

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	0	0	0	265	10

Nosilec predmeta / Lecturer: Uroš Tkalec

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

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

Zbranih najmanj 60 ECTS v tem študijskem programu.

Prerequisites:

At least 60 ECTS collected in this study programme.

Vsebina:

- Uvodni pregled nekaterih fizikalnih problemov iz zgodovine kot tudi aktualnih problemov iz različnih področij fizike oziroma njenih mejnih področij.

- 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 in periodika, baze, na spletu).

- Načini in pravila predstavitve raziskovalnega dela (poster, predavanje, objava).

Seminar:
Študent z mentorjem izbere raziskovalni problem, lahko samostojnega ali kot delnega v sklopu širšega raziskovalnega projekta. Raziskava je lahko vezana na izbiro teme magistrske naloge. Študent izvede raziskavo (teoretična ali eksperimentalna) ter raziskavo in njene rezultate predstavi v seminarski nalogi. Seminarska naloga mora biti izdelana v obliki »izvirnega kratkega znanstvenega prispevka« po navodilih ene izmed fizikalnih revij s faktorjem vpliva. Svojo raziskavo študent predstavi s 30 minutnim predavanjem v seminarju, 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, definition of a model, presenting model predictions and comparison with experimental results, summary of the research).

- 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:
A 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. A student performs research (theoretical or experimental) and documents the research results in a written report. A report has to be elaborated as an "original short scientific paper" according to instructions of a journal included in JCR. A student has also to present his research as a lecture of 30 minutes duration following the relevant requirements of scientific presentation.

Temeljni literatura in viri / Readings:

1. Znanstveni članki v revijah s področja izbire raziskovalnega problema v seminarju. / Scientific papers in periodicals chosen for the seminar.
2. Učbeniki s področja izbire raziskovalnega problema v seminarju / Textbooks on the topic chosen for the seminar.
3. R. A. Day: Scientific English: A Guide for Scientists and Other Professionals, Orxy Press, 1995.
4. R. A. Day: How to Write and Publish a Scientific Paper, Greenwood Press, 2006.
5. 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 taktiko teoretičnega in eksperimentalnega znanstvenoraziskovalnega dela na različnih področjih fizike.

Pri tem je poseben poudarek namenjen formuliranju raziskovalnega problema, izbiri ustreznih metod, izvedbi raziskave, vrednotenju in analizi rezultatov ter predstavitvi rezultatov domači in mednarodni strokovni javnosti na znanstvenih srečanjih in 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 izvirnega znanstvenega članka.

Prenesljive/ključne spretnosti in drugi atributi:

Sposobnost vodenega znanstvenoraziskovalnega 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 sources, citations).
Scientific literacy.

Metode poučevanja in učenja:

Predavanja
Seminar
Vodeno individualno raziskovalno delo

Learning and teaching methods:

Lectures
Seminar
Guided individual research work

Načini ocenjevanja:

Seminarska naloga
Ustna predstavitev seminarske naloge

Delež (v %) /

Weight (in %)

Assessment:

Written report of the project
Oral presentation of the project

Reference nosilca / Lecturer's references:

MUŠEVIČ, Igor, ŠKARABOT, Miha, TKALEC, Uroš, RAVNIK, Miha, ŽUMER, Slobodan. Two-dimensional nematic colloidal crystals self-assembled by topological defects. *Science (Wash. D.C.)*, 2006, 313, str. 954-958. [COBISS.SI-ID [1929572](#)]

TKALEC, Uroš, ŠKARABOT, Miha, MUŠEVIČ, Igor. Interactions of micro-rods in a thin layer of a nematic

liquid crystal. *Soft matter*, 2008, vol. 4, no. 12, str. 2402-2409. [COBISS.SI-ID [22189863](#)]

TKALEC, Uroš, RAVNIK, Miha, ŽUMER, Slobodan, MUŠEVIČ, Igor. Vortexlike topological defects in nematic colloids : chiral colloidal dimers and 2D crystals. *Phys. rev. lett.*, 2009, vol. 103, no. 12, str. 127801-1-127801-4. [COBISS.SI-ID [22895655](#)]

SENGUPTA, Anupam, TKALEC, Uroš, BAHR, Christian. Nematic textures in microfluidic environment. *Soft matter*, 2011, vol. 7, no. 14, str. 6542-6549. [COBISS.SI-ID [25167143](#)]

TKALEC, Uroš, RAVNIK, Miha, ČOPAR, Simon, ŽUMER, Slobodan, MUŠEVIČ, Igor. Reconfigurable knots and links in chiral nematic colloids. *Science (Wash. D.C.)*, 2011, vol. 333, issue 6038, str. 62-65. [COBISS.SI-ID [2336868](#)]