UČNI NAČRTI PREDMETOV

INTERDISICIPLINARNI DOKTORSKI ŠTUDIJSKI PROGRAM

VARSTVO OKOLJA

Ljubljana, marec 2014

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METODOLOŠKI PREDMET

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Interdisciplinarno znanstveno raziskovalno delo**
Course title:	Interdisciplinary Scientific Research Work

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Metodološki predmet/ Methodological course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
45	**15**	**/**	**/**	**190**	**/**	**10**

Nosilec predmeta / Lecturer:	**Mihael J. Toman,** Gregor Anderluh, Andrej Blejec, Mitja Brilly, Mitja Hafner Fink, Matjaž Mikoš, Dušan Plut, Marko Polič, Jože Rakovec, Andrej Ule

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij	Enrolment in doctoral studies

Vsebina:	**Content (Syllabus outline):**
Preverjanje znanstvenih hipotez in teorij v interdisciplinarnem smislu na področju okoljskih ved. Glavne teme: znanstvene metode, induktivne in deduktivne metode, kvalitativne in kvantitativne metode, opazovanje in eksperimenti, laboratorijske in terenske raziskave, analize in sinteza, testiranje hipotez in znanstvena razlaga. Terenske ekološke raziskave z vidika kvantitativnih in kvalitativnih vzorcev. Multivariatne in klasterske analize in metode prikazane na konkretnih ekoloških znanstvenih in aplikativnih raziskavah v različnih ekosistemih. Predstavitev organiziranja raziskovalnega dela na enem od bioloških in medicinskih področij. Značilnosti temeljnega, uporabnega in razvojnega raziskovalnega dela. Predstavitev Science Citation Index (SCI) in Social Sciences Citation Index (SSCI). Uporaba Web of Science, COBBIS in SICRIS. Spoznavanje baz podatkov (Swiss-Prot, PIR, OWL, GeneBank, EMBL, DDBJ) ter orodja za iskanje v teh bazah (npr. ENTREZ, BLAST, FASTA). Spoznavanje tehnologije raziskovalnega procesa v meteorologiji. Kritičen pogled na statistične metode, ki jih potrebujemo pri opisu variabilnih in nepredvidljivih pojavov, metode parametričnega in neparametričnega statističnega preverjanja hipotez ter uporabo statističnih metod v spremljanju kvalitete procesov (monitoring). Povezovanje prostorskih in humanističnih znanstveno raziskovalnih metod. Spoznavanje ključnih družboslovnih raziskovalnih strategij – kvalitativnega in kvantitativnega raziskovanja. Poseben poudarek na timskem delu v znanosti.	Testing of scientific theories from the interdisciplinary point of view in the filed of environment sciences. The main topics: scientific methods, inductive and deductive methods, qualitative and quantitative methods, observation and experiments, laboratory and field research, analises and synthesis, hypothesis testing and scientific explanation. Field ecological research using qualitative and quantitative samples. Multivariate and claster analyses and methods showm in real ecological scientific and applied research in different ecosystems. Presentation of organising research work in the field of biology and medicine. Features of basic, applied and evolutionary research work. Presentation of Science Citation Index (SCI) and Social Sciences Citation Index (SSCI). Use of Web of Science, COBBIS in SICRIS. Learning about databases (Swiss-Prot, PIR, OWL, GeneBank, EMBL, DDBJ) and tools for searching the data bases (e.g. ENTREZ, BLAST, FASTA). Learning research proceses in meteorological echnologies. Critical view to statistic methods, useful in the interpratation of variable and unpredictable phenomena, methods of parametric and non-parametric statistical verification of hypothesis. Use of statistical methods in evaluating priocess quality (monitoring). Integration of spatial and humanistic scientific methods. Learn about key social research strategies – gualitative and quantitative research. Special emphasis on teamwork in science.

Temeljni literatura in viri / Readings:

Feyerabend, P. (1978): Against Method, Outline of an Anarchistic Theory of Knowledge. Verso, London
- Gauch, H.G. (2002): Scientific Method in Practice. Cambridge : Cambridge University Press,
- Kitcher, Ph. (1993): The Advancement of Science, Oxford University Press, April 1993
- Moran, J. (2001): Interdisciplinarity (The New Critical Idiom). Oxford: Routledge.
- Newton-Smith, W. H. (1990): The Rationality of Science. London: Routledge.
- Rouse, J. (2003): How Scientific Practices Matter. Chicago: University of Chicago Press
- Ziman, J. (2000): Real Science: What it is, and What it Means. Cambridge, Uk: Cambridge University Press

