



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Fizikalni eksperimenti 3

Course title: Physics experiments 3

Študijski program in stopnja	Študijska smer	Letnik	Semester
Study programme and level	Study field	Academic year	Semester
Fizika, 1. stopnja	/	2	4
Physics, 1st cycle	/		

Vrsta predmeta / Course type

Obvezni/Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja	Seminar	Vaje	Lab. vaje	Terenske vaje	Samost. delo	ECTS
Lectures	Seminar	Tutorial	Laboratory work	Field work	Individ. work	
1	4		50		125	6

Nosilec predmeta / Lecturer:

Robert Repnik

Jeziki /

Predavanja / Lectures:

slovenski/Slovenian

Languages:

Vaje / Tutorial:

slovenski/Slovenian

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

Prerequisites:

Priporočljivo je predznanje iz nihanja, valovanja in optike ter osnove analize in vektorske analize.

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Pozitivno ocenjeno poročilo laboratorijskih vaj z zagovorom, pozitivno ocenjeno preverjanje

Recommended is preknowledge of oscillations, waves and optics, fundamentals of analysis and vector analysis.

Each of the listed obligations in the assessment methods must be completed with a positive grade. A positively evaluated laboratory report with

pripravljenosti na vaji in uspešno izdelan in predstavljen projekt so pogoji za pristop k ustnemu izpitu.

defense, a positively evaluated readiness assessment during the exercise, and a successfully completed and presented project are prerequisites for taking the oral exam.

Vsebina:

Predavanja

teoretični pregled zahtevnejših vsebin

laboratorijskih vaj in uporabljenih merilnih tehnik.

Laboratorijske vaje

Študent opravi eksperimente s področja nihanja in valovanja ter valovne in geometrijske optike.

Laboratorijske vaje so iz naslednjih vsebin: dušeno in nedušeno nihanje, vsiljeno nihanje in resonanca, električni nihajni krog, potujoče in stoječe valovanje, leče in zrcala, lečja, uklon in interferenca, spektroskopija, sevanje črnega telesa.

Projektno delo

Študent pripravi projektno nalogo: načrtuje in izdela meritev, pripravi navodila za izvajanje meritve, izvede meritev in napiše poročilo.

Seminar

Predstavitev projektne dela.

Content (Syllabus outline):

Lectures

theoretical overview of the demanding experiments and used measuring techniques.

Laboratory work

Student performs experiments from oscillations and waves and from wave and geometrical optics.

Experiments are from the following topics:

undamped and damped oscillations, forced oscillations and resonance, electrical oscillation circuit, travelling and standing waves, lenses and mirrors, systems of lenses, diffraction and interference, spectroscopy, blackbody radiation.

Project work

Each student works on a project. The work involves planning the experiment, building the experiment, performing the measurements and writing report.

Seminar

Oral presentation of project work.

Temeljni literatura in viri / Readings:

1. Repnik, R., & Hauko, R. (2022). Fizikalni eksperimenti 3: zbirka laboratorijskih vaj [elektronski vir]. Maribor: Univerza v Mariboru, Univerzitetna založba. ISBN 978-961-286-624-2. [COBISS.SI-ID 114276355]
<https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/114276355>
2. Koškin, N. I., & Širkevič, M. G. (1988). Priročnik elementarne fizike (1. slov. prev. po 3. predelani in izpopolnjeni izd., 6. ponatis). Ljubljana: Tehniška založba Slovenije. ISBN 86-365-0035-4. [COBISS.SI-ID 3996416]
<https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/3996416>
3. Halliday, D., Resnick, R., & Walker, J. (2008). Fundamentals of Physics (8th ed.). Hoboken, NJ: J. Wiley & Sons. ISBN 978-0-470-04472-8. [COBISS.SI-ID 62414337]
<https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/62414337>

4. Strnad, J. (2014). Fizika. Del 1: Mehanika, toplota (12. natis). Ljubljana: DMFA – založništvo. ISBN 978-961-212-047-4. [COBISS.SI-ID 271411200]
<https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/271411200>
5. Strnad, J. (2014). Fizika. Del 2: Električna optika (7. natis). Ljubljana: DMFA – založništvo. ISBN 978-961-212-048-1. [COBISS.SI-ID 271410944]
<https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/271410944>

Dodatna literatura / Additional readings:

1. Elektronska gradiva, objavljena v spletni učilnici / Teaching material available in the e-classroom.

Cilji in kompetence:

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

Objectives and competences:

The objective of this course is for students to acquire basic knowledge in measuring techniques and methods used in oscillations, waves and optics. Students are competent to find appropriate solutions of advanced problems in oscillations, waves and optics. They are able to propose, prepare and perform appropriate physical experiments and on the basis of experimentally obtained data combined with their theoretical knowledge in oscillations, waves and optics as well as professional literature and computer simulation tools reasonably formulate the final solution of the problem.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po uspešno zaključeni učni enoti je študent zmožen:

- uporabiti znanje s področja nihanja in valovanja ter optike,
- aplicirati teoretična znanja o merilnih tehnikah,
- uporabiti ustrezne metode za obdelavo in analizo podatkov,
- vrednotiti in interpretirati rezultate ter jih povezati s teorijo,
- precizno in adekvatno poročati o svojih eksperimentalnih ugotovitvah.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course students will be able to:

- use the knowledge from oscillations and waves and optics to execute laboratory work,
- apply the knowledge of measuring techniques,
- use appropriate methods for processing and analyzing data,
- evaluate and interpret results and connect them with theory,
- accurate and adequate reporting on their experimental work.

