

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



"ЗАТВЕРДЖУЮ"

Проректор з навчально-методичної роботи

Карина ДЕМІШКАЛО

**ВИЩА ТА ПРИКЛАДНА МАТЕМАТИКА**

**робоча програма навчальної дисципліни**

Галузь знань **24 Сфера обслуговування**

Спеціальність **242 Туризм**

Освітній рівень **перший (бакалаврський)**

Освітня програма **Туризм**

Статус дисципліни

**обов'язкова**

Мова викладання, навчання та оцінювання

**англійська**

Завідувач кафедри  
вищої математики та  
економіко-математичних методів

Людмила МАЛЯРЕЦЬ

Харків  
2021

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

**HIGHER AND APPLIED MATHEMATICS**

syllabus of the academic discipline

Branch of knowledge     **24 Service Sector**

Specialty                   **242 Tourism**

Level of education       **first (bachelor)**

Academic program       **Tourism**

Discipline status

**Compulsory**

Language of teaching, training and assessment

**English**

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

Lyudmyla MALYRETS



APPROVED

At the meeting of the Department of *Higher Mathematics*

*Economic and Mathematical Methods*

Protocol № 1 dated 27.08.2021

Completed by:

S. Lebedev, senior teacher 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

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Каріна НЕМАШКАЛО

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### Abstract of the Discipline

The current stage of globalization of the world economy and the formation of the information society determines the active use of the mathematical apparatus in all spheres of activity. The application of mathematical methods and models in solving practical problems of economics and management allows: to improve the systems of economic information 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; to conduct multivariate economic researches, to define and substantiate optimum decisions; deepen the quantitative analysis of economic problems; to solve fundamentally new economic problems.

Today there is a noticeable 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, design of urban development and roads, modernization of enterprises, environmental forecasting and so on. Methods and means of computational mathematics play a decisive role in solving these managerial problems. Therefore, every future specialist-economist and head of the enterprise needs a thorough mathematical training that forms analytical and research competencies, as well as allows the application of mathematical tools to solve a wide range of problems in their professional activities.

**The main purposes of teaching are:** the formation of a holistic system of theoretical knowledge of the mathematical apparatus, which helps to model, analyze and solve economic problems, assistance in mastering mathematical methods that allow to study and predict processes and phenomena in the future activities of students ; development of logical and algorithmic thinking, assistance in formation of abilities and skills of the independent analysis of research of economic problems, development of aspiration to scientific search of ways of improvement of the work.

### Characteristics of this academic discipline

Academic year	<b>1</b>	
Term	<b>1</b>	<b>2</b>
Number of credits ECTS	<b>4</b>	<b>5</b>
Form of final control	<b>Test</b>	<b>Exam</b>

### Structural and logical scheme of studying the academic discipline

Previous academic disciplines	Next academic disciplines
Algebra (Mathematics)	Managing the competitiveness of tourism enterprises
Geometry (Mathematics)	Statistics
	Economics of recreation and tourism

## Competences and result of mastering the academic discipline

Competences	Learning outcomes
CK3. Ability to analyze the recreational and tourist potential of the territories	PH6. Apply in practice the principles and methods of organization and technology of tourist services. PH7. Develop, promote and sell a tourism product. PH8. Identify tourist documentation and be able to use it correctly. PH18. Adequately to evaluate their knowledge and to apply it in various professional situations
CK4. Ability to analyze the activities of the tourism industry at all levels of government	PH3. Know and understand the basic forms and types of tourism, their division
CK8. Understanding of principles, processes and technologies of organization of work of the subject of the tourist industry and its subsystems	PH8. To identify tourist documentation and be able to use it correctly
CK11. Ability to use information technologies and office equipment in the work of tourist enterprises	PH21. To make informed decisions and be responsible for the results of their professional activities
CK13. Ability to cooperate with business partners and clients, the ability to provide effective communication with them	PH6. Apply in practice the principles and methods of organization and technology of tourist services. PH20. To identify problem situations and suggest ways to solve them
CK19. Develop, substantiate and implement the strategy of foreign economic activity of tourism enterprises	PH21. To make informed decisions and be responsible for the results of their professional activities

