


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

Department of Statistics and Economic Analysis


“CONFIRMED”

Dean of the Economic faculty,

 Anatolii DIBROVA
"28" August 2024

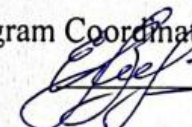
“APPROVED”

at the meeting of the Department
of Statistics and Economic Analysis
Minutes № 1 from “20” August 2024

 Andriy MUZYCHENKO

“REVIEWED”

Program Coordinator

 Olena KIREITSEVA

**PROGRAM OF THE COURSE
ECONOMIC AND MATHEMATICAL METHODS**

Field of Study 05 Social and behavioral sciences
Specialty 051 "Economics"
Academic
program "International Economics"
Faculty: Economic faculty
Lecturer: **Makarchuk O.G.**, Associate Professor of the Department of Statistics and
Economic Analysis, PhD in Economics, Associate Professor

Kyiv – 2024

Description of the course
ECONOMIC AND MATHEMATICAL METHODS

Field of Study, Specialty, Academic program, Academic degree		
Academic degree	Bachelor	
Field of Study	05 “Social and behavioral sciences”	
Specialty	051 “Economics”	
Academic Program	International economics	
Characteristics of the course		
Type	Compulsory	
Total number of hours	120	
Number of ECTS credits	4	
Number of content modules	2	
Term paper/Project paper	-	
Form of assessment	<i>Exam</i>	
Indicators of the course for full-time and part-time forms of study		
	Full-time	Part-time
Year of study	2	-
Semester	4	-
Lecture classes	30 hours	-
Seminars	30 hours	-
Laboratory	-	-
Self-study	60 hours	-
Individual assignments	-	-
Hours per week (full-time program)	4 hours	-

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

Methodological aspects of economic and mathematical modeling, conceptual provisions, models and methods of optimization problems, basics of systems analysis are considered.

Purpose of the course "Economic and mathematical methods" is to form a system of special knowledge and practical skills in the field of knowledge formation on methodology and tools of construction, as well as adequate use of different types of economic and mathematical methods.

The subject of the course "Economic and mathematical methods" is the methodology and tools of economic-mathematical modeling and analysis of economic objects, processes, phenomena, trends and cause-and-effect relationships in economics; theoretical and practical issues of economic and financial risk analysis.

The task of studying the course is theoretical and practical training of students on the methodology and methods of research of economic processes and phenomena using the tools of economic and mathematical modeling.

As a result of studying the discipline the student must:

know: the theory of construction of economic and mathematical modeling and mastering the methods of solving optimization problems, as well as some subclasses of nonlinear problems programming;

be able to: use programming as a method of cognition and analysis; professionally and creatively approach the preparation and adoption of management decisions on the enterprise, analyze and summarize the results of production and economic and commercial and financial activities, justify the main directions of economic policy, to predict the consequences of decisions and measures taken at any given time.

The discipline provides the formation of a number of general and special (professional, subject) competencies:

Acquisition of competencies:

Integrated competency (IC): the ability to solve complex specialized tasks and practical problems in the economic sphere, which are characterized by the complexity and uncertainty of conditions, which involves the application of theories and methods of economic science.

General competencies (GC):

GC 3. Ability to abstract thinking, analysis and synthesis.

GC 7. Information and communication skills technologies.

GC 11. Ability to make informed decisions.

Special (professional) competencies (SC):

SC 6. Ability to apply economic and mathematical methods and models to solve economic problems.

SC 7. Ability to apply computer technologies and data processing software to solve economic problems, analyze information and prepare analytical reports.

SC 8. Ability to analyze and solve problems in the field of economic, social and labour relations.

SC 9. Ability to forecast socio-economic processes based on standard theoretical and econometric models.

Program learning outcomes (PLO):

PLO 5. Apply analytical and methodological tools to substantiate proposals and make management decisions by various economic agents (individuals, households, enterprises and government bodies)

PLO 8. Apply relevant economic and mathematical methods and models for solving economic problems.

