

**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 | **Informatics** |
| 1.5. Study level | **2024-2025** |
| 1.6. Ciclul de studii | **Bachelor** |
| 1.7. Study programme / Qualification | **Mathematics - Computer Science** |
| 1.8. Form of education | **Full – Time study** |

1. **Course details**

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| 2.1. Name of the course | **Theoretical Mechanics** |
| 2.2. Course coordinator | **Prof. Adrian Palcu** |
| 2.3. Seminar/laboratory/project coordinator | **Prof. Adrian Palcu** |
| 2.4. Study year | **3** |
| 2.5. Semester | **2** |
| 2.6. Evaluation type | **Es** |
| 2.7. Course type | **DC** |

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 | **20** |
| 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 | **30** |
| 3.4.4. Tutorial coaching | **10** |
| 3.4.5. Examinations | **4** |
| 3.4.6. Other activities | **-** |
| 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 | Mathematical Analysis, Linear Algebra |
| 4.2. Competence related | Ability to operate and calculate with simple geometrical and algebraical notions |

1. **Conditions** (if applicable)

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| 5.1. for the lecture | Blackboard, marker |
| 5.2. for the seminar | Blackboard, marker |
| 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.**  **C3 Designing and alaysing algorithms for solving different problems.**  **C4. Conceiving models for describing phenomena.** |
| 6.2. Competenţe transversale | CT1.Applying the rules of organized and efficient work, of responsible attitudes towards teaching-scientific field, to value the own creative potential, while respecting the principles and norms of professional ethics. |

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

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| 7.1. General outcomes | At the end of the course, the student sshould deal with an applied science (mehanics) in a coherent manner by using the concepts and techniques acquired from matheatical topics previously studied. |
| 7.2. Specific outcomes | The student should be able to corelate rezults and methods in Matheatical analysis, Linear algebra and Differential equations toconcrete mechanics problems.    The student should understand the connection mathematics – physics – technologies and will be able to solve specific problems in mechanics by using the three mechanical approachesȘ Newtonțs, Lagrangețs and Hamiltonțs.    The student should be able to interpret certain phenomena in mechanics and use mathematical models to solve them. |

1. **Outline** (if applicable)

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| 8.1 Lecture Outline | Teaching methods | Remarks |
| 1. **Newton’s mechanics**   (1.1 Cinematics. 1.2 Principles. 1.3 Relative movement 1.4 Inertial systems 1.5 Gravitation 1.6 Dynamics of a point 1.7 Dynamics of a system of points**)**   1. **Lagrange’s mechanics**   (2.1 Connections and deplacements. 2.2 D’Alembert principle. 2.3 General dynamical equation. 2.4 Gneralized coordinates. 2.5 Lagrange equations for holonomic systems. 2.6 Lagrange equations for non-holonomic systems.**)**   1. **Hamilton’s mechanics**   (3.1 Canonical coordinates – Hamilton’s equations. 3.2 Poisson brakets. 3.3 Hamilton’s principle. 3.4 Hamilton – Jacobi formalism) | Presentatiions, Debate  Presentatiions, Debate  Presentatiions, Debate | 12 hours  10 hours  6 hours |
| 8.2 Lecture References   * 1. L. N. Hand and J. D. Finch: Analytical Mechanics, Cambridge University Press, 1998. * 2. H. Goldstein, Ch. Poole and J. Safko: Classical Mechanics, Addison Wesley, 2000. * 3. D. Tong: Classical Dynamics Part II: Mathematical Tripos, University of Cambridge 2004. * 4. Adrian Palcu, Mecanică teoretică (2024, notițe de curs – disponibil online) | | |

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| 8.3 Seminar Outline | Teaching methods | Remarks |
| 1. Calcul vectorial 2. Tipuri de miscare a punctului material 3. Tipuri de forte (1): forta de frecare 4. Tipuri de forte (2): forta elastica 5. Tipuri de forte (3): forta de atractie gravitationala; campul gravitational 6. Fluidodinamica: legile lui Arhimede, Bernoulli, curgerea stationara 7. Oscilatii armonice ideale; oscilatii amortizate 8. Ecuatiile Lagrange. Aplicatii 9. Formalismul Hamiltonian. Aplicatii | Exercise, problems | 28 ore |
| 8.4 Seminar References   * 1. L. N. Hand and J. D. Finch: Analytical Mechanics, Cambridge University Press, 1998. * 2. H. Goldstein, Ch. Poole and J. Safko: Classical Mechanics, Addison Wesley, 2000. * 3. D. Tong: Classical Dynamics Part II: Mathematical Tripos, University of Cambridge 2004. * 4. Adrian Palcu, Mecanică teoretică (2024, notițe de curs – disponibil online). | | |
| 8.5 Laboratory Outline | Teaching methods | Remarks |
| 8.6 Laboratory Outline | | |
| 8.7 Project Outline | Teaching methods | Remarks |
| 8.8 Project Outline | | |

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

**Evaluation / Grading** (if applicable)

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| Activity type | Evaluation criteria | Evaluation methods | Percentage of the final grade |
| 10.1. Lecture | Written and oral evaluation |  | 40% |
| 10.2.  Seminar | Written assessment (problems and exercises) |  | 60% |
| 10.3.  Laboratory |  |  |  |
| 10.4. Project |  |  |  |
| 10.5 Minimal performance standard  Student must grasp the fundamental ncncepts of mechanics and be able to solve simple problems.. | | | |

Course coordinator

Prof.Adrian Palcu, PhD

Seminar/laboratory/project coordinator,

Prof.Adrian Palcu, PhD

Head of the Department

Lect. Lorena Popa, PhD

Dean

Prof. Sorin-Florin Nădăban, PhD