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 Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika, prva Bolonjska stopnja	**Fizika**	**1**	**2**
Physics, Bachelor degree	**Physics**	**1**	**2**

Vrsta predmeta / Course type Obvezni/Compulsory

Univerzitetna koda predmeta / University course code:

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

Nosilec predmeta / Lecturer: **Andrej Dobovišek**

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni. Priporočljivo je predznanje iz mehanike in osnove vektorske analize.	None. Recomended is preknowledge of mechanics and basic knowledge of vector analysis.

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:	**Objectives and competences:**
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	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

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

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: -Poglobljeno razumevanje mehanskih pojavov in sposobnost njihove demonstracije in analize v primerno opremljenem laboratoriju. -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. - 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. -Študentje se usposobijo precizno in adekvatno poročati o svojih eksperimentalnih ugotovitvah.	**Knowledge and understanding:** -In deep understanding of mechanical phenomena and the ability to demonstrate them in an appropriately equipped laboratory. -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. -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. -Students are able to precisely and adequately report about their experimental findings.
Prenesljive/ključne spretnosti in drugi atributi: Spretnosti pisnega in ustnega komuniciranja: priprava laboratorijskih poročil, ustni zagovori laboratorijskih vaj, predstavitev projektnega dela. Uporaba informacijske tehnologije: uporaba simulacijskih orodij in programskih orodij za analizo podatkov. Praktična znanja in laboratorijske veščine: rokovanje z merilnimi napravami in laboratorijsko opremo.	**Transferable/Key Skills and other attributes:** Written and oral communication skills: preparation of laboratory reports, oral lab work defence, oral presentation of project work Use of information technology: use of computer simulation tolls and specialised software packages for data analysis. Practical and laboratory skills: handling with measuring devices and laboratory equipment.

Matematične spretnosti: spretnost presoje smiselnosti uporabe računskih približkov.	Mathematical skills: the sense to judge if the use of mathematicall approximation is reasonable or not.

Metode poučevanja in učenja:	**Learning and teaching methods:**
-predavanja (razlaga, razgovor, demonstracija) -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) -projektno delo (individualizacija poučevanja) -seminar (razlaga, razgovor) - elementi obrnjenega poučevanja	-lectures (explanation, discussion, demonstration) -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) -project work (individualization in teaching) -seminar work (explanation, discussion) - elements of flipped learning

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt) **Sprotni način ocenjevanja** Ustno preverjanje pripravljenosti na vaje Opravljene vse eksperimentalne vaje Izdelana poročila o vajah Ustni zagovori vaj Pisni kolokvij Projektna naloga Vsaka izmed naštetih obveznosti mora biti opravljena z pozitivno oceno.	 10% 20% 10% 20% 20% 20%	Type (examination, oral, coursework, project): **Constant assessment methods** Oral assessment of readiness for the forthcoming experiment All laboratory experiments done Done laboratory reports Oral avocation of the experiments Written test Project work Each of the mentioned commitments must be assessed with a passing grade.

Reference nosilca / Lecturer's references:

1. ŠTERK, Marko, MARKOVIČ, Rene, MARHL, Marko, FAJMUT, Aleš, **DOBOVIŠEK**, **Andrej**. Flexibility of enzymatic transitions as a hallmark of optimized enzyme steady-state kinetics and thermodynamics. *Computational biology and chemistry*. [Print ed.]. Apr. 2021, vol. 91, str. 1-10. ISSN 1476-9271. DOI: 10.1016/j.compbiolchem.2021.107449. [COBISS.SI-ID 52543491],
financer: ARRS, Programi, P1-0055, SI, Biofizika polimerov, membran, gelov, koloidov in celic

2. JURETIĆ, Davor, BONAČIĆ LOŠIĆ, Željana, KUIĆ, Domagoj, SIMUNIĆ, Juraj, **DOBOVIŠEK, Andrej**. The maximum entropy production requirement for proton transfers enhances catalytic efficiency for β-lactamases. *Biophysical chemistry*. [Print ed.]. Jan. 2019, vol. 244, str. 11-21, ilustr. ISSN 0301-4622. DOI: 10.1016/j.bpc.2018.10.004. [COBISS.SI-ID 24237832],
financer: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic

3. VITAS, Marko, **DOBOVIŠEK, Andrej**. Towards a general definition of life. *Origins of life and evolution of the biospheres*. 2019, vol. 49, iss. 1/2, str. 77-88, graf. prikazi. ISSN 0169-6149. DOI: 10.1007/s11084-019-09578-5. [COBISS.SI-ID 24634376]
financer: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic

4. VITAS, Marko, **DOBOVIŠEK, Andrej**. In the beginning was a mutualism : on the origin of translation. *Origins of life and evolution of the biospheres*. 2018, vol. 48, iss. 2, str. 223-243, ilustr. ISSN 0169-6149. DOI: 10.1007/s11084-018-9557-6. [COBISS.SI-ID 23839496]
financer: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic

5. **DOBOVIŠEK, Andrej**, MARKOVIČ, Rene, BRUMEN, Milan, FAJMUT, Aleš. The maximum entropy production and maximum Shannon information entropy in enzyme kinetics. *Physica. A, Statistical mechanics and its applications*. [Print ed.]. 2018, vol. 496, str. 220-232. ISSN 0378-4371. DOI: 10.1016/j.physa.2017.12.111. [COBISS.SI-ID 23601416]
financer: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic

6. **DOBOVIŠEK, Andrej**, VITAS, Marko, BRUMEN, Milan, FAJMUT, Aleš. Energy conservation and maximal entropy production in enzyme reactions. *Biosystems*. [Print ed.]. 2017, vol. 158, str. 47-56. ISSN 0303-2647. DOI: 10.1016/j.biosystems.2017.06.001. [COBISS.SI-ID 23218696]
financer: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic