

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES  
OF UKRAINE**

**Department of Economic Cybernetics  
Department of Statistics and Economic Analysis**



**“CONFIRMED”**

Dean of the Faculty of Agricultural Management

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Anatolii OSTAPCHUK

“30” August 2024

**“APPROVED”**

at the meeting of the Department of Economic  
Cybernetics

Minutes №1, “19” August 2024

\_\_\_\_\_  
Volodymyr KHARCHENKO

at the meeting of the Department of Statistics  
and Economic Analysis

Minutes №1, “20” August 2024

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Andriy MUZYCHENKO

**“REVIEWED”**

Program Coordinator

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Vira BUTENKO

**PROGRAM OF THE COURSE**

**APPLIED MODELING**

Field of Study    07 Management and Administration  
Specialty        073 “Management”  
Academic program    Management  
Faculty:         Agricultural Management  
Lecturers:       Galaieva L.V., Associate Professor of the Department of  
Economic Cybernetic, PhD in Economics, Associate Professor;  
Voliak L.R., Associate Professor of the Department of Statistics and  
Economic Analysis, PhD in Economics, Associate Professor

Kyiv – 2024

## Description of the course “Applied Modelling”

<b>Field of Study, Specialty, Academic program, Academic degree</b>		
Academic degree	Bachelor	
Field of Study	07 Management and Administration	
Specialty	073 “Management”	
Academic Program	Management	
<b>Characteristics of the course</b>		
Type	Core	
Total number of hours	150	
Number of ECTS credits	5	
Number of content modules	4	
Term paper/Project paper	-	
Form of assessment	Exam	
<b>Indicators of the course for full-time and part-time forms of study</b>		
	Full-time	Part-time
Year of study	2	-
Semester	4	-
Lecture classes	30 hours.	-
Seminars	60 hours	-
Laboratory	- hours	-
Self-study	60 hours	-
Individual assignments	- hours	-
Hours per week (full-time program)	6 hours	

### **1. Purpose, tasks competencies and program outcomes of the course**

**The purpose of the discipline** is to get students acquainted with basic knowledge of the Applied Modeling and knowledge transfer from modern mathematics which would enable learners to work with special models in practice.

**Tasks of the course** include learn the main concepts of the course; to develop logical thought and skills to solve practical tasks; to define special probability distributions, to analyze and to make decision; mastering the methods of building and evaluating econometric models; acquisition of practical skills of quantitative measurement of relationships between economic indicators; definition of criteria for testing the hypothesis regarding the qualities of economic indicators and forms of their connection; deepening of theoretical knowledge in the field of mathematical modeling of economic processes and phenomena; using the results of econometric analysis for forecasting and making sound economic decisions.

### **Acquisition of competencies:**

***Integrated competency (IC):*** the ability to solve complex specialized problems and practical problems that are characterized by complexity and uncertainty of conditions, in the field of management or in the process training involving the application of theories and methods social and behavioral sciences.

#### ***General competencies (GC):***

- GC 3. Ability to abstract thinking, analysis, synthesis..
- GC 4. Ability to apply knowledge in practical situations.
- GC 8 Information and communication skills technologies.
- GC 10. Ability to conduct research at an appropriate level.

#### ***Special (professional) competencies (SC):***

- SC 2 The ability to analyze the results of the organization's activities, to compare them with the factors of influence of the external and internal environment.
- SC 3 The ability to determine the prospects for the development of the organization.
- SC 12 Ability to analyze and structure problems organizations, form informed decisions.

#### ***Program learning outcomes (PLO):***

PLO 4 Demonstrate skills in identifying problems and substantiating managerial solutions.

PLO 6 Demonstrate the skills of searching, collecting and analyzing information, calculating indicators to justify management decisions.

PLO7 Demonstrate organizational projecting skills.

PLO 17 Conduct research individually and/or in a group under the guidance of a leader.

