

**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 informatics** |
| 1.8. Form of education | **Full – Time study** |

1. **Course details**

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| 2.1. Name of the course | **Mathematical logic and set theory** |
| 2.2. Course coordinator | **Sida Lavinia Elisabeta** |
| 2.3. Seminar/laboratory/project coordinator | **Sida Lavinia Elisabeta** |
| 2.4. Study year | **1** |
| 2.5. Semester | **1** |
| 2.6. Evaluation type | **summative** |
| 2.7. Course type | **compulsory** |

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) | **25** |
| 3.4.3. Preparing of seminars/laboratories/projects, homework, papers, portfolios and essays | **7** |
| 3.4.4. Tutorial coaching | **3** |
| 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 | Basic knowledge of mathematics according to the high school curriculum. |
| 4.2. Competence related | Operation with mathematical concepts and methods. |

1. **Conditions** (if applicable)

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| 5.1. for the lecture | Internet access  The classroom is equipped with a blackboard  Computer/Laptop and Video projector |
| 5.2. for the seminar | Internet access  Specific equipment and apparatus  Blackboard |
| 5.3. for the laboratory |  |
| 5.4. for the project |  |

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

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| 6.1. Professional skills | C1. Develops problem-solving strategies  C2. Performs analytical mathematical calculations  C3. Synthesizes information  C4. Thinks abstractly  C5. Communicates mathematical information  C6. Applies scientific methods  C13. Teach mathematics  C15. Use mathematical and computer tools |
| 6.2. Transversal skills | TC3. Takes responsibility  TC4. Works in teams  TC5. Shows confidence  TC6. Builds team spirit  TC7. Plans |

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 formal language and basic reasoning of mathematical logic, as well as the fundamental notions of number theory.  - The student should develop the ability to operate with discipline-specific deductive reasoning.  - The student should use the theoretical notions learned in concrete applications.  - The student must form and develop logical and rigorous thinking. |
| 7.2. Specific outcomes | - The student is able to demonstrate that he has acquired sufficient knowledge for: the correct use of logical quantifiers, the correct interpretation of a logic circuit, carefully deductive operation, determining the c.m.m.d.c, c.m.c.c of two integers, solving Diophantine equations, the correct use of the absolute error and the error relative to a number.  - The student can create projects for the mathematical modeling of a specific problem. |

1. **Outline** (if applicable)

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| 8.1 Lecture Outline | Teaching methods | Remarks |
| 1. Boolean algebras  1.1 Definition and examples.  1.2 Properties of Boolean algebra  2. Calculus of sentences  2.1 The language of propositional calculus  2.2 The semantic approach to sentence calculus  2.3 Canonical forms for logical expressions from the calculus of sentences  2.4 The principles of mathematical logic  3. Calculation of predicates  3.1 The language of the calculation of predicates  3.2 The semantic approach to the calculation of predicates  3.3 Operations with predicates  3.4 Predicative formulas  3.5 Deductibility  4. Boolean functions  4.1 Boolean functions  4.2 Normal forms of Boolean functions  4.3 Simplifying Boolean functions  4.4 Physical realization of Boolean functions  4.5 Contact schemes  4.6 Delucre function of a dipole with contacts  5. Crowds  5.1 Definition and examples  5.2 Operations with sets  5.3 Axioms of set theory  6. Binary relationships  6.1 Definition of relations. Properties  6.2 Partition of a set  6.3 Order relations. Equivalence relations.  6.4 Functional relationships  7. Cardinal numbers  7.1 Cardinal numbers  8. Crowds of numbers | • Interactive exposure  • The debate  • Problematization  • The lecture |  |
| 8.2 Lecture References  **1. Eduard Halic, Logică şi teoria numerelor, Editura Universităţii “Aurel Vlaicu”, Arad, 2006.**  **2. Ioan Dziţac, Logică computaţională: Material de studiu pentru învăţământ la distanţă, 2011.**  **3. M. Reghiş, Elemente de teoria mulțimilor şi de logică matematică, Ed. Facla, Timişoara, 1981.**  **4. C. Popa, V. Hiriş, M. Megan, Introducere în analiza matematică prin exerciţii şi probleme,**  **5. http://www.math.uaic.ro/~volf/depozit/LTM.pdf**  **6. D. Rimer, Noţiuni de teoria mulţimilor, Editura Didactică şi Pedagogică, Bucureşti, 1968.**  **7. C. Năstăsescu, Introducere în teoria mulţimilor, Editura Didactică şi Pedagogică, Bucureşti, 1974.**  **8. http://ro.scribd.com/doc/47640200/Eduard-Halic-Logica-si-Teoria-Numerelor**  **9. Suport de curs, SUMS, 2024**  **10. Andrei Mărcuș, Introducere în Logica matematică și teoria mulțimilor, Editura Casa Cărții de Știință, 2019**  **11. Avigad, J., Mathematical Logic and Computation, Cambridge University Press, 2022.** | | |

