MINISTRY OF INTERNAL AFFAIRS OF UKRAINE

DNIPROPETROVSK STATE UNIVERSITY OF INTERNAL AFFAIRS

DEPARTMENT OF ECONOMIC AND INFORMATION SECURITY

APPROVED
Rector of Dnipropetrovsk State
University of Internal Affairs
Colonel of the Police

ANDRII FOMENKO

CURRICULUM OF THE ACADEMIC DISCIPLINE

FURTHER MATHEMATICS

Academic level Bachelor
Specialty 073 " Management "
Educational program «Financial and economic security and risk management»
Status of the academic discipline Obligatory
Language of instruction: English

Dnipro – 2021

Further mathematics // Curriculum of the academic discipline. – Dnipro: Dnipropetrovsk State University of Internal Affairs, 2021. – 10 p.

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REVIEWERS:

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Presented at the meeting of the department of Economic and Information Security ___ _____ 20____, minutes № ___

Recommended by Scientific and methodical council of the University ___ _____ 20____, minutes № ___

Approved by Academic council of the University, recommended to be used in the teaching process for ____ years. ___ _____ 20____, minutes № ___

The goal of studying the academic discipline «Further mathematics» is:

academic - deepening of the knowledge received at school, remembering and repeating of statements, formulas of mathematics which will be necessary for studying and understanding of the following mathematical and economic disciplines;

developmental - the formation and development of the level of knowledge and mathematical culture, which allows you to understand and analyze the processes and patterns in the economy and the world;

educational - educating students to accurate and conscientious attitude to the tasks, developing a research and creative approach to any work based on the logic and rigor of thinking, as well as the ability to highlight the main and set new unsolved problems.

Professional competencies acquired in the course of study of the discipline «Further mathematics»:

- GC3. Ability to abstract thinking, analysis, synthesis.
- GC4. Ability to apply knowledge in practical situations.
- GC12. Ability to generate new ideas (creativity).
- SC3 Ability to determine the prospects of the organization.

Preliminaries of studying the academic discipline «Further mathematics»: the amount of knowledge, skills and abilities, acquired while getting secondary education in the mathematics.

The results of the study of the discipline «Further mathematics»:

LO13. Communicate orally and in writing in state and foreign languages.

LO18. Know the basic terminology and have basic and structured knowledge in the field of financial and economic security and risk management for further use in practice.

According to the requirements of the educational program students must know:

1) at the conceptual level: basic concepts and methods of mathematics, areas of application of applied mathematical methods.

2) at the fundamental level: basic theoretical concepts and methods of mathematics;

3) at the practical and creative level: features of working with specific mathematical problems.

Volume of the academic discipline: Appendixes 1.1, 1.2. *(оновлюється щорічно).*

Curriculum of the academic program

TOPIC 1. MATRICES. DETERMINANTS. SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS.

Determinants and their main properties. Matrices, operations with them, inverse matrix. Solving of systems of linear equations by Gauss, Cramer, matrix methods.

TOPIC 2. FUNCTIONS OF SINGULAR VARIABLE. BORDERS. CONTINUITY OF THE FUNCTION.

The concept of functional dependence. Properties of functions. Basic elementary functions and their graphs.

Numerical sequence. Limited and monotonous sequences. Sequence and function boundary. Special borders.

Continuity of functions. Basic theorems about continuous functions. Properties of continuous functions. Classification of function gaps.

Topic 3. Differential calculus of a function of singular variable.

The concept of derivative. Derivatives of basic elementary functions. Derivative calculation. Differential. Derivatives and differentials of higher powers. Basic theorems of differential calculus. Hospital's rule.

Rising and falling of functions. Finding of the extremes of the function. Investigation of a function to the extremes using higher-power derivatives. The largest and smallest values of the function on the segment. Investigation of the function of convexity and concavity. Inflection points. Asymptotes of curves. General scheme of plotting functions.

Topic 4. Indefinite and definite integral of functions of singular variable.

Initial. Indefinite integral and its properties. Integration methods. Table of basic integration formulas. Integration of some function classes.

The integral is defined as a limit of integral sums. The main properties of a definite integral. Newton- Leibniz formula. Calculation of a definite integral: integration by parts and substitution.

Topic 5. Functions of multiple variables

Functions of multiple variables. Scope, boundary of a function in a point, continuity. Partial derivatives. Full differential. Implicit functions. Differentiation of implicit functions. Extremes of functions of several variables. Conditional extreme.

TOPIC 6. SERIES

Numeric series. The concept of the sum of a numerical series. A necessary condition of convergence. Sufficient conditions of the convergence of familiar series. Alternate series, absolute and conditional convergence.

Functional series. Area of convergence. The concept of uniform convergence. Properties of uniformly convergent series. Power series, convergence radius. Taylor's series.

TOPIC 7. DIFFERENTIAL EQUATIONS.

General concepts related to differential equations. Cauchy's problem. Basic classes of first-order differential equations integrated in quadratures. Theorem of existence and unity of the solution of the Cauchy`s problem.

Equations that reduce the order. Linear differential equations, homogeneous and inhomogeneous. Cauchy`s problem for a normal system of differential equations Normal systems of linear differential equations with constant coefficients.

TOPIC 8. FUNDAMENTALS OF THEORY OF PROBABILITY.

Random events and operations with them. Set of elementary events. Relative frequency of the event. Classical probability. The formula of total probability. Bayesian`s formula. Bernoulli's formula.

The normal rule of distribution of a random variable. Examples of other distributions. Numerical characteristics of functions of random variables. Properties of mathematical expectation and variance. Numerical characteristics of functions of random variables. Properties of expected value and variance. The concept of variation and correlation coefficient. Conditional numerical characteristics. Regression.

