

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ
ІМЕНІ СЕМЕНА КУЗНЕЦЯ**

ТЕОРІЯ ЙМОВІРНОСТЕЙ ТА МАТЕМАТИЧНА СТАТИСТИКА

робоча програма навчальної дисципліни

Галузь знань	<i>07 Менеджмент і адміністрування</i>
Спеціальність	<i>075 Маркетинг</i>
Освітній рівень	<i>перший (бакалаврський)</i>
Освітня програма	<i>Маркетинг</i>
Статус дисципліни	<i>обов'язкова</i>
Мова викладання, навчання та оцінювання	<i>українська</i>

**THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY
OF ECONOMICS**

"APPROVED"

Vice-Rector responsible for educational and methodical work

Karina NEMASHKALO

PROBABILITY THEORY AND MATHEMATICAL STATISTICS

syllabus of the academic discipline

Branch of knowledge ***07 Management and Administration***

Specialty ***075 Marketing***

Level of education ***first (bachelor)***

Academic program ***Marketing***

Discipline status

Compulsory

Language of teaching, training and assessment

English

*Head of the Department of
Higher Mathematics,
Economic and Mathematical Methods*

Lyudmyla MALYRETS

Kharkiv
2022

APPROVED

At the meeting of the Department of *Higher Mathematics*

Economic and Mathematical Methods

Protocol № 6 dated 22.12.2022

Completed by:

I. Lebedeva, PhD, associate professor of *the Department of Higher Mathematics,*

Economic and Mathematical Methods

Sheet of renewal and re-approved of syllabus of the academic discipline

Academic year	Data of the department meeting – the developer of syllabus of the academic discipline	Protocol number	Signature of the chief of the department

ЗАТВЕРДЖЕНО

на засіданні кафедри кафедри *вищої математики та економіко-математичних методів*
Протокол № 6 від 22.12.2022 р.

Розробник:

Лебедева І.Л., канд. фіз.-мат. наук, доц. кафедри *вищої математики та економіко-математичних методів*,

Лист оновлення та перезатвердження робочої програми навчальної дисципліни

Навчальний рік	Дата засідання кафедри – розробника РПНД	Номер протоколу	Підпис завідувача кафедри

Abstract of the Discipline

The current stage of globalization of the world economy and the formation of the information society determine the active use of the mathematical apparatus in all spheres of practical activity in general and in international business in particular. The application of mathematical methods and models in solving practical problems of economics and management allows: to improve economic information systems by organizing them, identifying shortcomings in existing information and developing requirements for the preparation of new information or its adjustment; increase the accuracy of economic calculations; conduct research that suggests the existence of several alternatives; identify and justify optimal solutions; deepen the quantitative analysis of economic problems; to solve fundamentally new economic problems. The fundamental base in the mathematical preparation of economists and managers is the discipline “Probability theory and mathematical statistics”

Today it is noticeable the transition to new areas of application of mathematical methods in the development of socio-economic solutions that will determine the future of our country, namely: investment policy planning, modernization of enterprises, forecasting environmental processes, determining both state and private interests in development international projects and so on. In solving these management problems, the leading place is occupied by the methods and means of computational mathematics. Therefore, every future economist, business leader, business owner needs a thorough mathematical training that forms analytical and research competencies, as well as the ability to apply mathematical tools to solve a wide range of problems in their professional activities.

The main purpose of this discipline is: The main purpose of this discipline is: the formation of a holistic system of theoretical knowledge of the mathematical apparatus, which helps to model, giving students knowledge of the basic parts of probability theory and mathematical statistics; rise of the level of the fundamental mathematical preparation of students with intensification of its applied direction, mastering the fundamentals of probability theory and mathematical statistics and application of this knowledge in the economic investigations for solving economic problems, , the obtainment of necessary totality of theoretical and practical knowledge for solving specific problems, which are set in a process of forming economic and mathematical models, the development of the desire for scientific search for ways to improve their work.