Prenesljive/ključne spretnosti in drugi atributi:

Študent:

- pridobi laboratorijske spretnosti potrebne za samostojno delo pri demonstracijah in eksperimentalnih vajah s področja nihanja, valovanja in optike,
- se priuči rokovanja z merilnimi napravami in laboratorijsko opremo,
- prepozna možne vire nevarnosti pri eksperimentalnem delu in pozna postopke za varno delo v laboratoriju,
- usvoji znanje potrebno za pripravo kvantitativnega in kvalitativnega eksperimenta s področja nihanja, valovanja in optike,
- se seznani z iskanjem, sortiranjem in ustrezno rabo virov,
- pridobi spretnosti uporabe programskih orodij za analizo podatkov eksperimentov s področja nihanja, valovanja in optike,
- je zmožen presoje smiselnosti uporabe približkov,
- je sposoben sodelovalnega učenja,
- razvija spretnost samostojnega strokovnega in raziskovalnega dela.

Transferable/Key Skills and other attributes:

Student:

- acquires experiences and laboratory skills that are essential for an autonomous execution of demonstrative physics experiments in the field of oscillations, wave and optics,
- gains ability of handling with measuring devices and laboratory equipment,
- recognizes potential dangers in experimental work and knows procedures for safe laboratory work,
- gains knowledge needed to produce quantitative and qualitative experiments,
- gets acquainted with searching and sorting information sources and efficient use of sources,
- acquires skills to use software tools for analyzing data from experiments in the field of oscillation, wave and optics,
- is capable to judge the effective use of approximations.
- is capable of collaborative learning,
- develops skills of individual professional-research work.

Metode poučevanja in učenja:

- 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

Learning and teaching methods:

- 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 %) /

Assessment:

Weight (in %)

Laboratorijsko delo	80	Laboratory work
Projekt	10	Project
Ustni izpit	10	Oral exam

Reference nosilca / Lecturer's references:

HAUKO, Robert, DAJNKO, Matic, GAČEVIĆ, Dino, MARINKO, Peter, POTRČ, Melani, REPNIK, Robert. From speed of sound to vapour pressure : an undergraduate school experiment as an example of systematic error research. *European journal of physics*. 2022, vol. 43, no. 4, str. 1-14. ISSN 0143-0807. DOI: [10.1088/1361-6404/ac6cb9](https://doi.org/10.1088/1361-6404/ac6cb9). [COBISS.SI-ID [117802755](#)]

PANAHI, Shirin, NAZARIMEHR, Fahimeh, JAFARI, Sajad, SPROTT, Julien Clinton, PERC, Matjaž, REPNIK, Robert. Optimal synchronization of circulant and non-circulant oscillators. *Applied mathematics and computation*. [Print ed.]. Apr. 2021, vol. 394, art. no. 125830, str. 1-8. ISSN 0096-3003. DOI: [10.1016/j.amc.2020.125830](https://doi.org/10.1016/j.amc.2020.125830). [COBISS.SI-ID [43339779](#)]

OSRAJNIK, Damjan, GRUBELNIK, Vladimir, REPNIK, Robert. Multirhythmicity but no deterministic chaos in vibrating strings. *Chaos, solitons and fractals*. [Print ed.]. Sep. 2021, vol. 150, str. 1-5. DOI: [10.1016/j.chaos.2021.111206](https://doi.org/10.1016/j.chaos.2021.111206). [COBISS.SI-ID [73698819](#)]

SALIBAŠIĆ GLAMOČIĆ, Džana, MEŠIĆ, Vanes, NEUMANN, Knut, SUŠAC, Ana, BOONE, William J., AVIANI, Ivica, HASOVIĆ, Elvedin, ERCEG, Nataša, REPNIK, Robert, GRUBELNIK, Vladimir. Maintaining item banks with the Rasch model: an example from wave optics. *Physical review. Physics education research*. 2021, vol. 17, iss. 1, str. 010105-1-010105-18. ISSN 2469-9896. DOI: [10.1103/PhysRevPhysEducRes.17.010105](https://doi.org/10.1103/PhysRevPhysEducRes.17.010105). [COBISS.SI-ID [54415363](#)]

JOZIČ, Primož, ZIDANŠEK, Aleksander, REPNIK, Robert. Fuel conservation for launch vehicles: Falcon Heavy case study. *Energies*. 2020, vol. 13, no. 3, str. 1-10. ISSN 1996-1073. DOI: [10.3390/en13030660](https://doi.org/10.3390/en13030660). [COBISS.SI-ID [25125640](#)]