Cilji in kompetence:	**Objectives and competences:**
Kandidati bodo pridobili temeljna načela in osnovne metode in tehnike za raziskovalno delo. Študenti se bodo naučili pripraviti dobre projekte in dobre znanstvene članke.	Candidates will acguire the core principles and the basic metdods and techniques for scientific and research work. Students will learn how to prepare good project and how to write good quality research articles.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Raziskovalno delo na področju varstva okolja Priprava projektov Pisanje znanstvenih člankov	Knowledge and understanding: Research work on environment protection Project preparation Research articles

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo PP prezentacije Razprave na predavanjih Predstavitve seminarskih nalog z razpravo	Lectures using PP presentation Lectures discussion Seminar presentation and discussion

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
pisni izpit	**40%**	Examination
projekt	**60%**	Project

Reference nosilca / Lecturer's references:

Mihael Jožef Toman

ŽIŽEK, Suzana, HORVAT, Milena, GIBIČAR, Darija, FAJON, Vesna, **TOMAN, Mihael Jožef**. Bioaccumulation of mercury in benthic communities of a river ecosystem affected by mercury mining. *Sci. total environ.*, 2007, vol. 377, issues 2-3, str. 407-415

PUST, Mojca, **TOMAN, Mihael Jožef**. Quantitative analysis of the macroinvertebrate community in the river Temenica(SE Slovenia) = Kvantitativna analiza združbe makroinvertebratov v reki temenici (JV Sklovenija). *Acta biol. slov.*, 2006, letn. 49, št. 2, str. 23-32.

TOMAN, Mihael Jožef. Biological assessment of wastewater treatment plant conditions using sludge biotic index. *Verh. - Int. Ver. Theor. Angew. Limnol.*, 2002, letn. 28, str. 692-694.

Gregor Anderluh

ANDERLUH, G., Beseničar, M., Kladnik, A., et al**.,** 2005**.** Properties of non-fused liposomes immobilized on an L1 Biacore chip and their permeabilization by a eukaryotic pore-forming toxin. Anal. Biochem. 344 (1)**:** 43-52**.**

Berne S, Sepčič K, **Anderluh G**, et al**.,** 2005. Effect of pH on the pore forming activity and conformational stability of ostreolysin, a lipid raft-binding protein from the edible mushroom Pleurotas ostreatus. Biochemistry, 44(33): 11137-11147.

Gokce I, Woody RW, **ANDERLUH G**, et al**.,** 2005**.** Single peptide bonds exhibit poly(pro)II ("random coil") circular dichroism spectra**.** J. Am. Chem. Soc**:** 127 **(**27): 9700-9701.

Andrej Blejec

Lah Turnšek, T., Čerček, M., **BLEJEC, A.,** Kos, J., Gorodetsky, E., Somers, R., Daskal, L. Cathepsin B, a prognostic indicator in lymph node-negative breast carcinoma patients: comparison with cathepsin D, cathepsin L, and other clinical indicators. Clin Cancer Res, 2000, vol. 6, 578-584.

BLEJEC, A. Statistical method for detection of firing rate changes in spontaneously active neurons. Neurocomputing (Amst.), 2005, 65/66: 557-563.

Valentinčič, T., Metelko, J., Ota, D., Pirc, V. and **BLEJEC, A**., 2000: Olfactory discrimination of amino acids in brown bullhead catfish. Chem. Senses, 25(1): 21-29.

Mitja Brilly

MIKOŠ, M., Vidmar, A., **Brilly, M**., 2005**.** Using a laser measurement system for monitoring morphological changes on the Strug rock fall, Slovenia. Natural hazards and earth system sciences 5 **(**1**):** 143-153**.**

MIKOŠ, M., Cetina, M., **Brilly, M**., 2004. Hydrologic conditions responsible for triggering the Stoze landslide, Slovenia. Engineering geology, 73 **(**3-4**):** 193-213.

Šraj, M., Dirnbek, L., **Brilly, M.** The influence of effective rainfall on modeled runoff hydrograph. *Journal of Hydrology and Hydromechanics*, 2010, 58, (1): 3-14.

Mitja Hafner Fink

HAFNER-FINK, Mitja. Odnos javnosti do znanosti in tehnologije: kakovost merjenja tega odnosa v okviru javnomnenjske ankete (primer raziskave Slovensko javno mnenje). *Družbosl. razpr. (Tisk. izd.)*. [Tiskana izd.], avgust/december 2004, letn. 20, št. 46/47, str. 61-80.

UHAN, Samo, **HAFNER-FINK, Mitja.** Večrazsežnostne lestvice in vplivi konteksta na odgovore v družboslovnih anketnih raziskavah. *Družbosl. razpr. (Tisk. izd.)*. [Tiskana izd.], avg./dec. 2005, letn. 21, št. 49/50, str. 65-83.