Characteristics of the academic discipline

Academic year	1
Term	2
Number of credits ECTS	5
Form of final control	Exam

Structural and logical scheme of studying the academic discipline

Previous academic disciplines	Next academic disciplines
Higher mathematics	Statistics
Informatics	Operations Research and Optimization Techniques
	Econometrics

Competences and result of mastering the academic discipline

Competences	Learning outcomes
3K3. Ability to abstract thinking, analysis and synthesis	PH2. Analyze and forecast market phenomena and processes based on the application of fundamental principles, theoretical knowledge and applied skills of marketing activities. PH6. To determine the functional areas of marketing activities of the market entity and their relationships in the management system, to calculate the relevant indicators that characterize the effectiveness of such activities
3K4. Ability to learn and master modern knowledge	PH4. Collect and analyze the necessary information, calculate economic and marketing indicators, justify management decisions based on the use of the necessary analytical and methodological tools
3K7. Ability to apply knowledge in practical situations	PH4. Collect and analyze the necessary information, calculate economic and marketing indicators, justify management decisions based on the use of the necessary analytical and methodological tools
3K8. Ability to perform research at the appropriate level	PH4. Collect and analyze the necessary information, calculate economic and marketing indicators, justify management decisions based on the use of the necessary analytical and methodological tools
3K9. Skills in the use of information and communication technologies	PH7. Use digital information and communication technologies, as well as software products necessary for the proper conduct of marketing activities and practical application of marketing tools
CK1. The ability to logically and consistently reproduce the knowledge of the subject area of marketing, which were obtained	PH12. Demonstrate skills of independent work, flexible thinking, openness to new knowledge, be critical and self-critical

The syllabus of the academic discipline

Thematic module 1. Probability theory

- Theme 1. Empirical and logical bases of probability theory
- Theme 2. Basic theorems of probability theory, their economic meaning
- Theme 3. Scheme of independent trials
- Theme 4. Random variables and their economic meaning
- Theme 5. Distribution laws and numerical characteristics of random variables
- Theme 6. Multidimensional random variables

Thematic module 2. Mathematical statistics

Theme 7. Limit theorems of probability theory. Preprocessing of statistical data

Theme 8. Statistical estimates of the basic numerical characteristics of the general population and their properties. Point and interval estimates

Theme 9. Checking of statistical hypothesis

Theme 10. Elements of correlation theory

Theme 11. Elements of variance analysis

Theme 12. Elements of regression theory

The list of practical and laboratory classes, as well as questions and tasks for independent work is given in the table "Rating-plan of the discipline"

Teaching and learning methods

During the teaching of the discipline "Probability theory and mathematical statistics" in order to enhance the educational and cognitive activities of students such interactive forms of teaching provides for the use. There are presentations, computer simulations, visual support banks, "inverted classroom", interactive distance learning, and creative independent work. The application of these technologies is aimed at the formation of competencies that are defined for each topic of the discipline.

Presentations are speeches to the audience, used to present the results of individual tasks (for each theme of the discipline), a report on the implementation of creative independent work. Presentations can be individual or collective (a group of two to five students).

Computer simulation (game) is a method of learning based on the use of special computer programs that can be used to virtually simulate the process. It is used in teaching themes 8 and 12. The purpose of using this method is to develop students' systematic thinking, the formation of skills to recognize and analyze problems, evaluate alternatives, make optimal decisions.

Visual support banks help to intensify the learning process on the discipline with the help of clarity (for each theme of the discipline).

"Flipped classroom" is a principle of learning, according to which the main assimilation of new material by students takes place at home, and classroom time is allocated for tasks, exercises, laboratory and practical research, individual teacher consultations and more (for each theme of the discipline).

Interactive distance learning is a set of pedagogical technologies based on the principles of communication in the information educational space, serving to organize the education of users, distributed in space and time (for each theme of the discipline, if classes on this theme are on-line).

