

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Energija za človekovo uporabo
Course title:	Energy for Human Use

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		2	3
Physics 2 nd degree		2	3

Vrsta predmeta / Course type izbirni/ optional

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			15	15	105	5

Nosilec predmeta / Lecturer: Aleksander Zidanšek

Jeziki / Languages:	Predavanja / Lectures:	Slovenski/Slovenian in/and angleški/English
	Vaje / Tutorial:	Slovenski/Slovenian in/and angleški/English

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

Ni zahtev. Priporočeno znanje osnov fizike – termodinamike.

Prerequisites:

None. Recommended basic knowledge of classical physics – thermodynamics.

Vsebina:

1. Energija
Energija v fiziki, viri energije

2. Osnove termodinamike
Energijski zakon, prenos toplote; energija iz fosilnih goriv; toplotni stroji; shranjevanje in transport energije.

3. Termodinamske omejitve energijskih pretvorb
Entropijski zakon, motor z notranjim izgorevanjem, izkoristek

4. Okoljski učinki pridobivanja energije
Energija in okolje: zmanjševanje onesnaženja; cena energijskih transformacij.
Obnovljivi energijski viri: sončna energija, energija vetra, valovi, biološki viri energije.
Jedrska energija: zlitje, cepitev, varnost in sevanje, jedrski odpadki in varnost.
Gorivne celice: gorivne celice z membrano za izmenjavo protonov; energijski viri za gorivne

Content (Syllabus outline):

1. Energy
Energy in physics, sources of energy

2. Fundamentals of Thermodynamics
Energy law, heat transfer; fossile fuel energy; heat engine; storage and transport of energy.

3. Thermodynamic Limits of Energy Transformations
Entropy law, internal combustion engine, energy efficiency

4. Environmental Effects of Energy Production
Energy and natural environment: reduction of pollution; price of energy transformations.
Renewable energy sources: solar energy, wind energy, tidal energy, biological sources of energy.
Nuclear energy: fusion, fission, safety and radiation, nuclear waste and security.
Fuel cells: proton exchange membrane fuel cells.
Hydrogen: biological sources, bacteria and algae.

celice.
Vodik: biološki viri pridobivanja, bakterije in alge.

Temeljni literatura in viri / Readings:

1. Jefferson W. Tester, Michael J. Driscoll, William A. Peters, Elisabeth M. Drake, Michael W. Golay , Sustainable Energy: Choosing among Options, The MIT Press, Cambridge 2012.
2. D. MacKay, Sustainable Energy, UIT Cambridge, 2016.
3. Egbert Boeker, Rienk van Grondelle, Environmental Physics, John Wiley & Sons, New York 2011.
4. J. Nelson, Physics of Solar Cells, Imperial College Press. London 2003.
5. Članki v revijah New Scientist, Scientific World in Computational Physics

Cilji in kompetence:

Kandidat spozna načine kroženja energije v naravi in vpliv človekove rabe energije na okolje.

Kandidat spozna predvsem tiste energijske vire, ki so do okolja prijazni, in potencialne nevarnosti za okolje. Kandidat se nauči objektivno in kritično presojati vpliv posameznih načinov pridobivanja energije na ljudi in okolje.

Objectives and competences:

Students learn about energy flows in nature and the environmental impact of human energy use.

Students learn new environmentally friendly energy sources, as well as potential risks for environment. The candidates also learn to assess critically the impact of different energy sources on humans and environment.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razume načine kroženja in pridobivanja energije ter vpliva energijskih virov na okolje.
Analizira energijske probleme, oblikuje možne rešitve in jih ovrednoti s fizikalnega, okoljskega in ekonomskega vidika.

Prenesljive/ključne spretnosti in drugi atributi:
Predmet pripravlja študenta za delo na projektih s področja energetike in okoljevarstva.

Intended learning outcomes:

Knowledge and Understanding:
The students understand energy flow and production as well as the environmental impact of energy sources.
The students analyze energy problems, form possible solutions and evaluate them from a physical, environmental and economic point of view.
Transferable/Key Skills and other attributes:
Subject prepares the student for work on projects in the fields of energy and environmental protection.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
projektna naloga	50	project
ustni izpit	50	oral examination

Reference nosilca / Lecturer's references:

- ABINA, Andreja, PUC, Uroš, JEGLIČ, Anton, ZIDANŠEK, Aleksander. Structural characterization of thermal building insulation materials using terahertz spectroscopy and terahertz pulsed imaging. NDT & E International, ISSN 0963-8695. [Print ed.], 2016, vol. 77, str. 11-18, doi: 10.1016/j.ndteint.2015.09.004. [COBISS.SI-ID 28983847]
- PUC, Uroš, ABINA, Andreja, SLUBAN, Melita, ZIDANŠEK, Aleksander, JEGLIČ, Anton, VALUŠIS, Gintaras. Terahertz spectroscopic identification of explosive and drug simulants concealed by various hiding

techniques. *Applied optics*, ISSN 1559-128X. Tiskana izd., 2015, vol. 54, no. 14, str. 4495-4502, doi: 10.1364/AO.54.004495. [COBISS.SI-ID 28541735]

- PUC, Uroš, ABINA, Andreja, JEGLIČ, Anton, ZIDANŠEK, Aleksander, KAŠALYNAS, Irmantas, VENCKEVIČIUS, Rimvydas, VALUŠIS, Gintaras. Spectroscopic analysis of melatonin in the terahertz frequency range. *Sensors*, ISSN 1424-8220, 2018, vol. 18, no. 12, str. 4098-1-4098-12, doi: 10.3390/s18124098. [COBISS.SI-ID 31962407]
- VASUDEVAN, Aswathy, SHVALYA, Vasyi, ZIDANŠEK, Aleksander, CVELBAR, Uroš. Tailoring electrical conductivity of two dimensional nanomaterials using plasma for edge electronics : a mini review. *Frontiers of Chemical Science and Engineering*. 13 (3): 427-443, 2019, 17 str. ISSN 2095-0179. DOI: [10.1007/s11705-019-1805-4](https://doi.org/10.1007/s11705-019-1805-4). [COBISS.SI-ID 32306471]
- JAZBINŠEK, Mojca, PUC, Uroš, ABINA, Andreja, ZIDANŠEK, Aleksander. Organic crystals for THz photonics. *Applied sciences*, ISSN 2076-3417, 2019, vol. 9, no. 5, str. 882-1-882-45, doi: 10.3390/app9050882. [COBISS.SI-ID 32214055]