



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Osnovna merjenja
Course title:	Basic measurements

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika, 1. stopnja		1.	1.
Physics, 1st cycle		1.	1.

Vrsta predmeta / Course type:

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
5		25			60	3

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lectures:	<input type="text" value="Slovenski/Slovene"/>
	Vaje / Tutorial:	<input type="text" value="Slovenski/Slovene"/>

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

Prerequisites:

Vsebina:

Predavanja
Osnove merjenja, sistematične in naključne merske napake, statistična analiza izmerjenih podatkov z upoštevanjem napak pri merjenju, računanje z nenatančnimi podatki, analiza grafov z upoštevanjem merskih napak.
Laboratorijske vaje
1. Merjenje gostote trdnih teles
2. Merjenje prostornine in gostote kapljev
3. Merjenje koeficienta vzmeti

Content (Syllabus outline):

Lectures
Basics of measurements, systematic and random experimental errors, statistical analysis of experimental data by considering experimental errors, calculus with experimental errors, analysis of experimental errors in diagrams.
Laboratory work
1. Measurements of density of solid bodies

4. Merjenje debeline
5. Merjenje krivinskega polmera leč
6. Mikroskopsko merjenje majhnih dimenzij
7. Merjenje frekvence
8. Merjenje električnega upora
9. Merjenje električnega toka in električne napetosti
10. Meritve svetlobnega toka
11. Merjenje temperature
12. Obdelava merskih podatkov s programskimi paketi kot so npr: Mathematica, Origin in Excel
13. Kinematika: merjenje z računalniškim merilnim sistemom.

2. Measurements of volume and density of fluids
3. Measurements of spring constant
4. Measurements of thickness
5. Measurements of curvature radius of lenses
6. Microscopic measurements of small dimensions
7. Measurements of frequency
8. Measurements of electrical resistance
9. Measurements of electrical current and voltage
10. Measurements of light flux
11. Measurements of temperature
12. Analysis of experimental data with software packages like: Mathematica, Origin and Excel
13. Kinematics: Computer directed measurements

Temeljni literatura in viri / Readings:

- 1) A. Dobovišek, Osnovna merjenja : uvod v merske napake in kvantitativno analizo fizikalnih meritev (Univerzitetna založba Univerze v Mariboru, Maribor, 2021).
- 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 pridobijo osnovna teoretična in praktična znanja s področja merjenja, kakor tudi primerne izkušnje in laboratorijske spretnosti za samostojno delo pri eksperimentalnih vajah. Navadijo se uporabljati ustrezno strokovno literaturo, svoje teoretično in računsko znanje in druge informacijske vire. Usvojijo znanja, potrebna za pripravo kvantitativnega in kvalitativnega eksperimenta. Usposobijo se precizno in adekvatno poročati o svojih eksperimentalnih ugotovitvah.

Objectives and competences:

The objective of this course is for students to acquire basic knowledge in measuring techniques and methods. Students acquire elemental theoretical and practical knowledge from the field of measurements as well as appropriate experiences and laboratory skills essential for autonomous execution of measurements in above-outlined topics. They learn to use their theoretical and practical knowledge, as well as information offered from secondary sources, to master problems that might occur during experimental work and report on their findings.

Predvideni študijski rezultati:

Znanje in razumevanje:

-Študentje usvojijo temeljna teoretična znanja o merilnih tehnikah, metodah in njihovih merskih napakah pri merjenju osnovnih fizikalnih količin.

-Študentje usvojijo praktična znanja in laboratorijske spretnosti za samostojno izvedbo meritev na univerzitetni ravni izobraževanja.

- Študentje se naučijo statistično vrednotiti in analizirati eksperimentalno pridobljene podatke ob uporabi strokovne literature, informacijskih virov in specialnih programskih orodij.

-Študentje se naučijo natančno poročati o laboratorijskih meritvah.

Prenesljive/ključne spretnosti in drugi atributi

-Usposobljenost za delo v fizikalnem laboratoriju pri nadaljevalnih laboratorijskih vajah.

-Spretnosti pisnega in ustnega komuniciranja: priprava laboratorijskih poročil, ustni zagovori laboratorijskih vaj.

Uporaba informacijske tehnologije: uporaba programskih orodij za statistično analizo podatkov.

-Praktična znanja in laboratorijske veščine: rokovanje z merilnimi napravami in laboratorijsko opremo.

Intended learning outcomes:

Knowledge and understanding:

-Students acquire basic theoretical knowledge about measuring techniques and methods essential in measurements of basic physical quantities.

-Students acquire appropriate practical experience and laboratory skills essential for autonomous execution of measurements at university level of education.

-Students are able to statistically evaluate and analyse experimental data by using professional literature, other information sources and specialised software packages.

-Students are able to precisely and adequately report about laboratory measurements.

Transferable/Key Skills and other attributes

-Ability to work in the physics lab at the advanced physical experiments.

Written and oral communication skills: preparation of laboratory reports, oral lab work defence.

Use of information technology: use of specialised software packages for statistical analysis of experimental data.

Practical and laboratory skills: handling with measuring devices and laboratory equipment.

Metode poučevanja in učenja:**Learning and teaching methods:**

<ul style="list-style-type: none"> - Predavanja - Laboratorijske vaje <p>Laboratorijske vaje zajemajo teoretični uvod v določen fizikalni problem in samostojno izvedbo fizikalnega eksperimenta pod vodstvom vodje vaj.</p>	<ul style="list-style-type: none"> -Lectures -Laboratory work <p>They are based on: theoretical introduction to specific topics and an autonomous execution of experiments under the supervision of the professor.</p>
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Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Sprotni način ocenjevanja		Constant assessment methods
Ustno preverjanje pripravljenosti na vaje	10%	Oral assessment of readiness for the forthcoming experiment
Opravljene vse eksperimentalne vaje	10%	All laboratory experiments done
Izdelana poročila o vajah	30%	Done laboratory reports
Ustni zagovori vaj	30%	Oral avocation of the experiments
Pisni kolokvij	20%	Written test
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned commitments must be assessed with a passing grade.

Reference nosilca / Lecturer's references:

1. **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](https://doi.org/10.1016/j.heliyon.2023.e14035). [COBISS.SI-ID [143422211](#)]
2. 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](https://doi.org/10.1016/j.compbiolchem.2021.107449). [COBISS.SI-ID [52543491](#)], financier: ARRS, Programi, P1-0055, SI, Biofizika polimerov, membran, gelov, koloidov in celic
3. 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](https://doi.org/10.1016/j.bpc.2018.10.004). [COBISS.SI-ID [24237832](#)], financier: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic
4. 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](https://doi.org/10.1007/s11084-019-09578-5). [COBISS.SI-ID [24634376](#)], financier: ARRS, Programi, P1-0055 (B), SI, Biofizika polimerov, membran, gelov, koloidov in celic