



PA 7.5.1
PROGRAMA ANALITICĂ
(CURRICULUMUL CURSULUI)

RED.: 01

DATA: 19.11.2008

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Aprobat la ședința consiliului facultății Relații
 Economice Internaționale
 proces-verbal nr. _ din _____ 2018
 Președintele consiliului,
 conf. univ., dr. Crudu Rodica

Aprobat la ședința departamentului
 „Econometrie și Statistică Economică”,
 proces-verbal nr. 1 din 29.08.2018
 Șef-departament,
 prof. univ., dr. Pârțachi Ion

Course	ECONOMIC MATHEMATICS
Teacher	Associate professor, PhD Rodica Berzan

Level	L	Code	F.01.O.002.62	Year	1	Semester	I
Credits	5	Language	ENG	Final evaluation (<i>E – exam, V- verification</i>)			E
Direct Contact hours	60	Individual learning hours	90	Total hours		150	

Faculty	International Economic Relations
Program	World Economy and International Economic Relations
Chair	Mathematics and Economic Statistics

Total number of hours (per semester) of direct contact (T-theory course, S-seminar, L-laboratory activities, P-project or practical activities)				
Total	T	S	L	P
60	30	30		

Formative course category (<i>F-fundamental, G-general, H- socio-humanitarian, S- specialty</i>)	F
Optionality of the course (<i>O- obligatory, A - optional, F- free choice</i>)	
Maximum number of students at the course	50

Access conditions	obligatory	knowledge of mathematics at lyceum level
	recommended	knowledge of calculus: derivatives, integrals; higher algebra, geometry.

Foundation	To withstand new challenges in economic and business activity, the future economist must possess a good basis of both knowledge and useful techniques. The essential tool in economic analysis and research is mathematics. Mathematics has become the language of the modern economic science. Translating the real-world problems into mathematical forms and then solving the problems using mathematical methods enable us to realize the full potential of mathematics in economic and social studies.
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Objectives/ learning outcomes	<ul style="list-style-type: none"> • Accustoming with analyzing of mathematical models of economic processes. • Accustoming with mathematical models of solving economic problems.
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Course contents	Themes and topics including	Hours	Inclusive	
			Lectures	Seminars

(matter)	I. Functions of several variables			
	1.1. Examples of functions used in economics. Function of two and more variables. Domain of definition, level curves and the graph of a function of two variables. Partial derivatives and their economic sense. Total differential of the first and second order.	4	2	2
	1.2. Local extremum of the function of several variables. Necessary and sufficient condition of local extremum. Conditional extremum. Lagrange multipliers method. Method of the least squares. Applications.	4	2	2
	II. Ordinary differential equations			
	2.1. Mathematical models of economic problems having ordinary differential equations. Classification of differential equations. First order differential equations. General and particular solution. Cauchy theorem. Equations with separable variables, homogeneous and linear equations of the first order.	4	2	2
	2.2. Second order differential equations. Initial conditions for the equation. Cauchy theorem. Linear differential equation of the second order with constant coefficients (homogeneous and nonhomogeneous). Economic applications.	6	3	3
	III. Linear algebra			
	3.1. Systems of m - linear equations in n unknowns. Equivalent systems. Consistent and inconsistent systems. Gauss-Jordan elimination method. Basic and nonbasic variables. General, particular and basic solution to a system. Economic applications.	6	3	3
	IV. Linear programming			
	4.1. Economic examples of linear programming (LP) problems. Mathematical model of an LP problem. General notions and statements of LP. Graphical method of solving an LP problem.	4	2	2
4.2. Simplex method for solving LP problems. Basic feasible solution (b.f.s.). Determining the initial b.f.s. Passing from one b.f.s. to another. Optimality criterion of a basic feasible solution. Simplex algorithm. Simplex tables.	4	2	2	
4.3. Alternative optimal solutions. LP problems with mixed constraints. Finding basic feasible solutions using an artificial basis.	4	2	2	
4.4. Transportation problem (TP). Mathematical model and basic characteristics of a TP. Determining the initial basic feasible solution of a TP (North-West corner method; Least Cost method).	4	2	2	
4.5. Determining the optimal solution to TP. Potential method. Applications of the TP model in solving diverse economic problems.	4	2	2	
V. Elements of probability theory	4	2	2	
5.1. Random experiments, sample spaces, events.				

	Operations with the events (permutations, arrangements and combinations). Mutually exclusive events. Addition rule. Classic probability, empiric probability, subjective probability.	4	2	2
	5.2. Dependent and independent events. Conditional probability. Multiplication rule. Total probability formula. Probability of a hypothesis. Bayes formulas.	4	2	2
	5.3. Random variables. Discrete and continuous random variables. Probability distribution function and probability density function, their properties and graphs. Mean value, variation and standard deviation of a random variable.	4	2	2
	5.4. Probability distributions of the random variables. Discrete and continuous distributions. Binomial distribution and Poisson distribution. Uniform, normal and exponential distribution. The graph of the standard normal distribution. The $3 - \sigma$ law.			
	TOTAL	60	30	30

