Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

| UČNI NAČRT PREDMETA / COURSE SYLLABUS | |
|---|---|
| **Predmet:** | **Fizikalni eksperimenti 1** |
| **Course title:** | **Physics experiment 1** |

| Študijski program in stopnja<br>Study programme and level | Študijska smer<br>Study field | Letnik<br>Academic year | Semester<br>Semester |
|---|---|---|---|
| **Fizika, 1. stopnja** | **Fizika** | **1** | **2** |
| **Physics, 1st cycle** | **Physics** | **1** | **2** |

**Vrsta predmeta / Course type** Obvezni/Compulsory

**Univerzitetna koda predmeta / University course code:**

| Predavanja<br>Lectures | Seminar<br>Seminar | Vaje<br>Tutorial | Klinične vaje<br>work | Druge oblike študija | Samost. delo<br>Individ. work | ECTS |
|---|---|---|---|---|---|---|
| **3** | **2** | **50** | | | **65** | **4** |

**Nosilec predmeta / Lecturer:** **Andrej Dobovišek**

| **Jeziki / Languages:** | | |
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| | **Predavanja / Lectures:** | **Slovenski/Slovenian** |
| | **Vaje / Tutorial:** | **Slovenski/Slovenian** |

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Priporočljivo je predznanje iz mehanike in osnove vektorske analize.

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno.

**Prerequisits:**

Recomended is preknowledge of mechanics and basic knowledge of vector analysis.

Each of the listed obligations in the assessment methods must be completed with a positive grade.

**Vsebina:**

**Content (Syllabus outline):**

**Predavanja**
Teoretičen pregled vsebin zahtevnejših laboratorijskih vaj in zahtevnejših fizikalnih merilnih tehnik in metod uporabljenih na vajah.

**Laboratorijske vaje**

Študent opravi 15 laboratorijskih vaj s področja mehanike (kinematike, dinamike, hidrostatike in hidrodinamike).

**Projektno delo**
Študent se s projektno nalogo poglobi v zahtevnejši problem na področju mehanike in predlaga njegovo rešitev v obliki eksperimenta, ki zahteva uporabo zahtevnejše merilne tehnike. O rezultatih projektnega dela poroča v obliki pisnega laboratorijskega poročila in ustne predstavitve.

**Seminar**
Predstavitev projektnega dela pred kolegi.

**Lectures**
Theoretical overview of advanced laboratory excersises and advanced measuring techniques and methods used during laboratory work..

**Laboratory work**

Students perform 15 laboratory experiments from mechanics (kinematics, dynamics, hydrostatics, hidrodynamics).

**Project work**
In scope of the project work each student studies an advanced problem in mechanics and propose its solution in the form of an experiment, which require application of advanced measuring technique.
The results of the project work are presented in the form of written laboratory report and oral presentation.

**Seminar work**
Oral presentation of project work to colleagues.

**Temeljni literatura in viri / Readings:**

1) A. Dobovišek, Fizikalni eksperimenti 1 (Fakulteta za naravoslovje in matematiko, Maribor, 2015).
2) M.G. Sirkevič, N.I. Koškin, Priročnik elementarne fizike (Tehniška založba Slovenije, Ljubljana, 1990).
3) D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, 5. izdaja, (John Wiley & Sons, Inc., New York, 1997).
4) J. Strnad, Fizika, 1. del, Mehanika, Toplota, 2. izdaja (DMFA, Ljubljana, 2016).

**Cilji in kompetence:**

Cilj tega predmeta je, da študentje usvojijo temeljna znanja o merilnih tehnikah in metodah na področju mehanike. Študentje se usposobijo za samostojno reševanje zahtevnejših problemov s področja mehanike, pri čemer znajo predlagati, izdelati ter izvesti ustrezen fizikalni eksperiment. Na osnovi eksperimentalno pridobljenih podatkov, v kombinaciji z ustreznim teoretičnim znanjem iz mehanike in drugimi informacijskimi viri ter računalniškimi simulacijskimi okolji so

**Objectives and competences:**

The objective of this course is for students to acquire basic knowledge in measuring techniques and methods used in mechanics. Students are competent to find appropriate solutions of advanced problems in mechanics. They are able to propose, prepare and perform appropriate physical experiments and on the basis of experimentally obtained data combined with their theoretial knowledge in mechanics as well as professional literature and computer

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| sposobni smiselno oblikovati končno rešitev problema. | simulation tolls reasonably formulate the final solution of the problem. |