PLO 21. Be able to think abstractly, apply analysis and synthesis to identify key characteristics of economic systems at different levels, as well as the characteristics of the behavior of their subjects.

3. Topics of seminar (practical, laboratory) classes

№	Topic title	Hours
1	Mathematical formalization of problem conditions.	2
2	Study of applied programs for solving economic and mathematical problems on an Excel spreadsheet.	2
3	Modeling techniques.	2
4	Modeling of the optimal ration in agriculture.	2
5	Modeling of optimal sowing structure.	2
6	Examples of problems.	4
7	Examples of arithmetic programming problems. Canonical figures of LP tasks. Transformation of one figure to another.	4
8	Geometric interpretation and graphical solution of LP tasks.	2
9	Methods of constructing initial plans of the transport problem.	2
10	Construction of the optimal plan of the transport problem	2
11	Construction of dual problems.	2
12	The main features of LP tasks. Integer programming problems. Practical implementation on a PC.	4
	Total hours	30

4. Topics for self-study

№	Topic title	Number of hours
1.	Theoretical foundations of mathematical methods	4
2.	Principles and stages of construction Economic mathematical methods	4
3.	Basic methods of formalizing economic conditions	4
4.	The general problem of linear programming and its canonical figures	4
5.	Geometric interpretation of linear programming problems	4
6.	The solution of simplex method and its modifications	6
7.	Theory of duality and duality of linear optimization estimates tasks	6
8.	Transport problems of linear programming	4
9.	Analysis of optimization solutions tasks	6
10.	Mathematical modeling of the agricultural industry	6
11.	Production models	8
12.	Applied financial models	4
	Total hours	60

5. Diagnostic tools for learning outcomes

- Exam;
- Module tests;
- Calculation of practical works;
- Defence of practical works.

6. 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”.

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

9. Educational and methodological support

1. Makarchuk O.G. Electronic training course of the discipline «Economic and mathematical methods and models». URL: <https://elearn.nubip.edu.ua/course/view.php?id=5109>
2. Abstracts of lectures and their presentations (in electronic form). URL: <https://elearn.nubip.edu.ua/course/view.php?id=5109>
3. Макаrchук О.Г. Economic and mathematical methods and models. Methodical guidelines for studying the discipline "Economic and mathematical methods and models" for students of the first (bachelor's) level of higher education, specialty 051 "Economics", academic programme "International Economics", К.: НУБіП України. 2024. 56 с.

10. Recommended sources of information

1. Bruce E. Hansen. Econometrics. University of Wisconsin. Princeton University Press, 2022, 700 p.
2. Business Problems, School of Business and Technology Webster University, 2018, 264 p.
3. Hamulczuk M., Makarchuk O., Kuts T. Time-Varying Integration of Ukrainian Sunflower Oil Market with the EU Market. *Agris on-line (Papers in Economics and Informatics)*. 2021. Vol. XIII, №3. P. 35-49. URL: <https://doi.org/10.7160/aol.2021.130304>
4. Hamulczuk M., Cherevyk D., Makarchuk O., Kuts T., Voliak L. Integration of Ukrainian grain markets with foreign markets during russia's invasion of Ukraine. *Zagadnienia Ekonomiki Rolnej Problems of Agricultural Economics*. 2023. Vol. 377(4). P. 1-25. URL: <https://doi.org/10.30858/zer/177396>
5. Illukkumbura A. *Introduction to Regression Analysis (Easy Statistics)*, 2020, 121 p.
6. Kuts T., Makarchuk O. Environmental Awareness of students of National University of Life And Environmental Sciences (Nules) of Ukraine in the context of modern challenges, *Papers: Management, Economic Engineering in Agriculture & Rural Development*. 2023. Vol. 23 Issue 16, P. 363-370. URL: https://managementjournal.usamv.ro/pdf/vol.23_2/Art42.pdf
7. Makarchuk O., Kuts T., Voliak L. Green economy in Ukraine: analysis and modelling of development in agriculture. *Grail of Science*, 2024. №46, pp. 264-270. URL: <https://archive.journal-grail.science/index.php/2710-3056/issue/view/29.11.2024/34>
8. Makarchuk O., Kuts T., Labenko O., Kuts O. Market evaluation of rapessed in Ukraine: perspectives and challenges. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural development*. 2024. Vol. 24 (4), pp. 505-513. URL: https://managementjournal.usamv.ro/pdf/vol.24_4/volume_24_4_2024.pdf
9. Makarchuk O. Sunflower oil market in Ukraine: state and challenges. *Біоекономіка і аграрний бізнес*. 2022 р., НУБіП України. 2022. №2. С. 100-110. URL: <https://economicscience.com.ua/uk/journals/t-13-2-2022/rinok-sonyashnikovoyi-oliyi-v-ukrayini-stan-ta-vikliki>
10. Sean Beckett. *Introduction to Time Series Using Stata*. Stata Press, 2020, 670 p.

