computing when working with large masses of digital information. Data visualization allows you to identify patterns, trends, and correlations that may otherwise remain unnoticed in traditional reports or spreadsheets.

The discipline "Data visualization and visual analytics" is a selective discipline of the second (master's) level and its mastering will allow to use modern analytical tools and infographics for the analysis of complex, mass social and economic phenomena and processes. Students will learn to make informed decisions based on pre-processing data and their interactive visualization.

The object of the discipline is business processes and phenomena.

The subject of the discipline is theoretical and practical questions regarding the economic interpretation of the results of the analysis of business processes and their interactive visualization on the basis of the use of modern analytical methods and tools of infographics.

Purpose of the discipline: there is expansion and deepening of theoretical knowledge and acquisition of professional competences in the field of visual analytics of business processes and making effective decisions using analytical methods and data visualization tools.

Course	1M	
Semester	1,2	
Number of ECTS credits	5	
Audit lessons	lectures	20
	laboratory	20
Independent work		110
Form of final control	test	

Structural-logical scheme of studying the discipline:

Previous disciplines	The following disciplines
Economic theory	Business analytics
Microeconomics	Trainings
Macroeconomics	Writing of master's diploma works
Computer Science	
Statistics	

2. Competence and outcomes of studying in a discipline:

Competence	Results of studying
Ability to acquire theoretical knowledge on data visualization and to acquire the skills of formation of information space of research	- Ability to navigate the information space in order to create a qualitative information base of the study - Ability to conduct a primary analysis of the information space of research; - Ability to prepare information for processing by modern methods of business analytics
Ability of rational use of modern data visualization tools	- Ability to rational use of the tool base of business analysis for solving specific business tasks; - Get a view through the info design
Ability to use methods of analytical data processing and trend detection	- Understanding the essence of solvable tasks using analytical data processing methods; - Ability to model the interconnections between economic processes and phenomena; - Ability to choose analytical and expert methods of information processing under conditions of changing information environment
Ability to qualitative presentation of the results of analytical research for their further effective use	- Ability to visualize the results of analysis of business processes; - Ability to use tools of infographics rationally; - Ability to compile analytical reports.

3. Program of the academic discipline

Content module 1. The theoretical basis for data visualization

Topic 1. Visual information in the information society
1.1. Task, process and result of visualization. Use rendering to find ideas.
1.2. Stages of data visualization.
1.3. Graphics Grammar.
1.4. Basic principles of data visualization.
1.5. Types of visualization for different types of data. A table, a sparkline, a chart with columns, a circular diagram, a thermal map. scatter card, cartogram, graph, memory card.

1.6. Standard visualization errors. Examples of visualization. Detection and correction of errors.

Laboratory work 1 "Formation of information space for visualization. Overview of sources of information. Visualization of data in MS Excel. "

Task 1. To acquire the skills of searching for information in accordance with the purpose of the study.

Task 2. To get acquainted with domestic and foreign sources of statistical information and to form an informational space on the chosen research topic.

Task 3. To acquire the skills of visualization of statistical information using MS Excel and to learn to graphically present statistical data using the MS Excel charts wizard. To master the skills of using conditional formatting and sparklines.

Topic 2. Modern data visualization tools. Infodesign

2.1. Overview of tools that do not require programming to visualize data. The main advantages and disadvantages of data visualization tools. Areas of their use and types of tasks.

2.2. An overview of tools that require programming to visualize data. Graphical libraries, packages and their capabilities. The main advantages and disadvantages of tools. Areas of use and types of tasks.

2.3. Fundamentals of Infodesign. Typography, Applied Linguistics, Applied ergonomics, Graphic Design, Applied Psychology.

2.4. Selection of preparatory visual attributes.

2.5. Recommendations for choosing color palettes.

Laboratory work 2 "Visualization of text information. Building mental maps. "

Task 1. To acquire the skills of constructing mental maps.

Task 2. To get acquainted with the software products for the construction of mental maps and to create a mental map of the research object.

