

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Uvod v znanstvenoraziskovalno delo
Course title:	Introduction to Scientific Research

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		2	4
Physics 2 nd degree		2	4

Vrsta predmeta / Course type Obvezni / Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
15	20				265	10

Nosilec predmeta / Lecturer: Uroš Tkalec

Jeziki / Languages:	Predavanja / Lectures:	Slovenski / Slovene
	Vaje / Tutorial:	Slovenski / Slovene

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

Prerequisites:
None.

Vsebina:

- Uvodni pregled izbranih problemov iz zgodovine fizike in aktualnih izzivov iz raznih področij fizike oziroma interdisciplinarnih tem.
- Pristop k znanstvenoraziskovalnemu delu na izbranih zgledih (definicija problema, formuliranje modela, prikaz napovedi modela in primerjava z eksperimentalnimi rezultati, povzetek raziskave).
- Napake pri teoretičnih napovedih in meritvah.
- Delo z viri (knjige, periodika, baze na spletu).
- Načini in pravila predstavitve raziskovalnega dela (poster, predavanje, objava).
- Seminar: Študent z mentorjem izbere raziskovalni problem, lahko samostojnega ali delnega v sklopu širšega raziskovalnega projekta. Raziskava je lahko vezana na izbiro teme magistrske naloge. Študent izvede raziskavo (teoretično ali eksperimentalno) ter potek dela in rezultate predstavi v seminarski nalogi. Seminarska naloga mora biti izdelana v obliki »izvirnega znanstvenega prispevka«, po navodilih ene izmed fizikalnih revij s faktorjem vpliva. Seminarsko nalogo študent predstavi s 30 minutnim predavanjem, pri čemer upošteva pravila strokovne predstavitve.

Content (Syllabus outline):

- Introductory review of selected problems in physics from the past as well as current problems from various fields of physics and its interdisciplinary areas.
- Approach to scientific research on examples selected (definition of a problem and a model, presenting model predictions and comparison with experimental results, summary).
- Errors of theoretical predictions and measurement errors.
- Work with literature sources (books and periodicals, databases on the internet).
- Ways and rules of presentation of scientific research (poster, lecture, publication).
- Seminar: Student chooses a research problem with an advice of a mentor. The problem can be a unit by itself or a part of a broader research project. It can be related to a theme of the Master's thesis. Student performs research (theoretical or experimental) and documents the research results in a written report. A report has to be elaborated as "short scientific paper" (JCR standard). Student has also to present his research as a 30 minutes lecture, following the relevant requirements of scientific presentation.

Temeljni literatura in viri / Readings:

- Znanstveni članki v revijah s področja izbire raziskovalne tematike v seminarju. / Scientific papers in periodicals chosen for the seminar.
- Učbeniki s področja izbire raziskovalne tematike v seminarju. / Textbooks on the topic chosen for the seminar.
- W. Strunk, E. B. White, *The Elements of Style* (Allyn & Bacon, 1999).
- R. A. Day: *Scientific English: A Guide for Scientists and Other Professionals* (Orxy Press, 1995).
- R. A. Day: *How to Write and Publish a Scientific Paper* (Greenwood Press, 2006).
- M. Alley: *The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid* (Springer, 2005).

Cilji in kompetence:

Glavni cilj je predstaviti strategijo in pristope pri teoretičnem in eksperimentalnem znanstvenoraziskovalnem delu na več različnih področjih fizike. Študent usvoji formuliranje raziskovalnega problema, načine izbiranja ustreznih metod, korake pri izvedbi raziskave, vrednotenje in analizo rezultatov ter predstavitev rezultatov domači in mednarodni strokovni javnosti na znanstvenih srečanjih iz z objavami.

Objectives and competences:

The major aim of the course is to present the strategy and tactics of theoretical and experimental research in various fields of physics. The objectives are focused on defining the research problem, choice of relevant research methods, performing a scientific research, analysis and evaluation of results, and on presenting the results to domestic and international scientific community at scientific meetings as well as with publications.

Predvideni študijski rezultati:**Znanje in razumevanje:**

Študent zna definirati problem ter pod vodstvom mentorja izvesti raziskavo. Raziskavo in njene rezultate zna predstaviti v obliki predavanja in (poljudno)znanstvenega prispevka.

Prenesljive/ključne spretnosti in drugi atributi:

Sposobnost vodenega znanstveno-raziskovalnega dela. Delo z znanstveno literaturo (iskanje virov, uporaba virov, citiranje) Strokovna pismenost.

Intended learning outcomes:**Knowledge and understanding:**

A student can define a research problem and perform the research work under the advice of a mentor. He can present research results in the form of an oral presentation and scientific paper.

Transferable/Key skills and other attributes:

Ability of guided scientific research. Work with scientific literature (searching and using of sources, citations). Scientific literacy.

Metode poučevanja in učenja:

- predavanja,
- seminar,
- vodeno individualno raziskovalno delo.

Learning and teaching methods:

- lectures,
- seminar work,
- guided individual research work.

Načini ocenjevanja:

- seminarska naloga,
- ustna predstavitev seminarja.

Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.

Delež (v %) /
Weight (in %)

70
30

Assessment:

- written report of the project,
- oral presentation of the project.

Each of the mentioned commitments has to be assessed with a passing grade.

Reference nosilca / Lecturer's references:

EMERŠIČ, Tadej, ZHANG, Rui, KOS, Žiga, ČOPAR, Simon, OSTERMAN, Natan, PABLO, Juan J. de, TKALEC, Uroš. Sculpting stable structures in pure liquids. *Science advances*, ISSN 2375-2548, Feb. 2019, vol. 5, art. no. eaav4283, 8 str., ilustr., doi: [10.1126/sciadv.aav4283](https://doi.org/10.1126/sciadv.aav4283). [COBISS.SI-ID [3291748](#)]

KIM, Dae Seok, ČOPAR, Simon, TKALEC, Uroš, YOON, Dong Ki. Mosaics of topological defects in micro-patterned liquid crystal textures. *Science advances*, ISSN 2375-2548, Nov. 2018, vol. 4, art. no. eaau8064, 8 str., ilustr., doi: [10.1126/sciadv.aau8064](https://doi.org/10.1126/sciadv.aau8064). [COBISS.SI-ID [3267684](#)]

ČOPAR, Simon, TKALEC, Uroš, MUŠEVIČ, Igor, ŽUMER, Slobodan. Knot theory realizations in nematic colloids. *Proceedings of the National Academy of Sciences of the United States of America*, ISSN 0027-8424, 2015, vol. 112, no. 6, str. 1675-1680, ilustr. <http://www.pnas.org/content/112/6/1675.full.pdf+html>. [COBISS.SI-ID [2787940](#)]

SENGUPTA, Anupam, TKALEC, Uroš, RAVNIK, Miha, YEOMANS, Julia M., BAHR, Christian, HERMINGHAUS, Stephan. Liquid crystal microfluidics for tunable flow shaping. *Physical review letters*, ISSN 0031-9007. [Print ed.], 2013, vol. 110, iss. 4, str. 048303-1-048303-5. <http://prl.aps.org/abstract/PRL/v110/i4/e048303>. [COBISS.SI-ID [2528868](#)]

TKALEC, Uroš, MUŠEVIČ, Igor. Topology of nematic liquid crystal colloids confined to two dimensions. *Soft matter*, ISSN 1744-683X, 2013, vol. 9, issue 34, str. 8140-8150, doi: [10.1039/C3SM50713K](https://doi.org/10.1039/C3SM50713K). [COBISS.SI-ID [26755367](#)]