11. Економіко-математичні методи і моделі в галузі управління персоналом: навч. посіб. За заг. редакцією Л.В. Мазник. К. : Кафедра, 2019. 290 с.
12. Економіко-математичні методи та моделі у науково-дослідних роботах: навч. посіб. / за заг. ред. д-ра екон. наук, проф. О. Є. Кузьміна. Львів : Видавництво Львівської політехніки, 2021. 284 с.
13. Козьменко О.В. Економіко-математичні методи та моделі (економетрика): навчальний посібник. Суми: Університетська книга, 2023. 406 с.
14. Кузьмичов А. І. Економетрія. Моделювання засобами MS Excel: навчальний посібник. К. : ЦУЛ, 2019. 214 с.
15. Оптимізаційні методи та моделі в підприємницькій діяльності : Навч. посіб. / Л.О. Волонтир, Н.А. Потапова, І.М. Ушкаленко, І.А. Чіков, Вінницький національний аграрний університет. Вінниця : ВНАУ, 2020. 404 с.
16. Офіційний сайт Державної служби статистики України.
URL: <http://ukrstat.gov.ua/>
17. Офіційний сайт Державної служби України з питань праці.
URL: <https://dsp.gov.ua/>
18. Офіційний сайт Євростату.
URL: <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>
19. Офіційний сайт Кабінету Міністрів України.
URL: <http://www.kmu.gov.ua/control/>
20. Офіційний сайт Міністерства економічного розвитку і торгівлі України.
URL: <http://www.kmu.gov.ua>
21. Офіційний сайт Продовольчої та сільськогосподарської організації ООН (ФАО). URL: <http://www.fao.org/>
22. Офіційний сайт Світового банку. URL: <http://www.worldbank.org/>
23. Присенко Г. В., Равікович Є.І. Прогнозування соціально-економічних процесів: навч. посібник. К.: КНЕУ, 2020. 378 с.
24. Продовольча та сільськогосподарська організація ООН (ФАО).
URL: <http://www.fao.org/>
25. Руська Р. В. Економетрика: навч. посібник. Тернопіль: Тайп, 2021. 248 с.
26. Теоретичні основи кількісних методів моделювання та прогнозування економічних процесів. URL: http://bookss.co.ua/book_medoti-ekonomyko-statestichnih-doslidzhen_806/3_1.-teoretichn-osnovi-klksnih-metodv-modelyuvannya-taprognozuvannya-ekonomchnih-procesv.
27. Флегантов Л.О. Математичне програмування: лекції. Полтава: ПДАУ, 2022. 96 с.
28. Якимова Л. П. Оптимізаційні методи та моделі : практикум в MS Excel : навч.-метод. посіб. Чернівці : Чернівец. нац. ун-т ім. Ю. Федьковича, 2022. 272 с.
29. Яровий А. А, Ваховська Л. М., Крилик Л. В. Математичні методи дослідження операцій. Лінійне програмування. Частина 1 : навчальний посібник Вінниця : ВНТУ, 2020. 86 с.
30. Яцько О. М., Томка Ю.Я. Дослідження операцій та теорія ігор. Навчально-методичний посібник.. Чернівці: Технодрук, 2023. 392 с.