Content module 2. Using modern methods of analytical data processing

Topic 3. Planning, collecting and preparing data for visualization. Methods of collecting analytical information

3.1. Stages of data planning and analysis. Research hypothesis formulation. Determination of testing hypotheses. The choice of statistical methods for testing the hypothesis.

3.2. Methods of data collection. Overview of the main methods of data collection and their application. Advantages and disadvantages of data collection methods.

3.3. Analytical information. Her species. Overview of sources of analytical information and rules for its visualization.

Laboratory work 3 "Infographics: mapping"

Task 1. To acquire skills of visualization of data using cartographic tools.

Task 2. Using the software application Datawrapper to build two types of cards (Choropleth and Symbol) according to the chosen topic of research.

Theme 4. Basics of business analytics. Basic methods for processing digital information.

4.1. Analytical methods of data processing. Methods of modeling and forecasting.

4.2. Expert methods of data processing. Delphi method. Method of risk assessment. The method of "scenarios". The method of "brainstorming". Business games. SWOT analysis.

4.3. Features, limitations and recommendations for using analytical and expert methods of business analytics.

Laboratory work 4 "Analytical and expert methods of digital information processing".

Task 1. To get acquainted with the basics of business analysis, to get practical skills of using analytical and expert methods of data analysis

Task 2. To learn to apply analytical methods of processing digital information in accordance with the available data and to master the foundations of digital information visualization.

Task 3. To learn to apply expert methods of processing digital information according to available data.

Topic 5. Economic interpretation of visual analysis of data. Preparation of reports.

5.1. Analysis of socio-economic data. The main features of socio-economic data. Task and purpose of the analysis of socio-economic data.

5.2. Non-traditional sources of social and economic data. Types of data sources.

5.3 Types of reports. Different Types of Analytical Reports. Formation of the structure of the report. The purpose of the report is to match the characteristics of the target audience.

5.4. Develop a single style of analytical report. Reports of international organizations.

Laboratory work 5 "Analytical report: structure and features of construction".

Task 1. To get acquainted with the rules of the preparation of the analytical report, to get knowledge about the structure and main elements of the analytical report

Task 2: Make an analytical report on the study of the chosen industry (sphere) of the economy.

4. The order of assessment of the results of training

The assessment system of students' competences is based on the grades for all forms of classes conducted including lectures and laboratory works, self - preparation work and performance of individual tasks according to the program of the academic discipline "Data visualization and visual analytics". Evaluation of the formed competences of students is conducted on the cumulative 100-point scale. According to the Provisional Regulations "On the assessment of students' progress according to the cumulative rating system" at S. Kuznets KhNUE, the control methods include:

current control, carried out during the semester during lectures, laboratory classes, and estimated by the sum of the points scored (the maximum amount is 100 points; the minimum amount that allows the student to get a score is 60 points);

modular control conducted in the form of a colloquium as an intermediate mini-exam on the initiative of the teacher, taking into account the current control of the corresponding content module, and aims to integrate the evaluation of the student's learning outcomes after studying the material from the logically completed part of the discipline-content module;

final / semester control, conducted in the form of a credit (test), according to the schedule of the educational process.

The procedure for carrying out the current assessment of students' knowledge. Assessment of student's knowledge during seminars, practical and laboratory classes and performance of individual tasks is carried out according to the following criteria:

understanding, degree of assimilation of the theory and methodology of the problems under consideration; the degree of assimilation of the actual material of the

discipline; acquaintance with the recommended literature, as well as contemporary literature on the issues under consideration; the ability to combine theory with practice when considering production situations, solving tasks, performing calculations in the process of performing individual tasks and tasks submitted for consideration in an audience; logic, structure, style of presentation of the material in written works and speeches in the audience, ability to substantiate their position, to generalize information and to draw conclusions; arithmetic correctness of the implementation of an individual and complex settlement task; the ability to conduct a critical and independent assessment of certain problem issues; the ability to explain alternative views and the presence of their own point of view, the position on a certain problematic issue; application of analytical approaches; quality and clarity of reasoning; logic, structuring and substantiation of conclusions on a specific problem; independence of work; literacy of presentation of the material; use of comparison methods, generalizations of concepts and phenomena; registration of work.

