

| UČNI NAČRT PREDMETA / COURSE SYLLABUS   |   |                                |                                     |  |   |             |
|---|---|--------------------------------|-------------------------------------|--|---|-------------|
| <b>Predmet:</b>   | Mehanika 1                                  |                                |                                     |  |   |             |
| <b>Course title:</b>  | Mechanics 1                                 |                                |                                     |  |   |             |
|   |   |                                |                                     |  |   |             |
| <b>Študijski program in stopnja</b><br><b>Study programme and level</b>       | <b>Študijska smer</b><br><b>Study field</b> |                                |                                     | <b>Letnik</b><br><b>Academic year</b>  | <b>Semester</b><br><b>Semester</b>          |             |
| Enoviti magistrski študijski program Pedagoška matematika                     | ni smeri                                    |                                |                                     | 3 ali 4  | prvi  |             |
| Integrated Master's study programme Pedagogical Mathematics                   | none  |                                |                                     | 3 or 4   | first                                       |             |
| <b>Vrsta predmeta / Course type</b>   |   |                                |                                     |  |   |             |
|   |   |                                |                                     | izbirni  |   |             |
| <b>Univerzitetna koda predmeta / University course code:</b>                  |   |                                |                                     |  |   |             |
|   |   |                                |                                     | M0531  |   |             |
| <b>Predavanja</b><br><b>Lectures</b>  | <b>Seminar</b><br><b>Seminar</b>            | <b>Vaje</b><br><b>Tutorial</b> | <b>Klinične vaje</b><br><b>work</b> | <b>Druge oblike študija</b>  | <b>Samost. delo</b><br><b>Individ. work</b> | <b>ECTS</b> |
| 30  |   | 30                             |                                     |  | 90  | 5           |
| <b>Nosilec predmeta / Lecturer:</b>   |   |                                |                                     |  |   |             |
|   |   |                                |                                     | doc. George Mejak, doc. Pino Koc   |   |             |
| <b>Jeziki / Languages:</b>  | <b>Predavanja / Lectures:</b>               |                                |                                     |  |   |             |
|   | slovenski/Slovene                           |                                |                                     |  |   |             |
|   | <b>Vaje / Tutorial:</b>                     |                                |                                     |  |   |             |
|   | slovenski/Slovene                           |                                |                                     |  |   |             |
| <b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>  |   |                                |                                     | <b>Prerequisites:</b>  |   |             |
| Opravljeni predmeti Analiza 1, Algebra 1, Fizika 1, Analiza 2a in Analiza 2b. |   |                                |                                     | Completed courses Analysis 1, Algebra 1, Physics 1, Analysis 2a and Analysis 2b. |   |             |
| <b>Vsebina:</b>   |   |                                |                                     | <b>Content (Syllabus outline):</b>   |   |             |

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|---|---|
| <p>Osnove Newtonove mehanike: Galilejeva struktura, Galilejeve transformacije. Princip determiniranosti, Newtonovi zakoni. Delo, energija, izrek o delu, izrek o energiji.</p> <p>Premočrtno gibanje: Integrabilnost premočrtnega gibanja. Kvalitativni opis gibanja. Fazna ravnina. Periodično gibanje. Harmonični oscilator, harmonična aproksimacija periodičnega gibanja.</p> <p>Redukcija na premočrtno gibanje: Gibanje v polju centralne sile. Gibanje v polju gravitacijske sile, Keplerjevi zakoni, Bineteva formula. Integrabilnost gibanja v polju centralne sile, redukcija na premočrtno gibanje. Gibanje po gladki krivulji.</p> <p>Sistem materialnih točk: Enačba gibanja masnega središča, izrek o vrtilni količini. Problem dveh teles.</p> <p>Kinematika togega telesa: Relativni in absolutni koordinatni sistem, vektor kotne hitrosti. Togo gibanje, razcep togega gibanja na translatorno in rotacijsko gibanje. Eulerjevi koti.</p> <p>Dinamika togega telesa: Eulerjeve dinamične enačbe. Prosta vrtavka. Gibanje okrog stalne osi. Lagrangeeva vrtavka.</p> | <p>Basic principles of Newtonian mechanics: Galileoian structures and transformations. Principle of the determinisem, Newton's laws. Work, energy, work and energy theorems.</p> <p>Rectilinear motion: Integrability. Qualitative description. Phase portrait. Periodic motion. Harmonic oscillator, harmonic approximation of the periodic motion.</p> <p>Reduction to the one degree motion: Central froce motion. Integrability of the central froce motion, reduction to the linear motion. Motion in the gravitational field, Kepler's laws, Binet's formula. Motion without friction along a curve.</p> <p>System of particles: Center of mass, angular momentum theorem. Two body problem.</p> <p>Rigid body kinematics: Relative and absolute coordinate systems, angular velocity vector. Rigid motion, decomposition into translation and rotation motion. Euler angles.</p> <p>Rigid body dynamics: Euler equations of motion. Rotation around a fixed axis. Torque free motion. The heavy symmetric top.</p> |
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### Temeljni literatura in viri / Readings:

J. M. Knudsen, P. G. Hjorth: Elements of Newtonian Mechanics : Including Nonlinear Dynamics, 3rd edition, Springer, Berlin, 2002.

