UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	RACIONALNA RABA ENERGIJE
COURSE TITLE:	RATIONAL ENERGY USE

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 1. stopnja	/	2.	1.
Environmental Protection and Eco-technologies, 1st level	/	2st	1st

Vrsta predmeta / Course type Obvezni predmet / Obligatory subject

Univerzitetna koda predmeta / University course code: RRE

Predavanja Lectures	Seminar Seminar	Sem. Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
20	/	20	/	/	100	5

Nosilec predmeta / Lecturer: doc. dr. Željko Vukelič

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

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

Osnovna znanja iz fizike

Prerequisits:

Basic knowledge of physics.

Vsebina:

- **Osnovne energetske merske enote**
- **Učinkovita raba energije**
- **Obnovljivi viri energije**
  (energija vode, geotermalna energija, energija sonca, energija vetra, energija plimovanja, Biomasa)
- **Fosilna goriva in jedrska energija**
  (premog, zemeljski plin, nafta in jedrska energija)
- **Svetovne zaloge obnovljivih virov energije**
- **Svetovne zaloge fosilnih goriv in jedrske energije**
- **Potencialne zaloge obnovljivih virov energije v Sloveniji**
- **Bilanca energije**
  (Ali lahko vso potrebno energijo pridobimo iz obnovljivih virov energije?)
- **Tehnične smernice za učinkovito rabo energije**
  (Stanovanjski objekti, Poslovni objekti, Industrijski objekti)

Content (Syllabus outline):

- **Basic energy measurement units**
- **Efficient use of energy**
- **Renewable energy**
  (water energy, geothermal energy, solar energy, wind energy, tidal energy, Biomass)
- **Fossil fuels and nuclear energy**
  (coal, natural gas, oil and nuclear energy)
- **World reserves of renewable energy sources**
- **World reserves of fossil fuels and nuclear energy sources**
- **Potential reserves of renewable energy sources in Slovenia**
- **Balance of energy**
  (Can all the energy required be obtained from renewable energy sources?)
- **Technical guidelines for efficient energy use**
- (Residential buildings, Business offices, Industrial facilities)

Temeljni literatura in viri / Textbooks:

Obvezna / Required:

1. Volker Quaschning, Renewable Energy and Climate Change, 2010
2. Hal Marcovitz, Can renewable energy replace fossil fuels?, 2011
3. Peter Novak, Sašo Medved, Energija in okolje, 2000
4. Energetska proizvodnja, Fakulteta za strojništvo, 2011
5. Ibon Galarraga, Handbook of Sustainable Energy, 2011
6. Željko Vukelić, Izraba geotermalne energije I,II, predavanja UL NTF, 2010

Priporočena / Recommended:

1. David J. C. MacKay, Sustainable Energy — without the hot air, 2008
2. BP Statistical Review of World Energy, june 2016
3. Energetska bilanca Republike Slovenije 2015
4. Katedra za mehatroniko, Proizvodnja in shranjevanje vodika, 2012
5. Raba energije, Fakulteta za strojništvo, 2015

Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- študenta seznaniti s pomenom racionalne rabe energije.
- študenta usposobiti, da bo z razumevanjem rabe energije znal presojati postopke uporabe obnovljivih virov energije, ki naj bi v prihodnosti nadomestili fosilna goriva,

Splošne kompetence:

- sposobnost analize, sinteze in predvidevanja rešitev ter posledic pojavov in obvladovanje raziskovalnih in razvojnih metod racionalne rabe energije

Objectives and competences:

Specific competences:

- to familiarize the student with the importance of rational energy use.
- to enable the student to be able to assess the use of renewable energy sources, by understanding the use of energy. which should replace fossil fuels in the future.

General competences:

- ability to analyse, synthesize, anticipate solutions and consequences of phenomena and they will be familiar with the research and management research/development methods in the field of rational energy use.

Predvideni študijski rezultati:

<u>Znanje in razumevanje:</u>

Študent bo ob zaključku tega predmeta sposoben:

- Poznavanja energetskih virov
- Razumevanja principa racionalne rabe energije
- Določevanja in izbira optimalnih energetskih rešitev
- Presojanja razmerja: fosilna goriva/obnovljivi viri energije
- Poznavanja postopkov načrtovanja energetskih potreb za zgradbe
- Izdelati energetsko izkaznico preproste stavbe
- Poznavanja sodobnih postopkov pri energetski učinkovitosti.

<u>Prenesljive/ključne spretnosti in drugi atributi:</u>

Intended learning outcomes:

<u>Knowledge and Understanding:</u>

The student will be at the completion of this course able to:

- Knowledge of energy sources
- Understanding the principles of rational energy use
- Determination and selection of optimal energy solutions
- Assessment of the ratio: fossil fuels/ renewable energy sources
- Knowledge of planning procedures for energy needs for buildings
- Prerapre energetic performance certificate for building,
- Knowledge of modern energy efficiency procedures.