Practical activities and for individual learning of students	<p>Practical task nr.1. Functions of several variables. Examples of functions used in economy.</p> <p>Practical task nr.2. Local extrema of the functions of several variables.</p> <p>Practical task nr.3. The method of the least squares and applications in economy.</p> <p>Practical task nr.4. Linear differential equations with constant coefficients, their applications in economy.</p> <p>Practical task nr.5. Basic feasible solutions and their determining. Applications in economy.</p> <p>Practical task nr.6. Economic problems conducting to linear programming problems (LPP). Mathematical model of LPP.</p> <p>Practical task nr.7. Graphical method of solving of LPP.</p> <p>Practical task nr.8. Simplex method of solving LPP.</p> <p>Practical task nr.9. Classic, empiric and subjective probability.</p> <p>Practical task nr. 10. Discrete and continuous random variables, classical distributions.</p>
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Bibliography	<p>[1]. R. Berzan Mathematics for Economics and Business. Chişinău, 2016.</p> <p>[2]. I. Bunu și tot colectivul catedrei „Matematică”. <i>Matematici economice</i>. ASEM, Chişinău, 2012.</p> <p>[3]. Larson, Roland E., <i>Finite Mathematics with Calculus</i>, USA, 1991.</p> <p>[4]. Gilbert, Gary G. <i>Applied finite mathematics</i>. USA, 1984.</p> <p>[5]. R. Berzan, Mathematics, II. Functions of several variables, Chişinău, 2007.</p> <p>[6]. https://www.youtube.com/watch?v=a20OW3hl1ow</p> <p>[7]. https://www.youtube.com/watch?v=9Jx6SntghhE</p>
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Examination topics	<ol style="list-style-type: none"> 1. Functions of several variables. Level curves and surfaces. Examples. 2. Limit of a function at a point. Continuity of a function at a point. Examples. 3. Partial derivatives and differentials. Examples. 4. Partial derivatives of an implicit function. Examples. 5. Directional derivative. Gradient. Examples. 6. Partial derivatives of higher order. Examples. 7. Extrema of the function of two variables. Necessary condition, sufficient
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	<p>condition of extremum. Examples.</p> <ol style="list-style-type: none"> 8. Conditional extrema. Lagrange multipliers method. Method of the least squares. Example 9. First order differential equations. General, particular solution. Cauchy theorem. Examples. 10. Differential equations with separable variables. Examples. 11. First order differential equations. General, particular solution. Cauchy theorem. Examples. 12. Second order differential equations. General, particular solution. Cauchy theorem. Examples. 13. Second order differential equations, reducible to the first order differential equations. Examples. 14. Second order linear differential equations (homogeneous, nonhomogeneous). General solution. 15. Systems of linear equations (consistent, determinate, equivalent). Elementary transformations. Examples. 16. Gauss-Jordan elimination method. Gauss table. Example. 17. Positive basic solutions to the system of linear equations. Example. 18. Examples of LP – models. Economic examples conducting to LP. 19. LP – problem. Feasible, optimal solution. Equivalent forms of LP – problem. Examples. 20. LP – problem. Graphical method. Examples. 21. Simplex method (initial solution). Examples. 22. Simplex method (optimal solution). Example. 23. Dual problem. Basic theorems. Examples. 24. Dual pair. Determining the optimal solutions. Example. 25. Transportation problem. Determining the initial solution. Examples. 26. Potential method. Example. 27. Events and operations on them. Classic, empiric and subjective probabilities. 28. Dependent and independent events. Conditional probability. Addition rule and multiplication rule. 29. Formula of total probability. Bayes' formulas. 30. Discrete and continuous random variables. Distribution function. Probability density function. 31. Discrete probability distributions: binomial, geometric and Poisson.. 32. Continuous probability distributions: uniform, normal. Rule of $3 - \sigma$.
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Teaching technologies	<ul style="list-style-type: none"> • <i>main form of organization: in group, individual;</i> • <i>teaching-evolution-methods: exposing, resolving examples, control tests;</i> • <i>didactic means: tables, computer.</i>
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The way of the final evaluation	<i>Written exam on theory and resolving problems.</i>
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Final grade (percentage expressed in %)	Two tests during the semester	30%
	Current success (formative assessment)	20%
	Individual study	10%
	The result exam / verification (final evaluation)	40%

Timpul total (ore pe semestru) al activităților de studiu individual pretinse studentului

1. Descifrarea și studiul notițelor de curs	10	8. Pregătire prezentări orale	2
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2. Studiu după manual, suport de curs	10	9. Pregătire examinare finală	10
3. Studiul bibliografiei minimale indicate	10	10. Consultații	2
4. Documentare suplimentară în bibliotecă	10	11. Documentare pe teren	0
5. Activitate specifică de pregătire seminar și/sau laborator	20	12. Documentare pe INTERNET	5
6. Realizare teme, referate, eseuri, traduceri etc.	5	13. Alte activități	
7. Pregătire teste, lucrări de control	8	14. Alte activități	
TOTAL ore studiu individual (pe semestru) = 90			

Signature teachers: _____ Rodica Berzan

Signature Head of Chair _____

Date: 28.08.2018