## 2. Program and structure of the course for full-time and part-time forms of studying

### 2. Programme and structure of the discipline for: full-time form of study

Modules and topics	Number of hours													
	Full-time form								Part-time form					
	Weeks	Total	including						Total	including				
			1	s	lab	ind	ss	1		s	lab	ind	ss	
2	3	4	5	6	7	8	9	10	11	12	13	14		
1														
<b>Module 1. “Mathematical Programming”</b>														
<b>Module 1. Linear Models and Methods for Finding Solutions of Linear and Nonlinear Optimization Problems</b>														
Topic 1. Optimization models and methods.	1-2	7	2		4		1							
Topic 2. Linear programming. Methods for solving Linear Programming Problems.	3-4	8	2		4		2							
Topic 3. Duality in linear programming.	5-6	7	2		4		1							
Topic 4. Transportation Problem.	7-8	7	2		4		1							
Topic 5. Nonlinear Programming Problems.	9-10	5	1		2		2							
<b>Total for Content Module 1</b>		<b>34</b>	<b>9</b>		<b>18</b>		<b>7</b>							
<b>Module 2. “Mathematical Modelling”</b>														
<b>Content Module 2. Theoretical Basis of Mathematical Modelling and Practical Support</b>														
Topic 6. The Theoretical Basis of Economic Mathematical Modelling.	10-12	8	2		4		2							
Topic 7. The Models in Agriculture.	12-13	9	2		4		3							
Topic 8. Some Sections of Modelling.	14-15	9	2		4		3							
<b>Total for Content Module 2</b>		<b>26</b>	<b>6</b>		<b>12</b>		<b>8</b>							
<b>Total hours 1-2 modules</b>		<b>60</b>	<b>15</b>		<b>30</b>		<b>15</b>							
<b>Module 3. “Methods of Building a General Linear Model”</b>														
<b>Content Module 3. Linear Econometrical Models and Methods for its Estimation</b>														
Topic 1. The subject, methods and tasks of the Econometrics.	-	2	-		-		2							
Topic 2. Methods of building a general linear econometric model.	1-2	12	2		4		6							
Topic 3. Multicollinearity and its influence on model parameter estimates.	3-4	10	2		4		4							

Topic 4. Generalized econometric models.	5-6	12	2		4		6						
Topic 5. Econometric models of dynamics.	7-8	8	2		2		4						
Total for Content Module 3		<b>44</b>	<b>8</b>		<b>14</b>		<b>22</b>						
<b>Module 4. "Econometric Modeling"</b>													
<b>Content Module 4. Empirical methods of quantitative analysis based on statistical equations</b>													
Topic 6. Econometric methods of quantitative analysis based on statistical equations.	9-10	10	2		4		4						
Topic 7. Construction of an econometric model with autocorrelated residuals and a distributed lag model.	11-12	10	2		4		4						
Topic 8. Methods of instrumental variables.	-	6	-		2		4						
Topic 9. Distributed lag models.	-	6	-		2		4						
Topic 10. Econometric models based on the system of structural equations.	13-14	6	2		2		2						
Topic 11. Econometric modeling based on nonlinear regression.	15	8	1		2		5						
Total for Content Module 4		<b>46</b>	<b>7</b>		<b>16</b>		<b>23</b>						
Total hours 3-4 modules		<b>90</b>	<b>15</b>		<b>30</b>		<b>45</b>						
<b>Total hours</b>		<b>150</b>	<b>30</b>		<b>60</b>		<b>60</b>						

### 3. Topics of seminar (practical, laboratory) classes

№	Topic title	Number of hours
1.	Bases of Mathematical Programming. Graph Method.	4
2.	Simplex Method for solving Linear Programming Problems.	4
3.	Dual Problem.	4
4.	Transportation Problem.	4
5.	Nonlinear Programming Problems.	2
6.	The Theoretical Basis of Economic Mathematical Modelling.	4
7.	The System of Models in Agriculture.	4
8.	Some Sections of Modelling.	4
9.	The subject, methods and tasks of the Econometrics.	-
10.	Methods of building a general linear econometric model.	4
11.	Multicollinearity and its influence on model parameter estimates.	4
12.	Generalized econometric models.	4
13.	Econometric models of dynamics.	2
14.	Econometric methods of quantitative analysis based on statistical equations.	4
15.	Construction of an econometric model with autocorrelated residuals and a distributed lag model.	4
16.	Methods of instrumental variables.	2
17.	Distributed lag models.	2
18.	Econometric models based on the system of structural equations.	2
19.	Econometric modeling based on nonlinear regression.	2
<b>Total</b>		60

