SYLLABUS
Mathematics Applied to Economics

1. Information on academic programme

1.1. University	**"1 Decembrie 1918" University of Alba Iulia**
1.2. Faculty	**Faculty of Economics**
1.3. Departament	**Business Administration and Marketing**
1.4. Field of Study	**Business Administration**
1.5. Cycle of Study	**Undergraduate**
1.6. Academic programme / Qualification	**Business Administration/** 242102 Process improvement specialist, 242104 Process manager, 242110 Economic performance planning, control and reporting specialist

2. Information of Course Matter

2.1. **Course**		**Mathematics Applied to Economics**			2.2. **Code**		**BA112**
2.3. **Course Leader/** Seminar Tutor			Dorin Wainberg				
2.4. Seminar Tutor			Dorin Wainberg				
2.5. Academic Year	**I**	2.6. Semester	**I**	2.7. Type of Evaluation (E – final exam/C-examination /VP)	**E**	2.8. Type of course (**C**– Compulsory, **Op** – optional, **F -** Facultative)	**C**

3. Course Structure (Weekly number of hours)

3.1. Weekly number of hours	**4**	3.2. course	**2**	3.3. seminar, laboratory	**2**
3.4. Total number of hours in the curriculum	**56**	3.5. course	**28**	3.6. seminar, laboratory	**28**

Allocation of time:	hours
Individual study of readers	35
Documentation (library)	20
Home assignments, Essays, Portfolios	35
Tutorials	-
Assessment (examinations)	4
Other activities…….	-

3.7 Total number of hours for individual study	**94**
3.9 Total number of hours per semester	**150**
3.10 Number of credits	**6**

4. Prerequisites (*where applicable*)

4.1. about curriculum	-
4.2. about competences	-

5. **Requisites** (*where applicable*)

5.1. course-related	Classroom with video projector / board
5.2. seminar/laboratory-based	Classroom with whiteboard

6. **Specific competences to be aquired (chosen by the course leader from the programme general competences grid)**

Professional competences	C1. Adequate use of the concepts, theories, methods and instruments of financial type in public and private entities/organisations C2. Data collecting, analysis and interpretation, and items of information about economic and financial problems C3. Budget planning and implementation at the level of public and private entities/ organisations
Transversal competences	

7. **Course objectives** (as per the programme specific competences grid)

7.1 General objectives of the course	*On the one hand, the aim of the discipline is to provide students with the capacity to anayse and decide in a logical and rigorous mode, and on the other hand, to contribute to the future economists'multidisciplinary trainig. This is the reason why the course content aims to the students' familiarization with the concepts and mathematical modelling technique applied to the economic phenomena, the business plan placement in mathematical context and its solving with mathematical programming methods, the formulation of mathematical models for deferred payments and credits, as well as loan reimbursement, and the optimization of certain financial operations*
7.2 Specific objectives of the course	• *To characterise the concept of mathematical model for an economic process;* • *To distinguish between various types of models (physical, abstract, deterministic, stochastic, linear, non-linear models, etc);* • *To know the main stages in drawing up of a mathematical model (the analysis of economic problem, formalization of the realtions between the elements of a problem, model building, model solving, i.e. solution establishment, analysis, interpretation, validation and implementation);* • *To determine the algoritm for dual problem elaboration;* • *To identify the method (methods) for solving PPLs (simplex method, transport method,...);* • *To distinguish between algorithms for PPL solving;* • *To describe the algorithms for PPL solving in postoptimization situations (free term changes in restrictions – changes in the quantity of the available resources, changes in the coefficients of the objective function – price and unitary profit changes, modification of the technological coefficients, etc.);* • *To characterise the algorithm for PPL solving in whole numbers;* • *To determine the special cases of the transport problems* • *To recognize and use mathematical models associated with the following types of operations:* - *simple and compound interest; valorification and updating;*

	- *simple interest paid in advance;* - *loan amortization; annuities.*

8. Course contents

8.1 Course	**Teaching methods**	**Observations**
Solving linear programming problems *Algebraic and geometrical method*	*Lecture, presentation, discussions*	*2 hours*
Simplex algorithm *Particular cases: the infinite case, the degenerate case, multiple solution case*	*Lecture, presentation, discussions*	*2 hours*
Duality. Dual simplex *Couple of dual problems - symmetrical form*	*Lecture, presentation, discussions*	*2 hours*
Re-optimization of linear programming problems *Changes in vector c, column vector from matrix A, free term vectors*	*Lecture, presentation, discussions*	*2 hours*
Parametric linear programming *Linear dependency of a vector C parameter, and free term vector*	*Lecture, presentation, discussions*	*2 hours*
Transport problems *Particular cases: degenerate solution, multiple solution case*	*Lecture, presentation, discussions*	*2 hours*
Transport problem re-optimization *Modification of: the coefficient matrix, what is available and/or what is needed*	*Lecture, presentation, discussions*	*2 hours*
Parametric transport problems. *Linear vector dependency: of the coefficient matrix, what is available and/or what is needed*	*Lecture, presentation, discussions*	*2 hours*
Special transport problems *Problems with: imposed solution, restricted routes, grouped offer or demand*	*Lecture, presentation, discussions*	*2 hours*
Simple interest *Unitary interest, fructification, updating factor, medium values*	*Lecture, presentation, discussions*	*2 hours*
Compound interest *Gobal fructification/updating factor, initial/final sum*	*Lecture, presentation, discussions*	*2 hours*
Annual deferred payment (annuities) *Anticipated or posticipated payment*	*Lecture, presentation, discussions*	*2 hours*
Credit and loan reimbursement *Equivalent loan systems*	*Lecture, presentation, discussions*	*2 hours*
Direct and indirect amortizations	*Lecture,*	*2 hours*