Creative independent work involves writing a scientific article or thesis report, which highlights the economic problem and demonstrates the possibilities of using mathematical tools to solve it (the topic is chosen by the student himself from the list of themes which are teaching during a semester).

The order of assessment of studying results

The system of assessment of formed competencies of students during the study of this discipline takes into account the types of classes that, according to the curriculum of the discipline, include lectures, practical classes, laboratory work, as well as students' independent work. Assessment of competencies formed in students is carried out on a cumulative 100-point system.

Control measures include:

current control, carried out during the semester during lectures, practical classes and laboratory works and evaluated by the amount of points scored. The maximum amount is 60 points; the minimum amount that allows a student to take the exam is 35 points;

final / semester control, carried out in the form of a semester exam, according to the schedule of the educational process.

Current control is carried out within a term during:

lectures – in the form of colloquia (during the semester students write two colloquia; the maximum number of points for both colloquia is 16 points);

practical classes – in the form of tasks of written tests in practical classes (during the semester students perform two written tests; the maximum number of points for two tests is 16 points);

laboratory classes – in the form of defense of the report on laboratory work (during the semester students perform 6 laboratory works; the maximum number of points for the performance of six laboratory works is 10 points);

independent work:

in the form of homework (during the semester, students complete six homework assignments – the maximum number of points for completing six homework assignments is 10 points);

in the form of creative work (during the semester students perform one creative work – the maximum number of points is 8).

Final control of knowledge and competencies of students in the discipline is carried out on the basis of a semester exam, the task of which is to test students' understanding of the program material in general, logic and relationships between individual sections, ability to creatively use accumulated knowledge, ability to formulate their attitude to a particular problems of academic discipline, etc.

The examination ticket covers the program of the discipline and provides for the determination of the level of knowledge and the degree of mastery of competencies by students.

Each exam ticket consists of 5 practical situations (two stereotypical, two diagnostic and one heuristic task), which provide for the solution of typical and professional tasks and allow to diagnose the level of theoretical training of the student and his level of competence in the discipline.

The result of the semester exam is evaluated in points (maximum number – 40 points, minimum number of credits – 25 points) and is affixed in the appropriate column of the examination "Information of success".

It should be assessed student's progress, if a sum of points, obtained as the total result of an assessment by all forms of a control, equals or exceeds 60. Accordingly the minimal possible quantity of points by a current and a module control during a term equals 35 and the minimal possible quantity of points, obtained on an exam, equals 25.

The final grade in the discipline is calculated taking into account the points obtained during the exam and the points obtained during the current control of the accumulative system. The total result in points for the semester is: "60 or more points – credited", "59 or less points – not credited" and is entered in the "Statement of performance" of the discipline.

The final grade is set according to the scale given in the table "Grade scale: national and ECTS". Forms of assessment and distribution of points are given in the table "Rating-plan of the discipline".

The scales of assessment: national and ECTS

Sum of points including all forms of study	Mark on the ECTS scale	Mark on the national scale	
		for an exam, a term paper, practice	for a test
90 – 100	A	excellent	passed
82 – 89	B	good	
74 – 81	C		
64 – 73	D		
60 – 63	E	satisfactory	failed
35 – 59	FX	unsatisfactory	
1 – 34	F		

Rating-plan of the discipline

Theme	Forms and types of teaching		Forms of evaluation	Max points
Theme 1	<i>Classroom work</i>			
	Lecture	<i>Lecture №1.</i> Empirical and logical bases of probability theory	–	–
	Practical lesson	<i>Practical task №1.</i> Empirical and logical foundations of probability theory	–	–
	<i>Individual work</i>			
	Questions and tasks for self-study	Search, selection and review of literary sources on the subject of the discipline. Doing homework	–	–
Theme 2	<i>Classroom work</i>			
	Lecture	<i>Lecture №2.</i> Basic theorems of probability theory and their economic interpretation	–	–
	Laboratory lesson	<i>Laboratory task №1.</i> Empirical and logical foundations of probability theory. Basic theorems of probability theory, their economic interpretation	–	–
	<i>Individual work</i>			
	Questions and tasks for self-study	Study of lecture material, calculations in MS Excel	–	–
Theme 3	<i>Classroom work</i>			
	Lecture	<i>Lecture №3.</i> Scheme of independent trials	–	–
	Practical lesson	<i>Practical task №2.</i> Basic theorems of probability theory, their economic interpretation. Scheme of independent tests	–	–
	<i>Individual work</i>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–