### 3. Self-study work topics

№	Topic title	Number of hours
1.	Bases of Mathematical Programming. Graph Method.	1
2.	Simplex Method for solving Linear Programming Problems.	2
3.	Dual Problem.	1
4.	Transportation Problem.	1
5.	Nonlinear Programming Problems.	2
6.	The Theoretical Basis of Economic Mathematical Modelling.	2
7.	The System of Models in Agriculture.	3
8.	Some Sections of Modelling.	3
9.	The subject, methods and tasks of the Econometrics.	2
10.	Methods of building a general linear econometric model.	6
11.	Multicollinearity and its influence on model parameter estimates.	4
12.	Generalized econometric models.	6
13.	Econometric models of dynamics.	4
14.	Econometric methods of quantitative analysis based on statistical equations.	4
15.	Construction of an econometric model with autocorrelated residuals and a distributed lag model.	4
16.	Methods of instrumental variables.	4
17.	Distributed lag models.	4

18.	Econometric models based on the system of structural equations.	2
19.	Econometric modeling based on nonlinear regression.	5
<b>Total</b>		60

### **Diagnostic tools for learning outcomes**

- Exam;
- Module tests

### **4. Methods of teaching**

Methods of teaching are methods of joint activity and communication between the teacher and students of higher education, which ensure the development of positive motivation for learning, mastery of the system of professional knowledge, skills and abilities, the formation of a scientific worldview, the development of cognitive powers, the culture of mental work of future specialists.

The following teaching methods are used during the educational process:

- verbal method (lecture, discussion, interview);
- practical method (practical classes);
- visual method (illustration method, demonstration method);
- work with educational and methodical literature (summarizing, summarizing, annotating, reviewing, writing an abstract);
- video method (remote, multimedia, web-oriented, etc.);
- independent work (task performance);
- individual research work of students of higher education.

### **7. Assessment methods**

- exam;
- oral or written survey;
- module testing;
- presentations and speeches at scientific and practical events.

### **8. Distribution of grades received by students**

Assessment of student knowledge is on a 100-point scale and is translated into national assessments according to “Regulations on examinations and tests in NULES of Ukraine”

<b>Student rating, points</b>	<b>National grade based on exam results</b>	
	<b>Exams</b>	<b>Credits</b>
<b>90-100</b>	<b>Excellent</b>	<b>Passed</b>
<b>74-89</b>	<b>Good</b>	
<b>60-73</b>	<b>Satisfactory</b>	

<b>0-59</b>	<b>Unsatisfactory</b>	<b>Not passed</b>
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In order to determine the rating of a student (listener) in the discipline  $R_{dis}$  (up to 100 points), the rating from the exam  $R_{ex}$  (up to 30 points) is added to the rating of a student's academic work  $R_{aw}$  (up to 70 points):  $R_{dis} = R_{aw} + R_{ex}$ .

### **9. Educational and methodological support**

This work program of academic discipline, a summary of lectures, plans of seminars and practical classes, tasks for independent work, express control, tasks for final control, Elearn course by URL: <https://elearn.nubip.edu.ua/course/view.php?id=5115>

### **10. Recommended sources of information**

1. Anderson D.R., Sweeney D.J., Williams T.A. Statistics for Business & Economics, 14th Edition, Cengage Learning, 2019, 1120 p.
2. Basic Statics. Electronic source: <https://www.adb.org/publications/basic-statistics-2017>
3. Cox Dennis, Cox Michael. The Mathematics of Banking and Finance. The Atrium, Southern Gate, Chichester, John Wiley & Sons Ltd, 2016. 332 p.
4. Devore Jay L., Berk Kenneth N. Modern mathematical statistics with applications. Belmont, Calif.: Thomson Brooks/Cole, 2007. 810p.
5. Drury C. Management and cost accounting. C&C Offset, China, 2016. 775p.
6. Illukkumbura A. Introduction to Regression Analysis (Easy Statistics), 2020, 121 p.
7. John E. Freund's. Mathematical Statistic, USA, 2014
8. Keller, Gerald. Essentials of business statistics / Gerald Keller, Brian Warrack. Wadsworth, Inc., 2014. 593p.
9. Kennedy Peter. A guide to econometrics. Massachusetts: The MIT Press, 2015. 468p.
10. Kravchenko V.M., Galaieva L.V., Shulga N.G. Applied modeling: Economic and mathematical modeling. Kyiv: NULESU, 2023. – 363 p.
11. Morris R. Studies in mathematics education: The teaching of statistics. Unesco, 2016. 258 p.
12. Quirk T. Excel 2010 for Business Statistics. A Guide to Solving Practical. Business Problems, School of Business and Technology Webster University, 2018, 264 p.
13. Quirk T. Excel 2019 in Applied Statistics for High School Students: A Guide to Solving Practical Problems (Excel for Statistics) 2nd ed., Springer, 2021, 264 p.
14. Ruric E. Wheeler, W.D. Peeples, Jr. Modern Mathematics. Brooks: Cole Publishing Company, 2016. 707p.
15. Simon Carl P., Blume Lawrence. Mathematics for economists. New York, London: W.W.Norton & Company, 2017. 930p.



