

**UNIVERSITY OF ECONOMICS - VARNA**  
**FACULTY OF INFORMATICS**  
**DEPARTMENT STATISTICS AND APPLIED MATHEMATICS**

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Adopted by the FC (record № 9/ 24.04.2024)

Adopted by the DC (record № 6/ 15.04.2024)

**ACCEPTED BY:**

**Dean:**

(Prof. Vladimir Sulov, PhD)

**SYLLABUS**

**SUBJECT: APPLIED MATHEMATICS**

**DEGREE PROGRAMME: All programs taught in English; BACHELOR'S DEGREE**

**YEAR OF STUDY: 1; SEMESTER: 1;**

**TOTAL STUDENT WORKLOAD: 270 hours; incl. curricular 75 hours**

**CREDITS: 9**

**DISTRIBUTION OF STUDENT WORKLOAD ACCORDING TO THE CURRICULUM**

<i>TYPE OF STUDY HOURS</i>	<b>WORKLOAD, hours</b>	<b>TEACHING HOURS PER WEEK, hours</b>
<b>CURRICULAR:</b>		
incl.		
• LECTURES	30	2
• SEMINARS / LAB. EXERCISES	45	3
<b>EXTRACURRICULAR</b>	195	-

Prepared by:

1. ....  
(Assoc. Prof. Radan Miryanov, PhD)
2. ....  
(Assoc. Prof. Tanka Milkova, PhD)

Head of the department  
of „Statistics and Applied Mathematics“: .....  
(Assoc. Prof. Tanka Milkova, PhD)

## **I. ANNOTATION**

*The main aim of the subject „Applied Mathematics” is to generate and cultivate in students skills and erudition for working with all the fundamental mathematical terms and to apply them in solving basic economic problems, inspired from practice.*

*This program focuses on topics from fundamental mathematical chapters that directly relate to specialized economic subjects. It explores in detail basic elements of Linear Algebra and Analytic Geometry as well as their applications in economics. Fundamental subtopics of Financial Mathematics are studied, concerning most of all, interests, discounts and annuities. The basic elements of one variable and multivariable functions are observed, putting a stress on those examples which are usually involved in mathematical models of economic processes. Some topics in Combinatorics and Probability Theory are also examined as they concern random processes often used in economics and seen in practice.*

*The main aim of the subject Applied Mathematics is to generate and cultivate skills and erudition for working with all the fundamental mathematical terms and to apply them in solving basic problems in economics inspired from practice. By completing the course, the students should be able to understand the fundamental mathematical theory, methodology and its application in practice. Those basic skills and knowledge are necessary for the students' future and for taking their place in real life business environments.*

*The course “Applied Mathematics” develops the following key competencies:*

- *Mathematical competence, expressed in the ability and desire to use mathematical ways of thinking and presentation (formulas, models and graphs) for problem solving.*
- *Digital competencies, expressed in the ability to use digital information and the use of software to solve mathematical problems.*

## **II. THEMATIC CONTENT**

No	TITLE OF UNITS AND SUBTOPICS	NUMBER OF HOURS		
		L	S	L.E.
<b>1. Linear Algebra</b>		<b>4</b>	<b>6</b>	
1.1	Determinant. Basic Applications			
1.2	Matrix. Rank. Inverse of a Matrix. Matrix Equations			
1.3	Linear System of Equations			
<b>2. Analytical Geometry</b>		<b>4</b>	<b>6</b>	
2.1	Line Segments. Vectors			
2.2	Equation of a Line. Slope			
2.3	Angles. Perpendicular and Parallel Lines			
2.4	Distance Between Point and Between a Point and a Line			
2.5	Plane Curves			
<b>3. Financial Mathematics</b>		<b>6</b>	<b>9</b>	
3.1	Use of Percentages			
3.2	Simple Interest and Compound Interest			
3.3	Discount. Investment Profitability			
3.4	Annuity			
<b>4. Calculus – functions of one variable</b>		<b>8</b>	<b>12</b>	
4.1	Basic Functions. Curve Sketching			
4.2	Limits. Asymptotes.			
4.3	Continuous and Discontinuous Functions			

4.4	Differentiation and Derivatives. Application in Economics			
4.5	Local Extrema of $f(x)$ . Basic Applications			
4.6	Integrals (Antiderivatives). Applications.			
4.7	Consumer and Producer Surpluses and Gini Index			
<b>5. Multivariable Functions</b>		<b>4</b>	<b>6</b>	
5.1	Partial Derivatives			
5.2	Exact Differential. Gradient			
5.3	Local Extrema of $f(x,y)$			
5.4	The Least Squares Method			
<b>6. Combinatorics and Probability</b>		<b>4</b>	<b>6</b>	
6.1	Enumeration, Combination and Permutation of Sets			
6.2	Probability Axioms			
6.3	Basic Probability Theorems			
6.4	Random Variables			
<b>Total:</b>		<b>30</b>	<b>45</b>	

### III. FORMS OF CONTROL:

No. by row	TYPE AND FORM OF CONTROL	Number	extracurricular, hours
<b>1.</b>	<b>Midterm control</b>		
1.1.	Course Project / Term Homework	1	40
1.2.	Tests	2	60
<b>Total midterm control:</b>		<b>3</b>	<b>100</b>
<b>2.</b>	<b>Final term control</b>		
2.1.	Examination (test)	1	95
<b>Total final term control:</b>		<b>1</b>	<b>95</b>
<b>Total for all types of control:</b>		<b>4</b>	<b>195</b>

### IV. LITERATURE

#### REQUIRED (BASIC) LITERATURE:

1. Nikolaev, R., R. Miryanov, T. Milkova. Applied Mathematics, University Publishing House "Science and Economics", University of Economics – Varna, 2020.

#### RECOMMENDED (ADDITIONAL) LITERATURE:

- Logan, J.D. et al. Applied Mathematics, Wiley, 2013.
- Byleen, K.E. et al. College Mathematics for Business, Economics, Life Sciences, and Social Sciences, Pearson, 2014.
- Lancaster K. Mathematical Economics, Dover Publications, 2011.