MEDVEŠEK, Mojca, **HAFNER-FINK, Mitja**. Opis poteka raziskave percepcije slovenske integracijske politike. V: KOMAC, Miran (ur.). *Priseljenci : študije o priseljevanju in vključevanju v slovensko družbo*. 1. natis. Ljubljana: Inštitut za narodnostna vprašanja, 2007, str. 479-508.

Matjaž Mikoš

MIKOŠ, M., Vidmar, A., Brilly, M., 2005**.** Using a laser measurement system for monitoring morphological changes on the Strug rock fall, Slovenia. Natural hazards and earth system sciences, 5 **(**1**):** 143-153**.**

Petkovšek, G**., MIKOŠ, M**., 2004. Estimating the R factor from daily rainfall data in the sub-Mediterranean climate of southwest Slovenia**.** Hydrological sciences journal-journal des sciences hydrologiques, 49 (5)**:** 869-877.

MIKOŠ, M., Cetina, M., Brilly, M., 2004. Hydrologic conditions responsible for triggering the Stoze landslide, Slovenia. Engineering geology, 73 **(**3-4**):** 193-213.

Dušan Plut

PLUT, D., 2000. Environmental Challenges of Europe: The State of Environmnet and Environmental Trends in the EU (EU 15) and the Accession Coutries (AC 10). Geojournal 52 (2): 149-155. ISSN 0343-2521

PLUT, D., 2002, Concepts of Global Assessment of Environmental Limits on Material Activity of the Humankind. Moravian Geographical Reports 10 (1): 2-7. ISSN 1210-8812

PLUT, D., Špes, M., Brečko, V., 2000. Slovenia-Country Studies-Northern Group. Environmental Problems of East Central Europe (Edited by F.W. Carter and D. Turnock), Routledge Studies of Societies in Transition: 228-247.

Marko Polič

POLIČ, Marko, MARUŠIČ, Janez, KOS, Drago, NATEK, Karel. People-environment studies in Slovenia: past and prospects. V: MARTENS, Bob (ur.), KEUL, Alexander G. (ur.). *Designing social innovation: planning, building, evaluating*. Toronto: Hogrefe, cop. 2005, str. 17-26.

POLIČ, Marko, MAVER, Jasna, ZABUKOVEC, Vlasta, ŽUGELJ, Urška. The roles of academic libraries in present and in future: a facet analysis. V: LEVY, Shlomit (ur.). *Facet theory: towards cumulative social science*. Ljubljana: Filozofska fakulteta, Center za pedagoško izobraževanje: = Faculty of Arts, Center for Educational Development, 2003, str. 163-173.

BRILLY, Mitja, **POLIČ, Marko**. Public perception of flood risks, flood forecasting and mitigation. *Nat. hazards earth syst. sci. (Print)*, 2005, vol. 5, no. 3, str. 345-355.

Jože Rakovec
Žagar, N., Žagar, M., Cedilnik, J., Gregorič, G., **RAKOVEC, J.,** 2006. Validation of mesoscale low-level winds obtained by dynamical downscaling of ERA40 over complex terrain
Author(s): Source: Tellus series a-dynamic meteorology and oceanography, 58 (4)**:** 445-455.
RAKOVEC, J. VERTAČNIK, Gregor. Precipitation indexes for small regions on teh southern side of the Alps. *Meteorol. Z. (Berl.)*, 2006, 15, str. 225-236.
ŽABKAR, Rahela, **RAKOVEC, J.,** GABERŠEK, Saša: A trajectory analysis of summertime ozone pollution in Slovenia. V tisku *Geofizika*, 2008, vol. 25.

Andrej Ule
Primorac, Z., **ULE, A**. (2006): Mjesto i uloga metafora i analogija u kompleksnom i pojmovnom mišljenju. Prolegomena, Zagreb, god. 5, br. 1, str. [29]-51.
ULE, A. (2003): Razlozi Popperovog znanstvenog realizma. Revija za sociologiju, letn. 34, št. 1/2, str. 9-21.
ULE, A. (2005): Kdaj je "kopernikanska" revolucija postala znanstvena revolucija?. Filoz. vestn. letn. 26, št. 1, str. 29-44.

TEMELJNI PREDMETI

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKOLOGIJA Z VARSTVOM NARAVE**
Course title:	ECOLOGY WITH NATURE CONSERVATION

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet/ Core course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	**Mihael J. Toman**, Alenka Gaberščik, Ivan Kos

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij Varstvo okolja.	Enrolment in the doctoral study Environment protection.