Theme 4	<i>Classroom work</i>			
	Lecture	<i>Lecture №4.</i> Random variables and their economic meaning	–	–
	Laboratory lesson	<i>Laboratory task №2.</i> Random variables and their economic interpretation, investigation of their properties in MS Excel	–	–
	<i>Individual work</i>			
	Questions and tasks for self-study	Study of lecture material, preparation for practical classes, solving problems using MS Excel	–	–
Theme 5	<i>Classroom work</i>			
	Lecture	<i>Lecture №5.</i> Distribution laws and numerical characteristics of random variables		
	Practical lesson	<i>Practical task №3.</i> Distribution laws and numerical characteristics of DRV. Basic laws of distribution of CRV	Homemade work	5
	<i>Individual work</i>			
	Questions and tasks for self-study	Study of lecture material, preparation for practical classes. Doing homework	–	–
Theme 6	<i>Classroom work</i>			
	Lecture	<i>Lecture №6.</i> Multidimensional random variables	Colloquium №1	8
	Laboratory lesson	<i>Laboratory task №3.</i> Scheme of independent tests. Distribution laws and numerical characteristics of a discrete random variable	LW №1-3	5
	<i>Individual work</i>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of practical tasks. Preparation for the colloquium	–	–
Theme 7	<i>Classroom work</i>			
	Lecture	<i>Lecture №7.</i> Limit theorems of probability theory. Preprocessing of statistical data	–	–
	Practical lesson	<i>Practical task №4.</i> Boundary theorems of probability theory. Pre-processing of statistical data	RT №1	8
	<i>Individual work</i>			
	Questions and tasks for self-study	Study of lecture material. Doing homework. Preparation for control work	–	–

Theme 8	Classroom work			
	Lecture	Lecture №8. Statistical estimates of the basic numerical characteristics of the general population and their properties. Point and interval estimates	–	–
	Laboratory lesson	Laboratory task №4. Primary processing of statistical data. Statistical evaluation of distribution parameters in MS Excel	–	–
	Individual work			
Questions and tasks for self-study	Study of lecture material. Preparation for laboratory work. Execution of practical tasks	–	–	
Theme 9	Classroom work			
	Lecture	Lecture №9. Checking of statistical hypothesis	–	–
	Practical lesson	Practical task №5. Statistical evaluation of distribution parameters. Test of the statistical hypothesis about the distribution law	–	–
	Individual work			
Questions and tasks for self-study	Review of literature on the subject; doing homework using MS Excel	–	–	
Theme 10	Classroom work			
	Lecture	Lecture №8. Elements of correlation theory	–	–
	Laboratory lesson	Laboratory task №5. Test of the statistical hypothesis about the distribution law	–	–
	Individual work			
Questions and tasks for self-study	Study of lecture material; performance of practical tasks. Preparation for the presentation of an independent creative task	Creative work	8	
Theme 11	Classroom work			
	Lecture	Lecture №9. Elements of variance analysis	–	–
	Practical lesson	Practical task №6. Elements of the theory of correlation and regression analyzes	Homemade work.	5
			RT №2	8
Individual work				
Questions and tasks for self-study	Study of lecture material. Do your homework. Preparation for writing test	–	–	
Theme 12	Classroom work			
	Lecture	Lecture №10. Elements of regression theory	Colloquium №2	8
	Laboratory lesson	Laboratory task №6. Elements of correlation theory and regression theory	LW №4-6	5
	Individual work			
Questions and tasks for self-study	Study of lecture material. Execution of practical tasks. Preparation for the colloquium	–	–	
			Exam	40