## The syllabus of the academic discipline The themes of lectures

### Thematic module 1. Higher Mathematics

- Theme 1. Elements of the theory of matrices and determinants
- Theme 2. General theory of systems of linear algebraic equations
- Theme 3. Elements of vector algebra and analytic geometry
- Theme 4. Elements of limit theory
- Theme 5. Differential calculus of functions of one variable
- Theme 6. Basic concepts of the function of many variables
- Theme 7. Інтегральне числення. Визначений та невизначений інтеграл

### Thematic module 2. Probability Theory and Mathematical Statistics

- Theme 8. Basic concepts of probability theory. The classical definition of probability
- Theme 9. Conditional probability and the concept of independence of events. The formula of total probability. Bayesian formula
- Theme 10. Repeat test model, Bernoulli scheme. Discrete random variables, their distribution laws

and numerical characteristics

Theme 11. Uniform, exponential and normal distribution laws

Theme 12. Basic concepts of the sampling method

Theme 13. Expert data processing

### **Thematic module 3. Applied Mathematics. Optimization methods**

Theme 14. The subject of mathematical programming. Linear programming

Theme 15. Methods of solving the transport problem

Theme 16. Game theory and its application in tourism

### **Thematic module 4. Correlation-regression analysis**

Theme 17. Simple regression

Theme 18. Multifactor regression

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 "Higher and Applied Mathematics" 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, 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 14 – 18. 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.

*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 topics 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 work and evaluated by the amount of points scored. In the first semester, the maximum amount is 100 points; the minimum amount that allows a student to get a credit of 60 points. In the second semester, 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 30 points in the first semester and 16 points in the second semester);

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 28 points in the first semester and 14 points in the second semester);

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 18 points in the first semester and 12 points in the second semester);

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 18 points in the first semester and 12 points in the second semester);

in the form of creative work (during the semester students perform one creative work – the maximum number of points is 6).

**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

#### The first semester

Theme	Forms and types of teaching		Forms of evaluation	Max points
Theme 1	<i>Classroom work</i>			
	Lecture	<i>Lecture №1.</i> Elements of the theory of matrices and determinants	–	–
	Practical lesson	<i>Practical task №1.</i> Matrix operations and calculation of determinants	Homemade work	3
	<i>Individual work</i>			
	Questions and tasks for self-study	Search, selection and review of literary sources on the subject of the discipline. Study of lecture material and preparation for practical classes	–	–
Theme 2	<i>Classroom work</i>			
	Lecture	<i>Lecture №2.</i> General theory of systems of linear algebraic equations	–	–
	Laboratory lesson	<i>Laboratory task №1.</i> Solving systems of linear equations in MS Excel	LW №1	3
	<i>Individual work</i>			
	Questions and tasks for self-study	Study of lecture material, performance of calculations in MS Excel, preparation for practical classes	–	–
Theme 3	<i>Classroom work</i>			
	Lecture	<i>Lecture №3.</i> Elements of vector algebra and analytic geometry	–	–
	Practical lesson	<i>Practical task №2.</i> Operations on vectors. Equation of line and plane	Homemade work	3

	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–
<b>Theme 4 &amp; 5</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №4.</i></b> Elements of limit theory. Differential calculus of functions of one variable	–	–
	Laboratory lesson	<b><i>Laboratory task №2.</i></b> Research of function of one variable and construction of its schedule	LW №2	3
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Study of lecture material, preparation for laboratory classes	–	–
<b>Theme 6</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №5.</i></b> Basic concepts of the function of many variable	–	–
	Practical lesson	<b><i>Practical task №3.</i></b> Application of the function of many variables in economic research	Homemade work	3
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–
<b>Theme 7</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №6.</i></b> Integral calculus. Definite and indefinite integral	Colloquium №1	15
	Laboratory lesson	<b><i>Laboratory task №3.</i></b> Integral calculus in problems of economics Definite and indefinite integrals	LW №3	3
	<b><i>Individual work</i></b>			
	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	–	–
<b>Theme 8</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №7.</i></b> Basic concepts of probability theory. The classical definition of probability	–	–
	Practical lesson	<b><i>Practical task №4.</i></b> Determination of probability by the classical definition	Homemade work	3
RT №1			14	

