| UČNI NAČRT PREDMETA / COURSE SYLLABUS | |
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| **Predmet:** | Analitična mehanika |
| **Course title:** | Analytical mechanics |

| **Študijski program in stopnja**<br>**Study programme and level** | **Študijska smer**<br>**Study field** | **Letnik**<br>**Academic year** | **Semester**<br>**Semester** |
|---|---|---|---|
| Magistrski študijski program Matematika | ni smeri | 1 ali 2 | prvi ali drugi |
| Master's study programme Mathematics | none | 1 or 2 | first or second |

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| **Vrsta predmeta / Course type** | izbirni |
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| **Univerzitetna koda predmeta / University course code:** | M2118 |

| **Predavanja**<br>**Lectures** | **Seminar**<br>**Seminar** | **Vaje**<br>**Tutorial** | **Klinične vaje**<br>**work** | **Druge oblike študija** | **Samost. delo**<br>**Individ. work** | **ECTS** |
|---|---|---|---|---|---|---|
| **30** | **15** | **30** | | | **105** | **6** |

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| **Nosilec predmeta / Lecturer:** | doc. George Mejak |

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| **Jeziki / Languages:** | **Predavanja / Lectures:** | slovenski/Slovene, angleški/English |
| | **Vaje / Tutorial:** | slovenski/Slovene, angleški/English |

| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | **Prerequisites:** |
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| **Vsebina:** | **Content (Syllabus outline):** |
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| Lagrangeeva mehanika: Konfiguracijski prostor. Holonomni, neholonomni sistemi vezi. Princip virtualnega dela. D'Alembertov princip. Lagrangeeve enačbe. Konstante gibanja, | Lagrangian mechanics: Configurational space. Holonomic and nonholonomic constraints. Principle of virtual work. D'Alember principle. Lagrangian equations. Constant of motion. |

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| ciklične spremenljivke, Jacobijeva energijska funkcija, izrek Emmy Noether. Variacijski princip. Majhna nihanja okoli ravnovesne lege. Posplošen potencial.<br><br>Hamiltonova mehanika: Legendrova transformacija. Hamiltonova funkcija, kanonski sistem. Poissonov oklepaj, odvajanje vzdolž rešitve kanonskega sistema, konstante gibanja, Poissonov izrek. Kanonska transformacija, simplektična matrika, simplektični pogoj. Rodovne funkcije. Hamilton-Jacobijeva enačba | Cyclic variables, Jacobi energy function, Emmy-Noether theorem. Variational principles. Small oscillations. Generalized potential.<br>Hamiltonian mechanics: Legendre transformation. Hamiltonian function, canonical system. Poisson bracket, differentiation along solution of the canonical system, integrals of motion, Poisson theorem. Canonical transformation, symplectic matrix, symplectic condition. Generating functions. Hamilton-Jacobi equation. |

**Temeljni literatura in viri / Readings:**

V. I. Arnold: Mathematical Methods of Classical Mechanics, 2nd edition, Springer, New York, 1997.

H. Goldstein, C. P. Poole, J. L. Safko: Classical Mechanics, 3rd edition, Addison-Wesley, Reading, 2002.

A. Fasano, S. Marmi, Analytical Mechanics: An Introduction, Oxford University Press, Oxford, 2006

J. V. José, E. J. Saletan: Classical Dynamics : A Contemporary Approach, Cambridge Univ. Press, Cambridge, 1998.

| **Cilji in kompetence:** | **Objectives and competences:** |
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| Cilj predmeta je pridobiti osnovna znanja s področja analitične mehanike. Vsebine predmeta omogočajo uspešno reševanje dinamičnih problemov in ponazarjajo uporabo različnih matematičnih področij pri reševanju problemov s področja mehanike. | The goal is to obtain basic knowledge of principles of analytical mechanics. Mastering them enables problem solving of dynamical problems and to understand the role of mathematics in mechanics |

| **Predvideni študijski rezultati:** | **Intended learning outcomes:** |
|---|---|
| Znanje in razumevanje: Poznavanje in razumevanje osnovnih metod analitične mehanike<br>Uporaba: Osnova za nadgraditev osvojenega znanja s specifičnimi modeli iz področja klasične mehanike. Temelj za nadaljnji poglobljeni študij metod klasične in relativistične mehanike.<br><br>Refleksija: Povezovanje osvojenega matematičnega znanja v okviru enega | Knowledge and understanding: Knowledge and understanding of basic prnciples and methods of analytical mechanics.<br>Application: Application of the learnt methods in solving dynamical real word problems. First step for further graduate level study of methods of classical and relativistic mechanics.<br><br>Reflection: Crossbreeding of different mathematical subjects within a single course |

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| predmeta in njegova uporaba na področju analitične mehanike.<br><br>Prenosljive spretnosti – niso vezane le na en predmet: študent razvija sposobnost predstavitve problema na jasen in logičen način. Nauči se formulirati problem, izbrati ustrezni model, analizirati rešitev in preveriti veljavnost modela in rešitve. | and their application.<br><br>Transferable skills: Students develop abilities to clearly and logically formulate problems. They learn to critically assess modeling by analyzing their predictions and comparing them with real examples. |

| **Metode poučevanja in učenja:** | **Learning and teaching methods:** |
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| predavanja, vaje, seminar, domače naloge, konzultacije | Lectures, exercises, seminar, homeworks, consultations |

| **Načini ocenjevanja:** | Delež (v %) / Weight (in %) | **Assessment:** |
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| Tedenske domače naloge<br>Zagovor domačih nalog | | Regular homework assignments:<br>Oral presentation of homework |
| Ocene: 5 (negativno), 6-10 (pozitivno) (po Statutu UL) | 50%<br>50% | Grading: 5 (fail), 6-10 (pass) (according to the Statute of UL) |

**Reference nosilca / Lecturer's references:**

George Mejak:

MEJAK, George. On extension of functions with zero trace on a part of boundary. Journal of mathematical analysis and applications, ISSN 0022-247X. [Print ed.], 1993, let. 175, str. 305-314. [COBISS.SI-ID 5828441]

MEJAK, George. Finite element solution of a model free surface problem by the optimal shape design approach. International journal for numerical methods in engineering, ISSN 0029-5981. [Print ed.], 1997, vol. 40, str. 1525-1550. [COBISS.SI-ID 9983833]

MEJAK, George. Eshebly tensors for a finite spherical domain with an axisymmetric inclusion. European journal of mechanics. A, Solids, ISSN 0997-7538. [Print ed.], 2011, vol. 30, iss. 4, str. 477-490. [COBISS.SI-ID 16025177]