NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
Department of Higher and Applied Mathematics

APPROVED
Faculty of Plant Protection,
Biotechnology and Ecology
28.05 2025 p.

CURRICULUM OF ACADEMIC DISCIPLINE
HIGHER MATHEMATICS

Area of knowledge: E Natural Sciences, Mathematics and Statistics
Specialty: E2 “Ecology”
Academic program: Ecology
Faculty of Plant Protection, Biotechnology and Ecology
Developed by: Associate Professor Yana Liashenko, PhD in mathematics and physics, Associate professor.

Kyiv – 2025

Description of the discipline

"Mathematics" is a basic discipline necessary for the development of students' intellect and the development of their abilities to logical and algorithmic thinking, self-learning skills. The purpose of teaching the discipline is to master the mathematical apparatus necessary for the analysis, modeling and solution of theoretical and practical problems in the management activities of a future manager.

The main objectives of the discipline "Mathematics":

- mastering the basics of the mathematical apparatus necessary for solving theoretical and practical management problems;
- ability to independently find, study and apply scientific literature and other information sources and resources in higher mathematics;
- development of skills in mathematical research of applied problems, namely the ability to translate a specific management problem into mathematical language with the subsequent construction of its mathematical model;
- the ability to study the built mathematical models of certain economic processes;
- mastering the methods of processing and analyzing the results obtained in the study of the developed mathematical models.

Area of knowledge, specialty, academic programme, academic degree		
Academic degree	Bachelor	
Area of knowledge	E Natural Sciences, Mathematics and Statistics	
Specialty	E2 "Ecology"	
Academic programme	Ecology	
Characteristics of the discipline		
Type	compulsory	
Total number of hours	120 (75)	
Number of ECTS credits	4 (2)	
Number of modules	2	
Course project (work) (if any)	-	
Form of assessment	*exam*	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	**Part-time**
Year of study	1	
Term	1	
Lectures	*15 hours*	
Practical classes and seminars	*30 hours*	
Laboratory classes	—	
Self-study	*30 hours*	
Number of hours per week for full-time students	*3 hours*	

1. Aim, competences and expected learning outcomes of the discipline

The **aim** of the educational discipline "Mathematics" is to form students' personalities, develop their intelligence and abilities to logical and algorithmic thinking, master mathematical methods for solving managerial problems in the economic sphere.

The main **objectives** of the discipline "Mathematics" are as follows:

- mastery of the basics of the mathematical apparatus necessary for solving theoretical and practical management problems in the economic sphere;
- development of skills in mathematical research of applied problems, namely, the ability to translate a specific economic problem into mathematical language with the subsequent construction of its mathematical model;
- development of the ability to research the constructed mathematical models of certain management processes.

As a result of studying the discipline, the student should acquire the following **competencies**:

Integral competences (IK)*:*

The ability to solve complex specialized tasks and solve practical problems in the field of ecology, environmental protection and sustainable use of nature, or in the process of learning, which involves the application of basic theories and methods of environmental sciences, and are characterized by the complexity and uncertainty of conditions.

General competences (ЗК):

ЗК08. Ability to conduct research at an appropriate level.

ЗК16 . Ability to critically reflect on the main theories, methods and principles of the natural sciences.

ЗК17. Understanding the main theoretical positions, concepts and principles of mathematical and socio-economic sciences.

Professional competencies of the specialty (ФК):

ФК16. Ability to critically reflect on the basic theories, methods and principles of natural sciences.

ФК17. Understanding of the basic theoretical positions, concepts and principles of mathematical and socio-economic sciences.

Program Learning Outcomes (ПРН):

ПР03**.** Understand the basic concepts, theoretical and practical problems in the field of natural sciences that are necessary for analysis and decision-making in the field of ecology, environmental protection and optimal nature use.

ПР19. Improve professional level through continuing education and self-education.

ПР21. Be able to choose optimal methods and tools for conducting research, collecting and processing data.