	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Study of lecture material. Do your homework. Preparation for writing test	–	–
<b>Theme 9</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №8.</i></b> Conditional probability and the concept of independence of events. The formula of total probability. Bayesian formula	–	–
	Laboratory lesson	<b><i>Laboratory task №4.</i></b> Determination of probability by the formula of total probability and the Bayesian formula	LW №4	3
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–
<b>Theme 10</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №9.</i></b> Repeat test model, Bernoulli scheme. Discrete random variables, their distribution laws and numerical characteristics	–	–
	Practical lesson	<b><i>Practical task №5.</i></b> Calculation of numerical characteristics of the distribution of a discrete random variable	Homemade work	3
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–
<b>Theme 11</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №10.</i></b> Uniform, exponential and normal distribution laws	–	–
	Laboratory lesson	<b><i>Laboratory task №5.</i></b> Determination of the main numerical characteristics of a continuous random variable	LW №5	3
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Review of literature on the subject; doing homework on my own. Preparation for the presentation of creative work	Creative work	6
<b>Theme 12</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №11.</i></b> Basic concepts of the sampling method	–	–
	Practical lesson	<b><i>Practical task №6.</i></b> Estimation of numerical characteristics of a random variable based on the results of a sample survey	Homemade work.	3
RT №2			14	

<b>Theme 13</b>	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Study of lecture material. Do your homework. Preparation for writing test Doing homework	–	–
	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №12.</i></b> Expert data processing	Colloquium №2	15
Laboratory lesson	<b><i>Laboratory task №6.</i></b> Investigation of a two-dimensional random variable	LW №6	3	
<b>Theme 13</b>	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework	–	–

### Rating-plan of the discipline

#### Second semester

<b>Theme</b>	<b>Forms and types of teaching</b>		<b>Forms of evaluation</b>	<b>Max points</b>
<b>Theme 14</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №1.</i></b> The subject of mathematical programming. Linear programming: graphic method		
	Practical lesson	<b><i>Practical task №1.</i></b> Construction of a mathematical model of LPP. Application of the graphical method to the solution of LPP	Homemade work	2
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on the subject of the discipline. Study of lecture material and preparation for practical classes		
	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №2.</i></b> Linear programming: simplex method		
	Laboratory lesson	<b><i>Laboratory task №1.</i></b> Simplex solution of LPP in MS Excel environment	LW №1	2
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic		
<b><i>Classroom work</i></b>				
Lecture	<b><i>Lecture №3.</i></b> Linear programming: a dual task			

	Practical lesson	<b>Practical task №2.</b> Construction of a mathematical model of a conjugate pair of dual problems. Checking the stability of the optimal plan	Homemade work	2
Theme 15	<b>Individual work</b>			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Doing homework		
	<b>Classroom work</b>			
	Lecture	<b>Lecture №4.</b> Methods of solving the transport problem: the classic transport problem		
	Laboratory lesson	<b>Laboratory task №2.</b> Solving a classic transport problem in MS Excel	LW №2	2
	<b>Individual work</b>			
	Questions and tasks for self-study	Study of lecture material, preparation for laboratory work		
	<b>Classroom work</b>			
	Lecture	<b>Lecture №5.</b> Methods of solving the transport problem: transport problem by the criterion of time		
	Practical lesson	<b>Practical task №3.</b> Solving the transport problem by the criterion of time	Homemade work	2
			RT №1	7
<b>Individual work</b>				
Questions and tasks for self-study	Study of lecture material. Do your homework. Preparation for writing test			
Theme 16	<b>Classroom work</b>			
	Lecture	<b>Lecture №6.</b> Game theory and its application in tourism	Colloquium № 1	8
	Laboratory lesson	<b>Laboratory task №3.</b> Risk research on the example of a matrix game of two persons	LW №3	2
	<b>Individual work</b>			
Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Preparation for the colloquium			
Theme 17	<b>Classroom work</b>			
	Lecture	<b>Lecture №7.</b> Simple regression: correlation-regression analysis of the function of one variable		
	Practical lesson	<b>Practical task №4.</b> Estimation of pairwise linear regression parameters	Homemade work	2
	<b>Individual work</b>			
Questions and tasks for self-study	Study of lecture material. Doing homework			