Vsebina:	**Content (Syllabus outline):**
Ekologija (začetki ekologije in njen razvoj, pomen za človeka, nove usmeritve ekologije-ekologija in trajnostni razvoj). Osnove ekologije (znanstvene osnove, koncept ekosistema, pretok energije in kroženje snovi, odziv organizmov na abiotske in biotske dejavnike, omejitve okolja, aklimatizacija in adaptacija, kompeticija in sukcesija). Atmosfera (zgradba, spremembe v Zemeljini zgodvini). Celinske vode (abiotski in biotski dejavniki, stoječe in tekoče vode, omejujoči dejavniki biološke produkcije, življenski prostori in življenske združbe v vodnih telesih).	Ecology (ecology and its development, new trends in ecology, sustainable development) Fundamentals of ecology (scientific basis, concept of ecosystem, through flow of energy and nutrient cycling, the response of organisms to abiotic and biotic factors, acclimation and adaptation, competition and succession) Atmosphere (structure and changes in Earth history) Inland waters (abiotic and biotic parameters, standing and running waters, factor constraining production, habitats, communities in water bodies) Terrestrial environment (biomes, ecosystem

Kopensko okolje (osnovni biomi, značilnosti in raznolikosti ekosistemov v Evropi in Sloveniji). Sevanje in klima (globalne razmere na zemlji, v Evropi in posebnosti v Sloveniji, vpliv klime, topoklime in mikroklime ter svetlobe na organizme, populacije in ekosisteme). Primarna produkcija-osnovni proces tvorbe organskih snovi na Zemlji (vloga rastlin v ekosistemih, vpliv vegetacije na energetsko bilanco in kroženje vode, rastline vezane na posebna rastišča). Živalske združbe kot del življenskih združb ter vloga v ekosistemu (trofična organiziranost ekosistemov, pretok energije in kroženje snovi ter specifična vloga živali). Biodiverziteta-osnova stabilnosti ekosistemov (grožnje biodiverziteti, tujerodni organizmi, ohranjanje biodiverzitete). Stres-motnja ali sindrom-naravne omejitve okolja (sevanje, skrajne temperature, poplavljenje, suša, slana okolja). Človek in okolje (obremenjevanje in degradacija okolja, lokalne in globalne spremembe okolja). Upravljanje z naravnim okoljem in načrtovanje trajnostnega razvoja.	properties and diversity in Europe and Slovenia) Radiation and climate (global environment on Earth, influence of climate, regional climate, microclimate and radiation on organisms, populations and ecosystems). Primary productivity, the basic process of organic matter production on Earth (the role of plants in ecosystems, the influence of vegetation on energy balance and water cycling, plants of different habitats). Animal communities as a part of biotic communities and their role in ecosystems (trophic organisation of ecosystems, trough flow of energy and cycling of matter, specific role of animals). Biodiversity as a basis for ecosystem stability (threats to biodiversity, alien organisms, biodiversity conservation). Stress and natural constraint of environment (radiation, extreme temperatures, floods, drought, saline environment). Man and environment (pollution and environment degradation, local and global changes of environment). Nature management and sustainable development planning.

Temeljni literatura in viri / Readings:

Smith, R.L., Smith, T.M., 2001. Ecology and Field Biology. Addison Wesley Longman, Benjamin Cummings, 699-720, ISBN 0-321-04290-5

Gaston, J. K., Spicer, J. I., 2004. Biodiversity - An Introduction. Second edition, Blackwell Publishing, 1-16, 91-180. ISBN 1-4051-1857-1

Pullin, A. S. 2002. Conservation Biology, University Press Cambridge, 53-136, 150-251, ISBN 0-521-64284

Costanza R. Ecosystem services: Multiple classification systems are needed *Biological Conservation*, *Volume 141, Issue 2*, *February 2008*, *Pages 350-352.*

De Laender F., De Schamphelaere K. A.C.,. Vanrolleghem, P. A., Janssen, C. R. Is ecosystem structure the target of concern in ecological effect assessments? *Water Research*, *Volume 42, Issues 10-11*, *May 2008*, *Pages 2395-2402.*

Lawton J.H. 2000. Community Ecology in Changing World. In: Kinne O (ed) Excellence in ecology. Book 11. International Ecology Institute, Oldendorf/Luhe

Maestre, C. F. T., Vallejo R., Baeza M. J., Valdecantos, A. Pérez-Devesa, M. . Ecosystem structure, function, and restoration success: Are they related? *Journal for Nature Conservation*, *Volume 14, Issues 3-4*, *20 September 2006*, *Pages 152-160.*

Mitsch, W.J., Gosselink, J.G. Wetlands. John Wiley & Sons, Inc., 2007, 582 p.

