

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Fizika okolja
Course title: Environmental Physics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika, 1. stopnja Physics, 1st cycle		3	5

Vrsta predmeta / Course type

Izbirni / elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
45		15		15	105	6

Nosilec predmeta / Lecturer:

Aleksander Zidanšek

Jeziki / Predavanja / Lectures:

slovenski/Slovenian in/and angleški/English

Languages:

Vaje / Tutorial:

slovenski/Slovenian in/and angleški/English

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

Priporočeno je znanje klasične in moderne fizike.

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Opravljen projekt je pogoj za pristop k pisnemu izpitu. Pozitiven pisni izpit je pogoj za pristop k ustnemu izpitu.

Prerequisites:

Recommended is knowledge of classical and modern physics.

Each of the listed obligations in the assessment methods must be completed with a positive grade. Completed project is a prerequisite for taking the written exam. A positive grade of the written exam is a prerequisite for taking the oral exam.

Vsebina:

1. Fizikalni procesi in pojavi v okolju
 Atmosferski procesi in pojavi ter njihov vpliv na zemeljsko površje (sončev spekter, sklopitev med svetlobo in snovjo, biološke molekule, ozon in UV svetloba)Klima in klimatske spremembe (vreme in klima, modeliranje klimatskih sprememb). Obravnava fizikalnih procesov in pojavov v okolju (transport

Content (Syllabus outline):

1. Physical processes and phenomena in different environments Atmospheric processes and phenomena and their influence on earths surface (solar wind, coupling between light and matter, biological molecules, ozone and UV light)Climate and climatic changes (weather and climate, modeling of climatic changes). Treating of physical processes and phenomena in

polutantov, difuzija, tok v rekah, podzemnih vodah, morski tokovi, enačba dinamike tekočin, gore, gozd, urbana središča, potresna območja, vulkani, tektonika, erozija,...). Vpliv biosfere na fizikalne procese v okolju (biogeokemijska kroženja, mikroklima,...). 2. Fizikalni procesi in pojavi v različnih tehniških aplikacijah Obravnavanje fizikalnih procesov in pojavov v tehniških aplikacijah in njihov vpliv na okolje (elektrarne, bivalni objekti, pristanišča, zadrževalniki, transportna sredstva, družba in okolje, politika in okoljevarstvo, preprečevanje katastrof, akustika in človekovo zaznavanje zvoka, kriteriji hrupa, zmanjševanje prepustnosti zvoka, aktivna kontrola zvoka ...). 3. Fizika energijskih virov Od kod energija na Zemlji in energijski viri (obnovljivi, neobnovljivi). Energijski viri v Sloveniji. Jedrska energija (zlitje in cepitev jeder, varnost in sevanje, jedrski odpadki). Alternativni energijski viri. Varčna in okolju prijazna raba energijskih virov. 4. Fizika ravnanja z odpadki Odpadki v gospodinjstvih. Odpadki v industriji. Posebni odpadki (jedrski, kemični, biološki in drugi odpadki). Transport, shranjevanje in razgradnja različnih vrst odpadkov.	environment (transport of pollutants, diffusion, flow in rivers, underground waters, sea currents, equations of dynamics of fluids, mountains, forest, urban centers, earthquake areas, volcanoes, tectonic, erosion,...). Biosphere and its influence on physical processes in the environment (biogeochemical cycles, microclimate,...). 2. Physical processes and phenomena in different technical applications Treating of physical processes and phenomena in technical applications and their influence on environment (power plants, objects for residence, harbors, reservoir, means of communication, society and environment, policy and environment protection, prevention of disasters, acoustic and human's perception of sound, criteria of noise, decreasing of transition of sound, active control of sound ...). 3. Physics of energy sources Origin of energy on earth and energy sources (renewable, not renewable). Energy sources in Slovenia. Nuclear energy (fission and fusion of nuclei, security and radiation, radioactive waste). Alternative energy sources. Economic and environmentally friendly use of energy sources. 4. Physics of dealing with waste Waste in housekeeping. Waste in industry. Special waste (nuclear, chemical, biological and other waste). Transport, keeping and decomposition of different types of wastes.
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Temeljni literatura in viri / Readings:

- 1) J. Monteith M. Unsworth, Principles of Environmental Physics, Academic Press, 2013.
- 2) E. P. Harris, Introduction to Environmental Sciences and Sustainability, University of West Florida Pressbooks, 2023, <https://open.umn.edu/opentextbooks/textbooks/introduction-to-environmental-sciences-and-sustainability>

Dodatna literatura / Additional Readings

- 1) M. Dželalija, Environmental Physics, CreateSpace Independent Publishing Platform, 2014.
- 2) E. Boeker, R. Grondelle, Environmental Physics, John Wiley & Sons, New York 2011.
- 3) Brüel, Kjær, Okoljski hrup, Brüel&Kjær Sound& Vibration Measurement A/S, prevod IMS Industrijski merilni sistemi d.o.o., 2009.
- 4) Članki v revijah New Scientist, Scientific World in Computational Physics
- 5) Nekatera aktualna gradiva bodo objavljena v spletni učilnici / Some up to date teaching material will be published in a virtual classroom

Cilji in kompetence:

Študentje osvojijo znanja, potrebna za kompleksnejše razumevanje fizikalnih pojavov in procesov v okolju. Na različnih primerih iz naravnih in tehniških okolij spoznajo in razumejo pomen in vrste energijskih virov ter energijskih pretvorb. Spoznajo vrste odpadkov in razumejo, kako jih okolju prijazno transportiramo ter hranimo.