Form of the assessment of the learning success

Final control is checking of the level of acquisition of knowledge, skills, abilities and other competencies for a certain period of study (academic semester, academic year).

For academic discipline «Further mathematics» is required:

- for full-time studies – exam;
- for part-time studies – exam.

Criteria for the assessment of the learning success

Scoring policy

Assessment of students' classroom work is done out of a five in each practical lesson, followed by conversion by a special formula into a number of points less than or equal to 30.

Current control, in accordance with the regulations of the Ministry of Education of Ukraine, is carried out during practical classes and includes the following measures:

- control of the sequence of practical assignments and protection of practical assignment;
- oral interviews on the topic;
- written answers to independent assignment.

Evaluation of students' independent work:

Performing an independent assignment according to the options.

Evaluation of students' individual work:

Performing an individual assignment according to the options.

The order of the midterm(final) control

Midterm (final) control of the progress is held in the form of exam or test. Before the midterm control, the teacher announces the students' points obtained by students based on the previous results. The student is considered to be admitted to the final control if he has got 40 points.

If midterm control is in testing form according to curriculum and the student has received 60 points (on a 100-point scale) based on the previous results, the student may be given a grade of "60 points / E" in the receipt. The student must get at least 20 points during the test / exam to pass the control.

If a student does not appear on the test (exam) without valid reason, he receives the unsatisfactory grade. Academic debt appears when a student receives less than 60 points during the session.

Retaking tests/exams in order to increase the positive assessment is not allowed.

Instruments, equipment or software required for the academic discipline

Informational and methodical support of the academic discipline (recommended informational sources)

Appendix 2 *(оновлюється щорічно та/або в разі необхідності)*

Appendix 1.1.
to the curriculum of the academic discipline

APPROVED
Vice Rector of
Dnipropetrovsk State University of
Internal Affairs
LARYSA NALYVAIKO
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VOLUME OF THE ACADEMIC DISCIPLINE

Further mathematics

(назва навчальної дисципліни)

Academic level Bachelor Specialty 073 «Management»

for academic year 2020/2021

Form of study FULL-TIME Volume 8 ECTS credits (240 academic hours).
Faculty of Socio-Psychological Education and Management
Year of study **1** Academic groups **B-M-041IN**

№ of the topic according to the syllabus	Title of the topic (according to the syllabus)	Total volume, hours	In-class activity				Independent and individual assignments
			Total	Lectures	Seminars	Practical classes	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Matrices. Determinants. Systems of linear algebraic equations	**30**	**10**	**4**		**8**	**20**
2	Functions of singular variable. Borders. Continuity of the function.	**36**	**16**	**6**		**10**	**20**
3	Differential calculus of a function of singualar variable	**54**	**20**	**6**		**12**	**34**
	Semester, total	**120**	**46**	**16**		**30**	**74**
	Form of final control	***test***					
4	Indefinite and definite integral of functions of singular variable.	**24**	**10**	**4**		**6**	**14**
5	Functions of multiple variables	**14**	**6**	**2**		**4**	**8**
6	Series	**20**	**8**	**2**		**6**	**12**
7	Differential equations.	**24**	**12**	**4**		**8**	**12**
8	Fundamentals of theory of probability.	**38**	**18**	**6**		**12**	**20**

№ of the topic according to the syllabus	Title of the topic (according to the syllabus)	Total volume, hours	In-class activity				Independent and individual assignments
			Total	Lectures	Seminars	Practical classes	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Semester, total	**120**	**54**	**18**		**36**	**66**
	Academic year, total	**240**	**100**	**34**		**66**	**140**
	Form of final control	***exam***					

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Head of the department **_____** **Eduard RYZHKOV**

Appendix 2
to the curriculum of the academic discipline

INFORMATIONAL AND METHODICAL SUPPORT OF THE ACADEMIC DISCIPLINE

FURTHER MATHEMATICS

Academic level Bachelor Specialty 073 «Management»
for academic year 2020/2021

Textbooks:

1. David Rayner, Jim Fensom. Complete International Mathematics for Cambridge IGCSEOxford University Press - Children, 2013. P.516
2. James Nicholson. Complete Probability & Statistics 1 for Cambridge International AS & A Level. Oxford University Press - Children, 2019. P.226
3. Jean Linsky, Brian Western, James Nicholson, Complete Pure Mathematics 1 for Cambridge International AS & A Level. Oxford University Press - Children, 2018. P.260
4. Jean Linsky, Brian Western, James Nicholson. Complete Pure Mathematics 2 & 3 for Cambridge International AS & A Level. Oxford University Press - Children, 2019 P.348
5. Peter Jones, Michael Evans, Kay Lipson, Kyle Staggard, Cambridge Senior Maths AC/VCE Further Mathematics 3&4, Cambridge University Press, 2016. P.880
6. Tony Beadsworth, Complete Additional Mathematics for Cambridge IGCSE & O Level, Oxford University Press. United Kingdom. 2017.P.512
7. Vladimir Lepetic, Principles of Mathematics: A Primer. John Wiley and Sons Ltd. Hoboken, United States. 2016 P.672

Tutorials, other didactic and methodical materials:

8. Dyskovsky A.A., Kosychenko A.A., Rybalchenko L.V. Higher mathematics: Manual. Dnipro: Dnipropetrovsk State University of Internal Affairs, 2019. P.108.

Other sources:

9. GCE Further Mathematics Further Pure Unit 2 Textbook – AQA, URL: https://pdf4pro.com/view/gce-further-mathematics-6360-2cf39e.html
10. Wilson Mixon, Introduction to Mathematical Economics, URL: http://www.microlinkcolleges.net/elib/files/undergraduate/Management/Introduction%20to%20Mathematical%20Economics.pdf

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Head of the department **_____** **Eduard RYZHKOV**