G. R. Fowles, G. L. Cassiday: Analytical Mechanics, 7th edition, Brooks/Cole, Pacific Grove, 2005.

W. Greiner: Classical Mechanics : Point Particles and Relativity, Springer, New York, 2004.

**Cilji in kompetence:**

**Objectives and competences:**

Predstavitev osnovnih pojmov in vsebin Newtonove mehanike s poudarkom na korektni matematični formulaciji in povezovanju že osvojenih matematičnih znanj.

Mathematical correct presentation of the basic Newtonian mechanics with special attention to connect already acquired mathematical knowledge of students.

**Predvideni študijski rezultati:**

Znanje in razumevanje: Poznavanje in razumevanje osnovnih pojmov in principov Newtonove mehanike.  
Uporaba: Temelj za nadgraditev osvojenega znanja s specifičnimi znanji iz prakse s področja mehanike. Osnova za nadaljnji študij predmetov s področja mehanike.  
Refleksija: Povezovanje osvojenega matematičnega znanja v okviru enega predmeta in njegova uporaba na področju mehanike.  
Prenosljive spretnosti – niso vezane le na en predmet: Celovit pogled na matematične metode v okviru mehanike. Reševanje nalog in problemov iz sorodnih področij uporabne matematike.

**Intended learning outcomes:**

Knowledge and understanding: Familiarity and understanding of basic principles of Newtonian mechanics.  
Application: Application of basic principles of mechanics to the modellisation of real world problems. Base for further study of mechanics.  
Reflection: Interconnection of the already acquired mathematical knowledge within a single course and application of it in the field of Mechanics.  
Transferable skills: A global understanding of mathematical methods. Acquiring modellisation skills for real world problems.

**Metode poučevanja in učenja:**

Predavanja, vaje, konzultacije

**Learning and teaching methods:**

Lectures, exercises, consultations

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %) **Assessment:**

|   |                       |   |
|---|-----------------------|---|
| <p>Način (pisni izpit, ustno izpraševanje, naloge, projekt):<br/>2 kolokvija namesto izpita iz vaj, izpit iz vaj,<br/><br/>izpit iz teorije</p> <p>ocene: 5 (negativno), 6-10 (pozitivno) (po Statutu UL)</p> | <p>50%</p> <p>50%</p> | <p>Type (examination, oral, coursework, project):<br/>2 midterm exams instead of written exam, written exam</p> <p>oral exam</p> <p>grading: 5 (fail), 6-10 (pass) (according to the Statute of UL)</p> |
|---|-----------------------|---|

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

Pino Koc:

– KOC, Pino, ŠTOK, Boris. Computer-aided identification of the yield curve of a sheet metal after onset of necking. Computational materials science, ISSN 0927-0256. [Print ed.], 2004, letn. 31, št. 1/2, str. 155-168 [COBISS.SI-ID 7467803]

– KOC, Pino, ŠTOK, Boris. Usage of the yield curve in numerical simulations. Strojniški vestnik, ISSN 0039-2480, 2008, letn. 54, št. 12, str. 821-829 [COBISS.SI-ID 10772507]

– UREVC, Janez, KOC, Pino, ŠTOK, Boris. Characterization of material parameters used in the mathematical modelling of arc welding and heat treatment processes. Transactions of FAMENA, ISSN 1333-1124, 2011, vol. 35, no. 4, str. 1-14, ilustr [COBISS.SI-ID 12226587]

George Mejak:

– MEJAK, George. Vogalna singularnost torzije kompozitne palice = The corner singularity of composite bars in torsion. Strojniški vestnik, ISSN 0039-2480, 2002, letn. 48, št. 11, str. 571-579 [COBISS.SI-ID 5643291]

– 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. Optimization of cross-section of hollow prismatic bars in torsion. Communications in numerical methods in engineering, ISSN 1069-8299, 2000, vol. 16, št. 10, str. 687-695 [COBISS.SI-ID 9984089]