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| O imagine care conține siglă, simbol, Font, Grafică  Descriere generată automat | MINISTERUL EDUCAŢIEI **UNIVERSITATEA „AUREL VLAICU“ DIN ARAD**310130 Arad, B-dul Revolutiei nr. 77, P.O. BOX 2/158 AR *Tel.: 0040-257- 283010; fax. 0040-257- 280070*  [http://www.uav.ro](http://www.uav-arad.go.ro)*;* e-mail: rectorat@uav.ro |

**Operator de date cu caracter personal nr. 2929**

**SYLLABUS**

1. **Study programme**

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| 1.1. Higher education institution | **„Aurel Vlaicu” University of Arad** |
| 1.2. Faculty | **of Exact Sciences** |
| 1.3. Department | **Department of Mathematics and Computer Science** |
| 1.4. Field of study | **Mathematics** |
| 1.5. Study level | **2024-2025** |
| 1.6. Ciclul de studii | **Bachelor** |
| 1.7. Study programme / Qualification | **Mathematics and Computer Science** |
| 1.8. Form of education | **Full – Time study** |

1. **Course details**

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| 2.1. Name of the course | **GlCC5A10 Operations Research** |
| 2.2. Course coordinator | **Dr. Popa Lorena Camelia** |
| 2.3. Seminar/laboratory/project coordinator | **Dr. Popa Lorena camelia** |
| 2.4. Study year | **3** |
| 2.5. Semester | **1** |
| 2.6. Evaluation type | **Es** |
| 2.7. Course type | **Ob** |

1. **Estimated total time (hours per semester)**

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| 3.1. Hours per week | **4** |
| 3.2. Lecture hours per week | **2** |
| 3.3. Seminar/laboratory/project hours per week | **2** |
| 3.4. Total hours per curriculum | **56** |
| 3.5. Lecture hours per semester | **28** |
| 3.6. Seminar/laboratory/project hours per semester | **28** |
| Time division [hrs] | |
| 3.4.1. Independent study from textbooks, course support, bibliography and notes | **25** |
| 3.4.2. Additional reading (libraries, specialized electronic platforms and field research) | **20** |
| 3.4.3. Preparing of seminars/laboratories/projects, homework, papers, portfolios and essays | **15** |
| 3.4.4. Tutorial coaching | **5** |
| 3.4.5. Examinations | **4** |
| 3.4.6. Other activities | **0** |
| 3.7. Total individual study hours | **69** |
| 3.8. Total hours per semester | **125** |
| 3.9. Number of ECTS credits | **5** |

1. **Prerequisites** (if applicable)

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| 4.1. Curriculum related | Mathematical Analysis on R, Linear Algebra |
| 4.2. Competence related | Calculation of derivatives and integrals for functions of one variable.  Algebraic and graphical solution of linear systems of equations and inequalities. |

1. **Conditions** (if applicable)

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| 5.1. for the lecture | Classroom equipped with laptop, video projector and appropriate software Power Point, Excel, Mathcad, Internet access-accounts in the SUMS platform |
| 5.2. for the seminar | Classroom equipped with laptop, video projector and appropriate software Power Point, Excel, Mathcad, Internet access-accounts in the SUMS platform |
| 5.3. for the laboratory |  |
| 5.4. for the project |  |

1. **Specific educational objectives (competences to be acquired)**

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| 6.1. Competenţe profesionale | **C1.** Working with mathematical concepts and methods.  **C2.** Mathematical processing of data, analysis of phenomena and processes.  **C4.** Conceiving models for describing phenomena. |
| 6.2. Competenţe transversale | **CT1.** Applying the rules of organized and efficient work, of responsibie attitudes towards teaching-scientific field, to value the own creative potential, while respecting the principles and norms of professional ethics.  **CT2.** Efficient conduct of team activities.  **CT3.** Efficient use of information, communication resources and assisted education both in Roumanian and in an internationally widespread language. |

1. **Course outcomes (resulting from the specific educational objectives to be acquired)**

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| 7.1. General outcomes | **-The student should know the basic notions of operational research and understand the modeling of the most important standard problems**  **- The student should be able to mathematically model some practical optimization problems.**  **-** **The student should be able to apply optimization algorithms in practical problems.** |
| 7.2. Specific outcomes | **-The student is able to demonstrate that he understood concepts and procedures of linear programming, with one or more objective functions and dynamic programming. The student is able to apply the simplex algorithm, the method of potentials, reduction methods to a single synthesis function and the classical extremum theorems from mathematical analysis to determine the optimal points in the case of some classes of optimization problems.**  **-The student is able to correctly apply the basic methods and principles in solving linear programming problems.**  **The student is able to recognize the main classes/types of linear programming problems and select the appropriate methods and techniques for solving them.**  **- The student is able to mathematically model some concrete problems.** |

1. **Outline** (if applicable)