Recommended reading

Main

1. Лабораторний практикум із розділу “Теорія ймовірностей та математична статистика” навчальної дисципліни “Математика для економістів” : навч.-практ. посіб. / І. Л. Лебедева, О. О. Єгоршин, Е. Ю. Железнякова та ін. – Харків : Вид. ХНЕУ, 2009. – 116 с.
2. Малярець Л. М. Математика для економістів. Теорія ймовірностей та математична статистика: навч. посіб. У 3-х ч., ч.3 / Л. М. Малярець, І. Л. Лебедева, Л. Д. Широкоград – Харків : Вид. ХНЕУ, 2011. – 568 с.
3. Малярець Л. М. Практикум з теорії ймовірностей та математичної статистики в Excel : навч.-практ. посіб. / Л. М. Малярець, І. Л. Лебедева, Е. Ю. Железнякова. – Харків : Вид. ХНЕУ, 2007. – 160 с.
4. Місюра Є. Ю. Теорія ймовірностей. Конспект лекцій / Є. Ю. Місюра. – Харків : Вид. ХНЕУ, 2013. – 95 с. (Англ. мов.)

Additional

5. Малярець Л. М. Теорія ймовірностей та математична статистика: навч. посіб. / Л. М. Малярець, І. Л. Лебедева, Е. Ю. Железнякова та ін. – Х. : Вид. ХНЕУ, 2010. – 404 с.
6. Збірник вправ з розділу “Теорія ймовірностей та математична статистика” навчальної дисципліни “Математика для економістів” для студентів галузі знань “Економіка і підприємництво” усіх форм навчання / укл. Е. Ю. Железнякова, А. В. Ігначкова, З. Г. Попова та ін. – Харків : Вид. ХНЕУ, 2009. – 116 с.
7. Ross S. Introduction to probability and mathematical statistics / Sheldon Ross. – San Diego : Elsevier Academic Press, 2004. – 641 p.

Methodical support

8. Железнякова Е.Ю. Теорія ймовірностей та математична статистика : методичні рекомендації до самостійної роботи з теми "Емпіричні та логічні основи теорії ймовірностей. Основні теореми теорії ймовірностей" для студентів усіх спеціальностей / Е.Ю. Железнякова, І.Л. Лебедева, С.С. Лебедев // Мультимедійне видання. – Харків, ХНЕУ ім. С. Кузнеця, 2018. [Електронний ресурс] – Режим доступу : <http://ebooks.git-elt.hneu.edu.ua/tvms>
9. Железнякова Е.Ю. Теорія ймовірностей та математична статистика : методичні рекомендації до самостійної роботи з теми "Схема незалежних випробувань. Закони розподілу та числові характеристики дискретної випадкової величини" для студентів усіх спеціальностей / Е.Ю. Железнякова, І.Л. Лебедева, С.С. Лебедев // Мультимедійне видання. – Харків, ХНЕУ ім. С. Кузнеця, 2020. [Електронний ресурс] – Режим доступу : <https://pns.hneu.edu.ua/mod/url/view.php?id=274068>
10. Железнякова Е.Ю. Теорія ймовірностей та математична статистика : мультимедійні методичні рекомендації до самостійної роботи з теми "Основні закони розподілу неперервної випадкової величини" для студентів усіх спеціальностей / Е.Ю. Железнякова, І.Л. Лебедева, Л.О. Норік, С.С. Лебедев // Мультимедійне видання. – Харків, ХНЕУ ім. С. Кузнеця, 2021. [Електронний ресурс] – Режим доступу : <https://pns.hneu.edu.ua/course/view.php?id=8277>
11. Сайт персональних навчальних систем ХНЕУ ім. С. Кузнеця: Theory of Probability and Mathematical Statistics [Electronic resource] – Access mode: <https://pns.hneu.edu.ua/course/view.php?id=8357>