- Uporaba domačih in tujih zbirk tehnoloških podatkov - Zbiranje in interpretiranje tehnoloških podatkov - Pisno in ustno poročanje o tehnoloških rešitvah	**Transferable/Key Skills and other attributes:** - Use of domestic and international databases of technical data - Gathering and interpretation of technical data - Written and oral reporting about technological solutions

Metode poučevanja in učenja:	**Learning and teaching methods:**
Oblike dela: - predavanja - seminarske vaje - samostojno delo študentov/tk **Metode dela:** - razlaga - dialog, diskusija - aktivno skupinsko delo - predstavitev in zagovor seminarske naloge	**Forms of teaching:** - In-class lectures - Seminar courses - Individual work of students **Teaching methods:** - Explanation - Discussion, debate - Teamwork - Preparation, presentation of a seminar paper

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- pisni izpit - priprava, predstavitev in zagovor seminarske naloge Na vajah je obvezna vsaj 90-odstotna prisotnost. Študent mora izdelati poročila o vajah, potem lahko pristopi h končnemu pisnemu izpitu Ocenjevalna lestvica: ▪ zadostno 6: 60-67% ▪ dobro 7: 68-75% ▪ prav dobro 8: 76-83% ▪ prav dobro 9: 84-90% ▪ odlično 10: 91-100%	**70** **30**	- written exam - preparation, presentation and defence of seminar paper At least 90% attendance at lab work is required. Students must first draw up report on their lab work, which is a prerequisite for final written examination. Grading system: ▪ Sufficient D (6): 60-67% ▪ Good C (7): 68-75% ▪ Very good B (8): 76-83% ▪ Very good B+ (9): 84-90% ▪ Excellent A (10): 91-100%

Materialni pogoji za izvedbo predmeta :	**Material conditions for subject realization:**
- predavalnica z multimedijsko opremo - računalniška učilnica	- classroom with the multimedia equipment - computer classroom

Obveznosti študentov:	**Student's commitments:**
- Obvezna udeležba na seminarjih - Izdelana seminarska naloga	- Obligatory attendance at the seminars - Seminar paper

Reference nosilca predmeta:	**Lecturer's references:**
(1) Pedagoško delo: Docent na Naravoslovnotehniški fakulteti, Univerze v Ljubljani, Oddelek za geotehnologijo, rudarstvo in okolje. Nosilec predmetov na dodiplomskem, podiplomskem in	(1) Teaching: Assistant Professor, at the Faculty of Natural Scieinces and Engineering, University of Ljubljana, Department of Geotechnology, Mining and Environment. Lecturing at the

doktorskem študiju: Osnove strojništva, Geotermalna energija, Energetske politike, Izraba geotermalne energije, Raziskovalno vrtanje, Stroji in naprave v geotehnologiji.

(2)Raziskovalno delo:

Kot in soavtor več kot 100 znanstvenih in strokovnih člankov, dveh učbenikov. Sem tudi avtor več kot 20 uspešno realiziranih projektov , študij, investicijskih programov v rudarski industriji in okolijskih projektih.

Pomembnejša raziskovalna dela:

-ŠPORIN, Jurij, MRVAR, Primož, PETRIČ, Mitja, VIŽINTIN, Goran, VUKELIČ, Željko. The characterization of wear in roller cone drill bit by rock material - sandstone. *Journal of petroleum science & engineering*, ISSN 0920-4105. [Print ed.], 2019, vol. 173, str. 1355-1367,

-VUKELIČ, Željko, DERVARIČ, Evgen, ŠPORIN, Jurij, VIŽINTIN, Goran. The development of dewatering predictions of the Velenje coalmine. *Energies*, ISSN 1996-1073, 2016, vol. 9, no.9, 9 str

- VIŽINTIN, Goran, MAYER, Janez, LAJLAR, Bojan, VUKELIČ, Željko. Rock burst dependency on the type of steel arch support in the Velenje mine = Hribinski udari v odvisnosti od vrste jeklenih podpornih lokov v premogovniku Velenje. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2017, let. 51, št. 1, str. 11-18

- VUKELIČ, Željko, VULIĆ, Milivoj. Ocena in natančnost ocene 3D-položaja točk v vrtini = Evaluation of 3D positions and the positional accuracy of points within a borehole. *Geodetski vestnik : glasilo Zveze geodetov Slovenije*, ISSN 0351-0271. [Tiskana izd.], 2014, vol. 58, no. 2, str. 327-341,

- VUKELIČ, Željko, KRALJIĆ, Marijan, DERVARIČ, Evgen. Lendava - the first geothermal city in Slovenia. V: MEDVED, Milan (ur.), VULIĆ, Milivoj (ur.), LIKAR, Jakob (ur.). *eProceedings*, 5th Jubilee Balkan Mining Congress, Ohrid, Macedonia, 18th-21st September 2013. Skopje: Association of mining and geological engineers of Macedonia. 2013, str. 1-12.