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| 8.3 Seminar Outline | Teaching methods | Remarks |
| 1. Boolean algebras  1.1 Definition and examples.  1.2 Properties of Boolean algebra  2. Calculus of sentences  2.1 The language of propositional calculus  2.2 The semantic approach to sentence calculus  2.3 Canonical forms for logical expressions from the calculus of sentences  2.4 The principles of mathematical logic  3. Calculation of predicates  3.1 The language of the calculation of predicates  3.2 The semantic approach to the calculation of predicates  3.3 Operations with predicates  3.4 Predicative formulas  3.5 Deductibility  4. Boolean functions  4.1 Boolean functions  4.2 Normal forms of Boolean functions  4.3 Simplifying Boolean functions  4.4 Physical realization of Boolean functions  4.5 Contact schemes  4.6 Delucre function of a dipole with contacts  5. Crowds  5.1 Definition and examples  5.2 Operations with sets  5.3 Axioms of set theory  6. Binary relationships  6.1 Definition of relations. Properties  6.2 Partition of a set  6.3 Order relations. Equivalence relations.  6.4 Functional relationships  7. Cardinal numbers  7.1 Cardinal numbers  8. Crowds of numbers | • Interactive exposure  • The debate  • Problematization |  |
| 8.4 Seminar References  **1. Eduard Halic, Logică şi teoria numerelor, Editura Universităţii “Aurel Vlaicu”, Arad, 2006.**  **2. Ioan Dziţac, Logică computaţională: Material de studiu pentru învăţământ la distanţă, 2011.**  **3. M. Reghiş, Elemente de teoria mulțimilor şi de logică matematică, Ed. Facla, Timişoara, 1981.**  **4. C. Popa, V. Hiriş, M. Megan, Introducere în analiza matematică prin exerciţii şi probleme,**  **5. http://www.math.uaic.ro/~volf/depozit/LTM.pdf**  **6. D. Rimer, Noţiuni de teoria mulţimilor, Editura Didactică şi Pedagogică, Bucureşti, 1968.**  **7. C. Năstăsescu, Introducere în teoria mulţimilor, Editura Didactică şi Pedagogică, Bucureşti, 1974.**  **8. http://ro.scribd.com/doc/47640200/Eduard-Halic-Logica-si-Teoria-Numerelor**  **9. Suport de curs, SUMS, 2024**  **10. Andrei Mărcuș, Introducere în Logica matematică și teoria mulțimilor, Editura Casa Cărții de Știință, 2019**  **11. Avigad, J., Mathematical Logic and Computation, Cambridge University Press, 2022.** | | |
| 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 discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with mathematics and computer science teachers from the Arad pre-university education.

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

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| Activity type | Evaluation criteria | Evaluation methods | Percentage of the final grade |
| 10.1. Lecture | **• completeness of knowledge;**  **• logical coherence;**  **• degree of assimilation of the specialized language;**  **• the criteria for attitudinal aspects: seriousness, interest in the topic addressed** | Written assessment (final exam session) | 80% |
| 10.2.  Seminar | **• the ability to operate with assimilated knowledge;**  **• the ability to apply in practice;**  **• criteria include attitudinal aspects: conscientiousness, interest in individual and team study** | Current written works: assignments, projects. Evaluation of the final essay (in the exam session) Active participation in the seminars. | 20% |
| 10.3.  Laboratory |  |  |  |
| 10.4. Project |  |  |  |
| 10.5 Minimal performance standard  **Knowing the fundamental elements of theory, solving some simple applications.** | | | |

Course coordinator

Sida Lavinia

Seminar/laboratory/project coordinator

Sida Lavinia

Head of the Department

Lector Popa Lorena

Dean

Prof.univ.dr. Sorin-Florin NĂDĂBAN