| **Predvideni študijski rezultati:** | **Intended learning outcomes:** |
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| **Znanje in razumevanje:**<br>-Poglobljeno razumevanje mehanskih pojavov in sposobnost njihove demonstracije in analize v primerno opremljenem laboratoriju.<br><br>-Študentje usvojijo temeljna teoretična znanja o merilnih tehnikah in metodah iz področja mehanike ter pridobijo ustrezna praktična znanja in laboratorijske spretnosti za samostojno izvedbo zahtevnih šolskih eksperimentov na univerzitetni ravni izobraževanja.<br><br>- Študentje se naučijo ovrednotiti in analizirati smiselnost in točnost eksperimentalno pridobljenih podatkov ob uporabi strokovne literature, drugih informacijskih virov, simulacijskih orodij in specialne programske opreme za analizo podatkov.<br><br>-Študentje se usposobijo precizno in adekvatno poročati o svojih eksperimentalnih ugotovitvah. | **Knowledge and understanding:**<br><br>-In deep understanding of mechanical phenomena and the ability to demonstrate them in an appropriately equipped laboratory.<br><br>-Students acquire basic theoretical knowledge about measuring techniques and methods in mechanics as well as practical experiences and laboratory skills that are essential for autonomous execution of experiments at universitiy level of education.<br><br>-Students are able to evaluate and analyse experimental data by using professional literature, other information sources, computer simulation tolls and specialised software packages for data analysis.<br><br>-Students are able to precisely and adequately report about their experimental findings. |
| **Prenesljive/ključne spretnosti in drugi atributi:**<br>Spretnosti pisnega in ustnega komuniciranja: priprava laboratorijskih poročil, ustni zagovori laboratorijskih vaj, predstavitev projektnega dela.<br><br>Uporaba informacijske tehnologije: uporaba simulacijskih orodij in programskih orodij za analizo podatkov.<br><br>Praktična znanja in laboratorijske veščine: rokovanje z merilnimi napravami in laboratorijsko opremo.<br><br>Matematične spretnosti: spretnost presoje smiselnosti uporabe računskih približkov. | **Transferable/Key Skills and other attributes:**<br><br>Written and oral communication skills: preparation of laboratory reports, oral lab work defence, oral presentation of project work<br><br>Use of information technology: use of computer simulation tolls and specialised software packages for data analysis.<br><br>Practical and laboratory skills: handling with measuring devices and laboratory equipment.<br><br>Mathematical skills: the sense to judge if the use of mathematicall approximation is reasonable or not. |

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| **Metode poučevanja in učenja:** | **Learning and teaching methods:** |
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| -predavanja (razlaga, razgovor, demonstracija)<br>-laboratorijske vaje (metoda dela s tekstom, pisnih in grafičnih del, metoda praktičnih del, uporaba simulacij in programskih orodij za obdelavo podatkov, sodelovalno učenje, diskusija rezultatov)<br>-projektno delo (individualizacija poučevanja)<br>-seminar (razlaga, razgovor)<br>- elementi obrnjenega poučevanja | -lectures (explanation, discussion, demonstration)<br>-laboratory exercises (work with text, work with graphic elements, practical work, use of simulations and software tools for data processing, collaborative learning, discussion of results)<br>-project work (individualization in teaching)<br>-seminar work (explanation, discussion)<br>- elements of flipped learning |

| **Načini ocenjevanja:** | Delež (v %) / Weight (in %) | **Assessment:** |
|---|---|---|
| laboratorijsko delo<br>projekt | 80%<br>20% | laboratory work<br>project |

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

**1.** VITAS, Marko**, DOBOVIŠEK, Andrej.** A possible origin of life in nonpolar environments. *Biosystems*. [Print ed.]. Jan. 2025, vol. 247, [article no.] 105384, str. 1-8. ISSN 0303-2647. DOI: 10.1016/j.biosystems.2024.105384. [COBISS.SI-ID 222336003], [Odprti dostop, JCR, SNIP, WoS, Scopus]

**2. DOBOVIŠEK, Andrej,** BLAŽEVIČ, Tina, KRALJ, Samo, FAJMUT, Aleš. Enzyme cascade to enzyme complex phase-transition-like transformation studied by the maximum entropy production principle. *Cell reports physical science*. 2025, vol. 6, iss. 2, [article no.] 102400, 11 str. ISSN 2666-3864. DOI: 10.1016/j.xcrp.2024.102400, DOI: 20.500.12556/DKUM-91789. [COBISS.SI-ID 225246211]

**3.** VITAS, Marko**, DOBOVIŠEK, Andrej**. Is Darwinian selection a retrograde driving force of evolution?. *Biosystems*. [Print ed.]. Nov. 2023, vol. 233, [article no.] 105031, 8 str. ISSN 0303-2647. DOI: 10.1016/j.biosystems.2023.105031. [COBISS.SI-ID 165759235]

**4. DOBOVIŠEK, Andrej**, AMBROŽIČ, Milan, KUTNJAK, Zdravko, KRALJ, Samo. Liquid crystal based active electrocaloric regenerator. *Heliyon*. Mar. 2023, vol 9, iss. 3, [article no.] e14035, str. 1-12, ilustr. ISSN 2405-8440. https://www.sciencedirect.com/science/article/pii/S2405844023012422?via%3Dihub, DOI: 10.1016/j.heliyon.2023.e14035. [COBISS.SI-ID 143422211]

**5. DOBOVIŠEK, Andrej**, VITAS, Marko, BLAŽEVIČ, Tina, MARKOVIČ, Rene, MARHL, Marko, FAJMUT, Aleš. Self-organization of enzyme-catalyzed reactions studied by the maximum entropy production principle. *International journal of molecular sciences*. 2023, vol. 24, iss. 10, 21 str. ISSN 1422-0067. DOI: 10.3390/ijms24108734, DOI: 20.500.12556/DKUM-88180. [COBISS.SI-ID 152729603]