- BOMBAČ, Andrej, VUKELIČ, Željko, ANŽELJ, Iztok (urednik). *Naloge in rešitve izbranih poglavij termodinamike in mehanike tekočin*. 1. izd. Ljubljana: Naravoslovnotehniška fakulteta, Oddelek za geotehnologijo in rudarstvo, 2002.

- VUKELIČ, Željko, SUPOVEC, Ivan, TANCAR, Martin. *Program izdelave vrtin JUG-48/09 in JUG-49/09*. Ljubljana: HGEM, d.o.o., julij 2009. 7 f., 2 pril. [COBISS.SI-ID1436255] [tip COBISS: 2.13 Elaborat, predštudija, študija]

(3)Strokovno delo:

- Član upravnega odbora Inštituta za rudarstvo, geotehnologijo in okolje

(4)Priznanja in sodelovanje v mednarodnih organizacijah:

- Predsednik matične sekcije rudarjev in geotehnologov IZS

graduate and post-graduate studies the following courses/subjects: Fundamentals of Mechanical Engineering, Geothermal Energy, Energy Policy, Geothermal Energy Use, Research Drilling, Machines and devices in geotechnology.

(2)Research work:

As the author or a co-author he published more than 100 scientific and professional papers and 2 monographs, I`m author of more than 20 successfully realized economic projects, studies and investment programs in mining industry and environmental projects.

Selected research publications:

-ŠPORIN, Jurij, MRVAR, Primož, PETRIČ, Mitja, VIŽINTIN, Goran, VUKELIČ, Željko. The characterization of wear in roller cone drill bit by rock material - sandstone. *Journal of petroleum science & engineering*, ISSN 0920-4105. [Print ed.], 2019, vol. 173, str. 1355-1367,

-VUKELIČ, Željko, DERVARIČ, Evgen, ŠPORIN, Jurij, VIŽINTIN, Goran. The development of dewatering predictions of the Velenje coalmine. *Energies*, ISSN 1996-1073, 2016, vol. 9, no.9, 9 str

- VIŽINTIN, Goran, MAYER, Janez, LAJLAR, Bojan, VUKELIČ, Željko. Rock burst dependency on the type of steel arch support in the Velenje mine = Hribinski udari v odvisnosti od vrste jeklenih podpornih lokov v premogovniku Velenje. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2017, let. 51, št. 1, str. 11-18

- VUKELIČ, Željko, VULIĆ, Milivoj. Ocena in natančnost ocene 3D-položaja točk v vrtini = Evaluation of 3D positions and the positional accuracy of points within a borehole. *Geodetski vestnik : glasilo Zveze geodetov Slovenije*, ISSN 0351-0271. [Tiskana izd.], 2014, vol. 58, no. 2, str. 327-341,

- VUKELIČ, Željko, KRALJIĆ, Marijan, DERVARIČ, Evgen. Lendava - the first geothermal city in Slovenia. V: MEDVED, Milan (ur.), VULIĆ, Milivoj (ur.), LIKAR, Jakob (ur.). *eProceedings*, 5th Jubilee Balkan Mining Congress, Ohrid, Macedonia, 18th-21st September 2013. Skopje: Association of mining and geological engineers of Macedonia. 2013, str. 1-12.

- BOMBAČ, Andrej, VUKELIČ, Željko, ANŽELJ, Iztok (urednik). *Naloge in rešitve izbranih poglavij termodinamike in mehanike tekočin*. 1. izd. Ljubljana: Naravoslovnotehniška fakulteta, Oddelek za geotehnologijo in rudarstvo, 2002.

- VUKELIČ, Željko, SUPOVEC, Ivan, TANCAR, Martin. *Program izdelave vrtin JUG-48/09 in JUG-49/09*. Ljubljana: HGEM, d.o.o., julij 2009. 7 f., 2 pril. [COBISS.SI-ID1436255] [tip COBISS: 2.13 Elaborat, predštudija, študija]

(3)Professional work:

- Member of the board of the Institute for Mining, Geotechnology and Environment

(4)Awards and participation in international organizations:

- Predsednik Komisije za izobraževanje IZS - Član UO IZS - Član geotehničnega in hidrotehničnega sveta ARAO - Član Svetovne inženirske organizacije - Član Mednarodne zveze naftnih inženirjev - Redni član Balkanske akademije rudarskih znanosti	- President of the Section of Mining and Geotechnology Engineers SCE (Slovenian Chamber of Engineers), - Member of the Executive Board of SCE, - Chairman of the Academy of Education SCE, - Member of the ARAO Geotechnical and Hydrotechnical Council, - Member of WFEO (International Engineering Organization), - Member of the SPE (International Association of Petroleum Engineers) - Member of Balkan Academy of Mining Sciences.