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| 8.1 Lecture Outline | Teaching methods | Remarks |
| Chapter 1. Introduction to the field of operational research 1.1. 10 hours problems. exposition, problematization, mathematical modeling, solving of problems with practical content Participatory lecture, debate, 4 hours Examples of operational research problems. 1.2. Gauss-Jordan elimination method, Jordan step. 1.3. Applications: calculating the rank of a matrix, inverting a quadratic matrix, discussing and solving systems of linear and homogeneous equations, discussing and solving systems of linear equations | Participatory lecture, debate, interactive exposition, documentation on the web, exemplification, problematization | Chapter 1 - 4 hours |
| Chapter 2 Linear programming 2.1. Examples of math programming problems. 2.2. Classification of mathematical programming problems. 2.3. The linear programming problem. Geometric interpretation of the linear programming problem. 2.4. The simplex method for the linear programming problem with inequality constraints. 2.5. The simplex method for the linear programming problem with equality constraints. 2.6. The simplex method for the linear programming problem with mixed constraints. 2.7. Degeneracy in linear programming. 2.8. Cycling in linear programming. 2.9. The simplex method for the linear programming problem where the constraint coefficients are intervals. | Participatory lecture, debate, interactive exposition, documentation on the web, exemplification, problematization | Chapter 2 - 10 hours |
| Chapter 3 3. The problem of transport 3.1. The general transport problem: mathematical formulation, examples. 3.2. The open model of the transportation problem. 3.3. The method of potentials. The maximum problem. 3.4. Degeneracy in the transportation  problem. | Participatory lecture, debate, interactive exposition, documentation on the web, exemplification, problematization | Chapter 3 - 6 hours |
| 4. The assignment problem 4.1. The simple problem of attribution, history, examples. 4.2. The generalized assignment problem: mathematical formulation, examples. 4.3. Existence and optimality theorems 4.4. The Hungarian algorithm 4.5. Solving human resources allocation problems. | Participatory lecture, debate, interactive exposition, documentation on the web, exemplification, problematization | Chapter 4 - 4 hours |
| 5. Optimization according to several criteria 5.1. General formulation of the vector optimization problem. Examples. 5.2. Global optimal solution, noptimal optimal solution of an n-balanced vector minimization problem, equilibrium point, equilibrium set. | Participatory lecture, debate, interactive exposition, documentation on the web, exemplification, problematization | Chapter 5 - 4 hours |
| 8.2 Lecture References  **1. Popa, L., Cercetări operaționale, 2024, Universitatea Aurel Vlaicu, Platforma UAV online: https://core.uav.ro**  **2. Blaga, L., Lupşa, L., Elemente de programare liniară, Ed. Risoprint, Cluj-Napoca, 2003.**  **3. N. Mihăilă, Introducerea în programarea liniară, Ed. Didactică și pedagogică, București, 1970.**  **4. Gh. Ciobanu, Eugen Ţigănescu, Cercetări Operaţionale cu aplicaţii în economie. Optimizări liniare, Editura ASE,Bucureşti, 2002.**  **5. Margaret L. Lial, Raymond N. Greenwell, Nathan P. Ritchey, Finite Mathematics and Calculus with Applications,Editura Pearson, S.U.A, 2013** | | |
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| 8.3 Seminar Outline | Teaching methods | Remarks |
| 1. Introduction to the field of operational research | The exercise, the discussions and the debate, the modeling, the project | 2 hours |
| 2. Linear programming | The exercise, the discussions and the debate, the modeling, the project | 6 hours |
| 3. The problem of transport | The exercise, the discussions and the debate, the modeling, the project | 2 hours |
| 4. The problem of attribution | The exercise, the discussions and the debate, the modeling, the project | 2 hours |
| 5. Optimization according to several criteria | The exercise, the discussions and the debate, the modeling, the project | 2 hours |
| 8.4 Seminar References  **1. Popa, L., Cercetări operaționale, 2024, Universitatea Aurel Vlaicu, Platforma UAV online: https://core.uav.ro**  **2. Blaga, L., Lupşa, L., Elemente de programare liniară, Ed. Risoprint, Cluj-Napoca, 2003.**  **3. Margaret L. Lial, Raymond N. Greenwell, Nathan P. Ritchey, Finite Mathematics and Calculus with Applications,Editura Pearson, S.U.A, 2013** | | |
| 8.5 Laboratory Outline | Teaching methods | Remarks |
| 8.6 Laboratory References | | |
| 8.7 Project Outline | Teaching methods | Remarks |
| 8.8 Project Outline | | |

1. Correlation of course outline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

The content of the discipline is consistent with what is done in other university centers in the country and abroad. In order to better adapt the content of the discipline to the demands of the labor market, meetings were held both with representatives of the business environment and with teaching staff from the Faculty of Economic Sciences and the Faculty of Engineering of our university.

1. **Evaluation / Grading** (if applicable)

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| Activity type | Evaluation criteria | Evaluation methods | Percentage of the final grade |
| 10.1. Lecture | - correctness and completeness of knowledge;  - logical coherence;  - degree of assimilation of specialized language;  - criteria aimed at attitudinal aspects: conscientiousness, interest in individual study. | Final evaluation: 30% Active participation in the courses. 10%. | 40% |
| 10.3.  Laboratory | - the ability to operate with assimilated knowledge;  - the ability to apply in practice;  - criteria aimed at attitudinal aspects: conscientiousness, interest in individual study.. | Current works: assignments, projects. 30% Final evaluation 20% Active participation in seminars. 10% | 60% |
| 10.3.  Laboratory |  |  |  |
| 10.4. Project |  |  |  |
| 10.5 Minimal performance standard  **Knowing the fundamental elements of theory, solving a simple application.** | | | |
| |  |  |  |  | | --- | --- | --- | --- | | Course coordinator | Seminar/laboratory/project coordinator | Head of the Department | Dean | | Lect.univ.dr. Lorena Camelia POPA | Lect.univ.dr. Lorena Camelia POPA | Lect.univ.dr. Lorena Camelia POPA | Prof.univ.dr. Sorin-Florin NĂDĂBAN | | | | |