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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 | **GlCF2O08 Algebra 2 (Linear Algebra)** |
| 2.2. Course coordinator | **Dr. Stoica Codruța Simona** |
| 2.3. Seminar/laboratory/project coordinator | **Dr. Popa Lorena Camelia** |
| 2.4. Study year | **1** |
| 2.5. Semester | **2** |
| 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 | **30** |
| 3.4.2. Additional reading (libraries, specialized electronic platforms and field research) | **30** |
| 3.4.3. Preparing of seminars/laboratories/projects, homework, papers, portfolios and essays | **25** |
| 3.4.4. Tutorial coaching | **5** |
| 3.4.5. Examinations | **4** |
| 3.4.6. Other activities | **0** |
| 3.7. Total individual study hours | **94** |
| 3.8. Total hours per semester | **150** |
| 3.9. Number of ECTS credits | **6** |

1. **Prerequisites** (if applicable)

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| 4.1. Curriculum related | Basic notions of algebra: algebraic structures, matrices, determinants, systems of linear equations. |
| 4.2. Competence related |  |

1. **Conditions** (if applicable)

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| 5.1. for the lecture |  |
| 5.2. for the seminar |  |
| 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. Develops problem-solving strategies  C2. Performs analytical mathematical calculations  C3. Synthesizes information  C4. Thinks abstractly  C5. Communicates mathematical information  C6. Applies scientific methods  C9. Manages personal professional development  C10. Carries out research activities at an interdisciplinary level |
| 6.2. Competenţe transversale | TC1. Shows initiative  TC2. Give advice to others  TC3. Takes responsibility  TC4. Works in teams |

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 and understand the important theorems of linear algebra.**  **- The student should develop his skills to correctly apply the accumulated knowledge to solve different types of problems.**  **- The student must train and develop his ability to think and analyze linear algebra problems.** |
| 7.2. Specific outcomes | **The student is able to demonstrate that he has acquired sufficient knowledge to understand the notions of: linear space, basis and dimension of a linear space, linear applications, etc.**  **- The student is able to correctly apply the basic methods and principles in solving linear algebra problems.**  **- The student is able to recognize the main classes/types of linear algebra problems and select the appropriate methods and techniques for solving them.** |

1. **Outline** (if applicable)

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| 8.1 Lecture Outline | Teaching methods | Remarks |
| 1. Matrices. Determinants 1.1. Array operations. Properties 1.2. Calculation of determinants 1.3. Calculation of the rank of a matrix 1.4. Invertible matrices. Calculation of the one-matrix inverse 2. Systems of linear equations 2.1. Compatibility of systems of linear equations 2.2. Methods of solving systems of linear equations (Cramer, pivot, Gauss) 3. Linear spaces 3.1. Definition. Examples of outstanding linear spaces3.2. Calculation rules in linear spaces 4. Linear dependence of vectors. Bases. Size 4.1. The linear combination of a system of vectors 4.2. System of independent (dependent) linear vectors 4.3. Generating vector system4.4. Basis of a linear space. Examples. 4.5. The dimension of linear space. 4.6. Canonical bases of remarkable linear spaces. 4.7. Changes of bases and coordinates 5. Linear subspaces 5.1. Definition of linear subspace. Examples5.2. Properties of linear subspaces 5.3. Subspace sums. Direct sums 6. Linear applications 6.1. Definition of linear applications between linear spaces. Examples 6.2. The core and image of a linear application 6.3. The matrix expression of a linear application 7. Linear operators 7.1. Definition of a linear operator. Examples. 7.2. Analytic and matrix expression of a linear operator 7.3. Vectors and eigenvalues 7.4. The diagonal form of a linear operator 8. Linear shapes. 8.1. Definition of linear forms. Examples 8.2. Analytical and matrix expression of a linear form 8.3. Dual linear space 9. Bilinear forms. Quadratic forms 9.1. Definition of bilinear forms. Examples 9.2. Analytical and matrix expression of the bilinear form 9.3. Definition of quadratic forms. Examples 9.4. Analytic and matrix expression of a quadratic form 9.5. Bringing the quadratic forms to the canonical form (Gauss, Jacobi, eigenvalue method) 10. Euclidean linear spaces 10.1. Scalar product. Norm. Distance 10.2. Cauchy's inequality 10.3. Rn as a linear Euclidean space 11. Orthogonality. Orthonormal bases 11.1. The Gramm-Schmidt orthogonalization procedure 11.2. The orthogonal complement of a linear subspace | Participatory lecture, interactive exposition, problematization, demonstration, algorithmization, exemplification. | Chapter 1 - 2 hours Chapter 2 - 2 hours Chapter 3 - 2 hours Chapter 4 - 4 hours Chapter 5 - 2 hours Chapter 6 - 2 hours Chapter 7 - 4 hours Chapter 8 - 2 hours Chapter 9 - 4 hours Chapter 10 - 2 hours Chapter 11 - 2 hours |
| 8.2 Lecture References  **1. Suport de curs și seminar - platforma SUMS 2024**  **2. Moț G., Popa L., Algebră liniară, geometrie analitică și geometrie diferențială, Editura Universității“AurelVlaicu”, 2015.**  **3. Moț G., Popa L., Algebră superioară pentru profilurile tehnic și economic, Editura Universității “AurelVlaicu”,2010.**  **4. Moț, G., Popa, L. Algebră liniară. Culegere de probleme, Ed. Mirton, Timișoara, 1999.**  **5. C. Udrişte, O. Dogaru, Algebră liniară, Geometrie Analitică, Universitatea Politehnică din Bucureşti, 1991.**  **6. Poole D, Linear Algebra - A Modern Introduction (4th edition), Cengage Learning, USA, 2015.** | | |