	presentation, discussions	

8.2 Bibliography

[1] J. Franklin, *Mathematical Methods of Economics: Linear and Nonlinear Programming, Fixed-Point Theorem*, Springer-Verlag, New York, 1980.
[2] G. B. Dantzig, *Linear Programming and Extensions*, Princeton University Press, 1963
[3] David Gale, *The Theory of Linear Economic Models*, McGraw-Hill, 1960.
[4] Samuel Karlin, *Mathematical Methods and Theory in Games, Programming and Economics*, vol. 1, Addison-Wesley, 1959.
[5] James K. Strayer, *Linear Programming and Applications*, Springer-Verlag, 1989.
[6.] F. S. Hillier and G. J. Lieberman.. *Introduction to Operations Research,* 6th ed. New York: McGraw-Hill,1995.
[7] Ernest Haeussler, Jr. and Richard S. Paul, *Introductory Mathematical Analysis for Students of Business and Economics*, Reston Publishing Company, Inc., Reston, VA, 1983.
[8] John McCutcheon and William F. Scott, *An Introduction to the Mathematics of Finance*, Elsevier Butterworth-Heinemann, 1986.
[9] Petr Zima and Robert L. Brown, *Mathematics of Finance*, 2nd ed., Schaum's Outline Series, McGraw-Hill, 1996.
[10] Vasek Chvatal, *Linear Programming*, W. H. Freeman & Co., 1983.
[11] Dorin Wainberg, *Mathematics applied in Economics*, Seria Didactica, Univ. "1 Decembrie 1918" Alba Iulia, 2012.

Seminar-lab		
Solving linear programming problems *Algebraic and geometrical method*	*Presentation, analysis, discussions*	*2 hours*
Simplex algorithm *Particular cases: the infinite case, the degenerate case, multiple solution case*	*Presentation, analysis, discussions*	*2 hours*
Duality. Dual simplex *Couple of dual problems - symmetrical form*	*Presentation, analysis, discussions*	*2 hours*
Re-optimization of linear programming problems *Changes in vector c, column vector from matrix A, free term vectors*	*Presentation, analysis, discussions*	*2 hours*
Parametric linear programming *Linear dependency of a vector C parameter, and free term vector*	*Presentation, analysis, discussions*	*2 hours*
Transport problems *Particular cases: degenerate solution, multiple solution case*	*Presentation, analysis, discussions*	*2 hours*
Transport problem re-optimization *Modification of: the coefficient matrix, what is available and/or what is needed*	*Presentation, analysis, discussions*	*2 hours*
Parametric transport problems. *Linear vector dependency: of the coefficient matrix, what is available and/or what is needed*	*Presentation, analysis, discussions*	*2 hours*
Special transport problems *Problems with: imposed solution, restricted routes, grouped offer or demand*	*Presentation, analysis, discussions*	*2 hours*
Simple interest *Unitary interest, fructification, updating factor, medium values*	*Presentation, analysis, discussions*	*2 hours*
Compound interest *Gobal fructification/updating factor, initial/final sum*	*Presentation, analysis,*	*2 hours*

	discussions	
Annual deferred payment (annuities) *Anticipated or posticipated payment*	*Presentation, analysis, discussions*	*2 hours*
Credit and loan reimbursement *Equivalent loan systems*	*Presentation, analysis, discussions*	*2 hours*
Direct and indirect amortizations	*Presentation, analysis, discussions*	*2 hours*

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[4] Samuel Karlin, *Mathematical Methods and Theory in Games, Programming and Economics*, vol. 1, Addison-Wesley, 1959.
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[6.] F. S. Hillier and G. J. Lieberman.. *Introduction to Operations Research,* 6th ed. New York: McGraw-Hill,1995.
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9. Corroboration of course contents with the expectations of the epistemic community's significant representatives, professional associations and employers in the field of the academic programme

The content of the discipline was analyzed in the monitoring and evaluation commission of the study program. Representatives of the employers and professional associations in the field are included in the commission.

- *Elaboration of a project / work of a financial nature*
- *Writing and supporting a case study on an economic-financial problem*
- *Designing a draft for the execution of a plan or budget*

10. Assessment

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight of the final grade
10.4 Course	*Final assessment*	*Written exam*	50%
	-	-	-
10.5 Seminar	*Eg. Verification during the semester*	*Writen test* *Portfolio with practical works*	30% 20%
	-		-
10.6Minimum performance standard: Obtaining minimum 5 (five).			
The evaluation test during the course requires the solution of an economic problem using the simplex algorithm. The minimum standard involves knowing the steps of the algorithm and placing the problem data in the simplex table. *The seminar note has a passive participation component and an active participation component.*			

The written exam contains:

2 optimization problems that are solved with the simplex algorithm and the distributive algorithm, one of them also having a re-optimization component. The minimum standard involves knowing the steps of the algorithm and placing the problem data in the simplex table, respectively in the Tucker diagram.

2 proposals for financial mathematics. The minimum standard implies the correct use of simple and compound interest formulas.

Fill in date
04.09.2019

Course titular's signature,

PhD Lect. Dorin Wainberg

Seminar titular's signature,

PhD Lect. Dorin Wainberg

Approval date in departament
5.09.2019

Department director's signature,
PhD Assoc.Prof. Gavrila-Paven Ionela