2. Programme and structure of the discipline

Modules and topics	**Number of hours**											
	full-time						**part-time**					
	total	including					total	including				
		l	p	lab	ind.	s.st.		l	p	lab	ind.	s.st.
Module 1. Fundamentals of mathematical analysis												
Topic1. Function: definition, domain. Methods of assignment. Inverse, composite, even, odd, periodic functions. Elementary functions,	**12**	**2**	**4**			**4**						

construction of their graphs												
Topic 2. The limit of a function at a point. Basic theorems about limits. Technique for finding typical limits.	**10**	**2**	**4**			**4**						
Topic 3. The first and second honorable limits, their application. Modul Test 1.	**13**	**2**	**4**			**4**						
Total for module 1	**30**	**6**	**12**			**12**						
Module 2. Differential and integral calculus												
Topic 4. Derivative of a function of one variable. Differentiation technique. Table of derivatives. Derivative of a composite, inverse, implicitly specified function. Logarithmic differentiation.	**25**	**2**	**4**			**4**						
Topic 5. Investigation of functions on intervals of increase and decrease, extremum, convexity and concavity, finding asymptotes.	**12**	**2**	**4**			**4**						
Topic 6. A complete investigation of the function	**10**	**2**	**4**			**4**						
Topic 7. Definition of the antiderivative and the indefinite integral. Properties of integrals. Table of integrals. Basic integration methods.	**12**	**2**	**4**			**4**						
Topic 8. Definite integral: definition, basic properties, calculations. Newton-Leibniz' theorem. Applications of the definite integral. Modul Test 2	**12**	**1**	**2**			**2**						
Total for module 2	**69**	**9**	**18**			**18**						
Total hours	**75**	**15**	**30**			**30**						

3. **Topics of lectures**

No.	Topic	Hours
1	**Lecture 1:** Function: definition, domain. Methods of assignment. Inverse,	2

	composite, even, odd, periodic functions. Elementary functions, construction of their graphs	
2	**Lecture 2:** The limit of a function at a point. Basic theorems about limits. Technique for finding typical limits.	2
3	**Lecture 3:** The first and second honorable limits, their application.	2
4	**Lecture 4:** Derivative of a function of one variable. Differentiation technique. Table of derivatives. Derivative of a composite, inverse, implicitly specified function. Logarithmic differentiation.	2
5	**Lecture 5:** Investigation of functions on intervals of increase and decrease, extremum, convexity and concavity, finding asymptotes	2
6	**Lecture 6:** A complete investigation of the function	1
7	**Lecture 7:** Definition of the antiderivative and the indefinite integral. Properties of integrals. Table of integrals. Basic integration methods.	2
8	**Lecture 8**: Definite integral: definition, basic properties, calculations. Newton-Leibniz' theorem. Applications of the definite integral.	2
	Total hours	**15**

4. Topic of practical classes

No.	Topic	Hours
1	**Topic 1**. Function: definition, domain. Methods of assignment. Inverse, composite, even, odd, periodic functions. Elementary functions, construction of their graphs.	4
2	**Topic 2**. The limit of a function at a point. Basic theorems about limits. Technique for finding typical limits.	4
3	**Topic 3**. The first and second honorable limits, their application	4
4	**Topic 4.** Derivative of a function of one variable. Differentiation technique. Table of derivatives. Derivative of a composite, inverse, implicitly specified function. Logarithmic differentiation.	4
5	**Topic 5**. Investigation of functions on intervals of increase and decrease, extremum, convexity and concavity, finding asymptotes.	4
6	**Topic 6**. A complete investigation of the function.	4
7	**Topic 7.** Definition of the antiderivative and the indefinite integral. Properties of integrals. Table of integrals. Basic integration methods.	4
8	**Topic 8**. Definite integral: definition, basic properties, calculations. Newton-Leibniz' theorem. Applications of the definite integral.	2
	Total hours	**30**

5. Topics of self-study

No.	Topic	Hours
1	**Topic 1**. Elementary investigation of the function.	7
2	**Topic 2**. The limit of a function at a point. Basic theorems about limits. Technique for finding typical limits.	7
3	**Topic 3**. A complete investigation of the function.	8
4	**Topic 4**. Definite integral: definition, basic properties, calculations. Newton-Leibniz' theorem. Applications of the definite integral.	8
	Total hours	**30**

6. Methods of assessing expected learning outcomes:

- oral or written questioning;
- interview
- testing;
- defense of practical work;

– self-assessment.

7. Teaching methods*:*

– method of problem-based learning;
– method of practice-oriented learning;
– case method;
– project-based learning method;
– method of flipped classroom, blended learning;
– method of learning through research;
– method of educational discussions and debates;
– method of teamwork, brainstorming.