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| 8.3 Seminar Outline | Teaching methods | Remarks |
| 1. Matrices. Determinants. 2. Solving the systems of linear equations. 3. Linear spaces 4. Linear dependence of vectors. Base. Dimension 5. Linear subspaces 6. Linear applications 7. Linear operators. 8. Linear shapes. 9. Bilinear forms. Quadratic shapes 10. Euclidean linear spaces 11. Orthogonality. Orthonormal bases. | Exercise method, conversation, problem solving, independent learning and through cooperation. | 2 hours 2 hours 2 hours 4 hours 2 hours 2 hours4 hours 2 hours 4 hours 2 hours 2 hours |
| 8.4 Seminar References  **1. Course and seminar support - SUMS 2024 platform**  **2. Moț G., Popa L., Linear algebra, analytic geometry and differential geometry, "Aurel Vlaicu" University Press, 2015.**  **3. Moț G., Popa L ., Higher algebra for technical and economic profiles, "Aurel Vlaicu" University Publishing House, 2010.**  **4. Moț, G., Popa, L. Linear algebra. Collection of problems, Ed. Mirton, Timisoara, 1999.**  **5. Poole D, Linear Algebra - A Modern Introduction (4th edition), Cengage Learning, USA, 2015.** | | |
| 8.5 Laboratory Outline | Teaching methods | Remarks |
| 8.6 Laboratory Outline | | |
| 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 subject to the demands of the labor market, meetings were held both with representatives of the business environment and with mathematics and computer science teachers from the pre-university education of Arad.

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.  - correctness and completeness of knowledge;  - logical coherence; - degree of assimilation of specialized language;  - criteria aimed at attitudinal aspects: conscientiousness, interest in individual study. | Written assessment (final in the exam session)  Written assessment (during the semester): partial exam  Active participation in classes. | 10%  10%  10% |
| 10.2.  Seminar | **- correctness and completeness of knowledge;**  **- logical coherence;**  **- degree of assimilation of specialized language;**  **- criteria aimed at attitudinal aspects: conscientiousness, interest in individual study.** | Written assessment (final in the exam session)  Written assessment (during the semester): partial exam  Active participation in seminars | 30%  30%  10% |
| 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 | | Prof.univ.dr. Codruța Simona Stoica | Lect.univ.dr. Lorena Camelia POPA | Lect.univ.dr. Lorena Camelia POPA | Prof.univ.dr. Sorin-Florin NĂDĂBAN | | | | |