The general criteria for evaluating non-auditing independent work of students are: the depth and strength of knowledge, the level of thinking, the ability to systematize knowledge on specific topics, the ability to make sound conclusions, the possession of categorical apparatus, skills and techniques for the implementation of practical tasks, the ability to find the necessary information, carry out its systematization and processing, self-realization on laboratory works.

The final control of knowledge and competences of students in the academic discipline "Visualization of data and visual analytics" is carried out in the form of protection of an individual research work (IRW). The IRW covers the program of discipline and involves determining the level of knowledge and the degree of mastery of competences by students.

Each student chooses a field of study, forms an information space and defines methods (techniques, methods) for processing digital information. The result of the implementation of the INDS is the preparation of an analytical report and its protection. The INDS is rated at 20 points out of them:

1-3 points - only the informational space of research is formed;
4-6 points - the correct information base has been formed, the justification and rational use of modern methods of business analytics and data visualization have been provided;
7-9 points - the information base has been correctly formed, the justification and rational use of modern methods of business analytics and data visualization have been provided, but some elements of infographic and information design are inaccurate;
10-12 points - the information base has been correctly formed, the justification and rational use of modern methods of business analytics and data visualization have been provided; however, there is no economic interpretation of the results of the analysis;
13 points - the analytical report has been prepared methodically correct, the sustained structure, the information base has been correctly formed, the justification and rational use of modern methods of business analytics and data visualization are provided, and the economic interpretation of the results of the analysis is correct.

The task of the IRW is to test the student's understanding of the program material in general, the logic and interrelations between the individual sections, the ability to use the accumulated knowledge creatively, the ability to formulate their attitude to a particular problem of academic discipline, etc. In the conditions of the implementation of the competent approach, the INDS assesses the level of mastering the competences provided by the qualification requirements.

The student can't be admitted to the assembly offset if the number of points obtained in the audit progress during the current control according to the semantic module throughout the semester, the amount has not reached 60 points. After the exam session, the dean of the faculty issues an order to liquidate academic debt. In due time the student gets score points.

Student should be considered qualified if the sum of points obtained by the results of final / semester verify performance, equal to or greater than 60. The minimum number of points for the current and the control module during the semester is 60, and the maximum - 100 points.

The final score of the discipline is calculated on the basis of scores obtained during IRW defense and points earned during the current control of a memory system. The total score in the points for the semester is: "60 and more points are counted", "59 and less points are not counted" and entered in the "Record of success" of the academic discipline.

Distribution of points for a week
(specify means of evaluation according to the technological card)

Name of content modules/themes			Lectures	Laboratory sessions	The written test	Homeworks	Total
Content module 1. The theoretical basis for data visualization	Topic 1	3, 4 Week	4	5	3	4	16
	Topic 2	5, 6 Week	4	5	3	4	16
Content module 2. Using modern methods of analytical data processing	Topic 3	7, 8 Week	4	5	3	4	16
	Topic 4	9, 10 Week	4	5	3	4	16
	Topic 5	11, 12 Week	4	5	3	4	16
Protection of individual research work							20
Total			**20**	**25**	**15**	**20**	**100**

Grading scale: national and ECTS

Assessment of the S. Kuznets KhNUE according to Economics scale	ECTS assessing scale		Assessment according to national scale
90-100	A	excellent performance	Excellent
82-89	B	above average	
74-81	C	work at all correct, but with a number of errors from	Good
64-73	D	not bad, but many drawbacks	Satisfactory
60-63	E	performance meets the minimum criteria	
35-59	FX	need to re-take	Unsatisfactory
1-34	F	repeat the discipline	

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