Objectives and competences:

Students acquire knowledge that is necessary for complex understanding of physical phenomena and processes in environment. On different examples from natural or technical environments they understand importance and kinds of energy sources and energy transitions. They understand different types of waste and how to safely transport and store them.

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

Po zaključku predmeta študent:

- razume kompleksne naravne pojave in procese v okolju, energetiki in ravnanju z odpadki,
- zna opisati okoljske sisteme, pojave in procese s fizikalnimi modeli,
- je sposoben meriti fizikalne parametre v okolju in jih interpretirati,
- analitično in numerično reši fizikalne modele okoljskih sistemov.

Prenesljive/ključne spretnosti in drugi atributi:

Študent je sposoben uporabe analitičnih in računalniških orodij za reševanje kompleksnih fizikalnih problemov.

Prav tako se zaveda pomena varovanja okolja in je pripravljen za delo na fizikalnih projektih s področja okoljevarstva.

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

Upon completion of the course, the student:

- understands complex physical phenomena and processes in the environment, energetics, and waste management;
- can describe environmental systems, phenomena, and processes with physical models;
- is able to measure physical parameters in the environment and interpret the obtained measurements;
- analytically and numerically solves physical models of environmental systems.

Transferable/Key Skills and other attributes:

The students are able to use analytical and numerical tools to solve complex physics problems.

They are also aware of the importance of environmental protection and capable to work on physics projects in the field of environment.

Metode poučevanja in učenja:

Razlaga, razgovor, demonstracija, študij primerov, problemsko učenje ter terensko delo

Learning and teaching methods:

Lecture, discussion, demonstration, case studies, problem-based learning, field work.

Delež (v %) /

Načini ocenjevanja:

Weight (in %) **Assessment:**

projekt	30	project
pisni izpit	30	written exam
ustni izpit	40	oral exam

Reference nosilca / Lecturer's references:

1. ZID, Maha, PAL, Kaushik, HARKAI, Saša, ABINA, Andreja, KRALJ, Samo, ZIDANŠEK, Aleksander. Qualitatively and quantitatively different configurations of nematic–nanoparticle mixtures. *Nanomaterials*. [Online ed.]. 2024, vol. 14, issue 5, str. 1-16. ISSN 2079-4991. DOI: [10.3390/nano14050436](https://doi.org/10.3390/nano14050436). [COBISS.SI-ID [187069955](https://www.cobiss.si/id/187069955)]
2. ABINA, Andreja, PUC, Uroš, JAZBINŠEK, Mojca, ZIDANŠEK, Aleksander. Analytical gas sensing in the terahertz spectral range. *Micromachines*. 2023, vol. 14, str. 1-38, ilustr. ISSN 2072-666X. <https://www.mdpi.com/2072-666X/14/11/1987>, DOI: doi.org/10.3390/mi14111987. [COBISS.SI-ID [170582019](https://www.cobiss.si/id/170582019)]
3. ZIDANŠEK, Aleksander, HÖLBL, Arbresha, RANJKESH SIAHKAL, Amid, CORDOYIANNIS, George, KUTNJAK, Zdravko, KRALJ, Samo. Impact of random-field-type disorder on nematic liquid crystalline structures. *The European physical journal. E., Soft matter*. 2022, vol. 45, no. 7, str. 63-1-63-12, ilustr. ISSN 1292-895X. DOI: [10.1140/epje/s10189-022-00217-y](https://doi.org/10.1140/epje/s10189-022-00217-y). [COBISS.SI-ID [116649731](https://www.cobiss.si/id/116649731)]
4. VASUDEVAN, Aswathy, SHVALYA, Vasyl, KOŠIČEK, Martin, ZAVAŠNIK, Janez, JUROV, Andrea, SANTHOSH, Neelakandan Marath, ZIDANŠEK, Aleksander, CVELBAR, Uroš. From faceted nanoparticles to nanostructured Thin Film by Plasma-Jet Redox Reaction of Ionic Gold. *Journal of alloys and compounds*. [Print ed.]. Dec. 2022, vol. 928, [article no.] 167155, str. 1-11, ilustr. ISSN 0925-8388. DOI: [10.1016/j.jallcom.2022.167155](https://doi.org/10.1016/j.jallcom.2022.167155). [COBISS.SI-ID [121112067](https://www.cobiss.si/id/121112067)]