	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №8.</i></b> Simple regression: construction of a confidence interval for the regression line		
	Laboratory lesson	<b><i>Laboratory task №4.</i></b> Construction of a confidence interval for a pairwise regression line	LW №4	2
	<b><i>Individual work</i></b>			
Questions and tasks for self-study	Study of lecture material. Preparation for laboratory work			
<b>Theme 18</b>	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №9.</i></b> Multifactor regression: models with natural variables		
	Practical lesson	<b><i>Practical task №5.</i></b> Estimation of the correlation density between endogenous and exogenous factors	Homemade work	2
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Study of lecture material; doing homework		
	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №10.</i></b> Multifactor regression: time series		
	Laboratory lesson	<b><i>Laboratory task №5.</i></b> Estimation of parameters of the linear regression equation for the case of a multifactor model	LW №5	2
	<b><i>Individual work</i></b>			
	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	6
	<b><i>Classroom work</i></b>			
	Lecture	<b><i>Lecture №11.</i></b> Multifactor regression: analysis of variance		
	Practical lesson	<b><i>Practical task №7.</i></b> Application of analysis of variance to check the quality of a multifactor regression model	Homemade work;	2
			RT №2	7
	<b><i>Individual work</i></b>			
	Questions and tasks for self-study	Study of lecture material. Do your homework. Preparation for writing test		
<b><i>Classroom work</i></b>				
Lecture	<b><i>Lecture №12.</i></b> Multifactor regression: prediction based on the results of regression analysis	Colloquium №2	8	
Laboratory lesson	<b><i>Laboratory task №8.</i></b> Regression models with qualitative variables on the example of time series. Forecasting by time series	LW №6	2	

<i>Individual work</i>			
Questions and tasks for self-study	Study of lecture material. Execution of practical tasks. Preparation for the colloquium		
			Exam 40

### Recommended reading

#### Main

1. Вища математика : базовий підручник для вузів / під ред. В. С. Пономаренка. – Харків : Фоліо, 2014. – 669 с.
2. Малярець Л. М., Математика для економістів. Теорія ймовірностей та математична статистика: навчальний посібник. Ч. 3 / Л. М. Малярець, І. Л. Лебедева, Л. Д. Широкоград. – Харків : Вид. ХНЕУ, 2011. – 568 с.
3. Малярець Л. М. Практикум рішення задач по теорії вероятностей и математической статистике в MS Excel. Учебное пособие. / Л. М. Малярець, Е. Ю. Железнякова, І. Л. Лебедева – Харків : Вид. ХНЕУ, 2012. – 220 с.
4. Малярець Л. М. Теорія ймовірностей та математична статистика: навчальний посібник / Л. М. Малярець, Е. Ю. Железнякова, І. Л. Лебедева та ін. – Харків. : Вид. ХНЕУ, 2010. – 404 с.
5. Математика для економістів: практ. посіб. до розв'язання задач економічних досліджень в MatLab / Л. М. Малярець, Є. В. Резнік, О. Г. Тижненко. – Харків : Вид. ХНЕУ, 2008. – 212 с.
6. Місюра Є. Ю. Теорія ймовірностей. Конспект лекцій / Є. Ю. Місюра. – Харків : Вид. ХНЕУ, 2013. – 95 с. (Англ. мов.)

#### Additional

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