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17. Taha Hamdy A. Operations Research. Ninth Edition. Prentice Hall; 2010. 832 p.
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19. Горкавий В.К. Статистика: Навч. посібник. К.: Алерта, 2020. 644 с.
20. Горошанська О.О. Статистика: Практикум. Харк. держ. університет харчування та торгівлі. Харків, 2017. 133 с.
21. Економетрика: підруч. для студ. вищ. навч. закл. О. І. Черняк та ін.; /за ред. О. І. Черняка; Київ. нац. ун-т ім. Т. Шевченка. ВПЦ "Київський університет", 2020. 359 с.
22. Економетрика з R : навчальний посібник . А.В. Скрипник, Д.М. Жерліцин, Ю.О. Нам'ясенко. Київ: ФОП Ямчинський О.В., 2020. 248 с
23. Економетрія: навч. посіб. І. Л. Ковальова та ін. Одеса : ОДАБА, 2019. 423 с.
24. Жерліцин Д.М., Галаєва Л.В., Наконечна К.В. Статистичний аналіз та візуалізація даних. Навчальний посібник. Київ: Видавничий центр НУБіП України. 2022. 344с.
25. Козирєва О.В., Федорова В.О. Статистика: навчальний посібник. Харків: Видавництво Іванченка І.С., 2021. 187 с.
26. Козьменко О.В. Економіко-математичні методи та моделі (економетрика) : навчальний посібник. О.В. Козьменко. Суми: Університетська книга, 2019. 406 с.
27. Лоднар С. І. Економетрія засобами MS Excel. навчальний посібник / С. І. Лоднар, Р. В. Юринець Київ: Вид-во Європ. Ун-ту, 2018. 242 с.
28. Мармоза А.Т. Практикум з теорії статистики і сільськогосподарської статистики: Навч.посіб. Центр навчальної літератури, 2019. 664 с.
29. Мармоза А.Т. Теорія статистики: Навч. посібник. К.: ЦУЛ, 2019.592 с.
30. Опря А.Т., Дорогань-Писаренко Л.О., Єгорова О.В., Кононенко Ж.А. Статистика (модульний варіант з програмованою формою контролю знань). Навчальний посібник. Підручник. Київ: Центр навчальної літератури, 2019. 536 с
31. Педченко Г. П. Статистика: Навчальний посібник Мелітополь: Колор Принт, 2018. 266 с.
32. Рязанцева В.В. Економетрія. Моделювання макроекономічних процесів: навч.посіб. Київ : Київ. нац. торг.-екон. ун-т, 2018. 388 с.
33. Скрипник А.В., Галаєва Л.В., Коваль Т.В., Шульга Н.Г. «Теорія ймовірностей ймовірнісні процеси та математична статистика». Київ: ТОВ» Аграр Медіа Груп», 2017. 265с. – Режим доступу: <http://elibrary.nubip.edu.ua/16947/>
34. Статистика : підручник. Колектив авторів: С. І. Пирожков, В. В. Рязанцева, Р. М. Моторин та ін. Київ : Київ. нац. торг.-екон. ун-т, 2020. 328 с.
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38. Peter Kennedy. A guide to econometrics. Massachusetts: The MIT Press, 1998. 468.

39. Барковський В.В., Барковська Н.В., Лопатін О.К. Теорія ймовірностей та математична статистика. К.: ЦУЛ, 2012. 448 с.

40. Кремень В.М., Кремень О.І. Фінансова статистика: Навч. посібник. Київ: Центр навчальної літератури, 2017. 368 с.

41. Мармоза А.Т. Економічна статистика: Навч. посібник. Київ: ЦУЛ, 2019. 600 с.

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#### **Internet resources**

1. Кабінет Міністрів України. URL: <http://www.kmu.gov.ua/control/>  
2. Державний Комітет статистики України. URL: <http://ukrstat.gov.ua/>  
3. Продовольча та сільськогосподарська організація ООН (ФАО). URL: <http://www.fao.org/>

4. Світовий банк. URL: <http://www.worldbank.org/>

5. Євростат. URL: <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>