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1. Linear and vector algebra		
Topic1. Function: definition, domain. Methods of assignment. Inverse, composite, even, odd, periodic functions. Elementary functions, construction of their graphs	To know and be able to construct graphs of elementary functions.	**5**
Topic 2. The limit of a function at a point. Basic theorems about limits. Technique for finding typical limits.	To know the definition of a limit of a function at a point; be able to use the technique for finding limits.	**5**
Topic 3. The first and second honorable limits, their application	To be able to apply the first and second honorable limits.	**5**
Module control work 1.		**30**
Module 2. Differential and integral calculus		
Topic 4. Derivative of a function of one variable. Differentiation technique. Table of derivatives. Derivative of a composite, inverse, implicitly specified function. Logarithmic differentiation.	To be able to differentiate the functions of one variable. To be able to find the derivatives of a complex, inverse, implicitly given function. Use logarithmic differentiation.	**5**
Topic 5. Investigation of functions on intervals of increase and decrease, extremum, convexity and concavity, finding asymptotes.	To be able to investigate the functions on intervals of increase and decrease, extremum, convexity and concavity, finding asymptotes.	**5**
Topic 6. A complete investigation of the function.	To be able to investigate the functions and construct its graph	**5**
Topic 7. Definition of the antiderivative and the indefinite integral. Properties of integrals. Table of integrals. Basic integration methods.	To know the definition, properties, and table of integrals. To know the simplest methods of integration.	**5**
Topic 8. Definite integral: definition, basic properties, calculations. Newton-Leibniz' theorem. Applications of the definite integral.	To know the definition and properties of a definite integral. To apply the definite integral to solve geometric problems.	**5**
Module control work 2.		**30**

Total for semester		**100**
Class work	**(M1 + M2)/2*0,7 ≤ 70**	
Exam/credit	**30**	
Total for year	**(Class work + exam) ≤ 100**	

8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.3. Assessment policy

Deadlines and exam retaking rules	*EXAMPLE:* works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
Academic integrity rules	*EXAMPLE:* cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	*EXAMPLE:* Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids:

- e-learning course of the discipline (*https://elearn.nubip.edu.ua) MANDATORY*;
- references to digital educational resources;
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum).

1. E-learning course of the discipline "Higher Mathematics" on the educational portal of National University of Life and Environmental Sciences of Ukraine eLearn. URL: https://elearn.nubip.edu.ua/course/view.php?id=3975
2. Artemchuk L.M. Lecture notes and their presentations in electronic form. URL: https://elearn.nubip.edu.ua/course/view.php?id=3975
3. Artemchuk L.M. Methodical recommendations for practical classes and individual tasks in electronic form. URL: https://elearn.nubip.edu.ua/course/view.php?id=3975
4. Batechko N.G., Pantalienko L.A., Shostak S.V., Tsypiy T.I., Ruzhylo M.Y. Higher Mathematics. Collection of tasks. Kyiv: NULES Publishing House, 2021. 352 pp.
5. Meish Yu.A., Arnauta N.V. Higher Mathematics. Theory, examples, tasks for independent work. Part 1. Textbook. - K.: OOO "TSK "KOMPRINT", 2023. 391p.
6. Meish Yu.A., Arnauta N.V. Higher Mathematics. Theory, examples, tasks for independent work. Part 2: textbook - K.: OOO "TSK "KOMPRINT", 2024. 310 p.

10.Recommended sources of information

1. Artemchuk L.M., Khaydurov V.V., Tsyupii T.I., Shcherbak T.M. Higher and Applied Mathematics: Textbook. Kyiv: NUBiP of Ukraine 2024. 307 p.
2. Yeremina T.O., Povarova O.A. Higher Mathematics. Elements of linear algebra and analytical geometry: a textbook. Igor Sikorsky Kyiv Polytechnic Institute; Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2021. 115 pp. URL: https://ela.kpi.ua/handle/123456789/41267
3. Pasichnyk YA Higher mathematics: a textbook. Ostroh: Publishing House of the National University of Ostroh Academy, 2021. 432 c
4. Panchenko N. G. Rezunenko M. E. Higher mathematics: a textbook. Part 1 - Kharkiv: UkrDUZT, 2022. 232 pp. URL: http://lib.kart.edu.ua/handle/123456789/10149
5. Batechko N.G., Pantalienko L.A., Khaidurov V.V., Tsyupiy T.I., Shostak S.V. Mathematics textbook for students of preparatory courses. Kyiv: FOP Yamchynskyi O.V., 2020. 248 pp.