Odum H. T.. Explanations of ecological relationships with energy systems concepts. *Ecological Modelling*, *Volume 158, Issue 3*, *31 December 2002*, *Pages 201-211.*

Oren, A. Molecular ecology of extremely halophilic Archaea and Bacteria. *FEMS Microbiology Ecology*, *Volume 39, Issue 1*, *January 2002*, *Pages 1-7.*

Rapport, D. J., Costanza, R, . McMichael, A. J. Assessing ecosystem health. *Trends in Ecology & Evolution*, *Volume 13, Issue 10*, *1 October 1998*, *Pages 397*

Cilji in kompetence:	**Objectives and competences:**
Pridobivanje znanja o naravi in delovanju abiotskih in biotskih dejavnikov na organizme. Razumevanje energijske, materialne in funkcionalne povezanosti med posameznimi komponentami ekosistemov in posledice delovanja človeka. Seznanjanje z izbranimi ekosistemi in s problemi onesnaževanja, obremenjevanja in degradacije okolja in naravne dediščine zaradi človekovega delovanja. Spoznavanje teženj onesnaževanja in spreminjanja okolja in ukrepov za zmanjšanje škodljivih učinkov.	Students will gain knowledge on nature as well as influences of biotic and abiotic parameters on organisms. They will become aware of the energetic, material and functional relations among the components of ecosystems. They will gain knowledge about specific ecosystems and problems of pollution and environment degradation, as well as natural heritage due to human impacts. They will be able to recognize, explain and discuss the trends of pollution and changes in ecosystems and measures to mitigate the effects.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poznavanje osnovnih zakonitosti naravnih sistemov. Uporaba: Razumevanje kompleksnosti našega okolja, dinamike ekosistemov, človekovih vplivov na okolje in njihovih posledic. Refleksija: Aplikacija znanj o nižjih nivojih naravnih sistemov na nivoju ekosistema. Prenosljive spretnosti – niso vezane le na en predmet: Uporaba domače in tuje literature in drugih virov, zbiranje in razlaga podatkov, analiza podatkov pridobljenih z meritvami, njihova sinteza in pisanje poročil, delo v skupini.	Knowledge and understanding. Students will gain a comprehensive overview on basic principles of natural systems. Application. They will understand the complexity of environment, ecosystem dynamic, human influences and its consequences. Reflection. The application of the knowledge about lower organizational levels to higher levels of ecosystem. Transferable skills. The use of Slovenian and foreign literature and other sources, gathering and interpretation of results, analyses of data, their synthesis, writing reports, working in a group.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predmet se izvaja v obliki predavanj in seminarjev. Predavanja so interaktivna s predstavitvijo novih znanj ter aktivnim povezovanjem novega in že obstoječega znanja v skupnih razpravah.	The course includes lectures in seminars. Lectures are interactive with the presentation of new skills, and active integration of new and existing knowledge in joint discussions.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit Seminar Oddano poročilo o opravljenih vajah od 6-10 (pozitivno) oz. 1-5 (negativno)	**50%** **50%**	Exam: written Seminar Grading scale: from 1-10: 1-5 (negative) and 6-10 (positive).

Reference nosilca / Lecturer's references:

prof. dr. Mihael J. Toman:

1. URBANIČ, Gorazd, **TOMAN, Mihael Jožef**, KRUŠNIK, Ciril. Microhabitat type selection of caddisfly larvae (Insecta: Trichoptera) in a shallow lowland stream. Hydrobiologia (Den Haag), 2005, vol. 541, str. 1-12.
2. URBANIČ, Gorazd, **TOMAN, Mihael Jožef**. Influence of environmental variables on stream caddis larvae in three Slovenian ecoregions: Alps, Dinaric western Balkans and Pannonian lowland. Int. rev. hydrobiol.. [Print ed.], 2007, letn. 92, št. 4-5, str. 582-602.
3. ŽIŽEK, Suzana, HORVAT, Milena, GIBIČAR, Darija, FAJON, Vesna, **TOMAN, Mihael Jožef**. Bioaccumulation of mercury in benthic communities of a river ecosystem affected by mercury mining. Sci. total environ.. [Print ed.], 2007, vol. 377, str. 407-415.

prof. dr. Alenka Gaberščik:

1. URBANC-BERČIČ, Olga, **GABERŠČIK, Alenka**. The relationship of the processes in the rhizosphere of common reed Phragmites australis, (Cav.) Trin. ex Steudel to water fluctuation. Int. rev. hydrobiol.. [Print ed.], 2004, letn. 89, št. 5-6, str. 500-507.
2. KRŽIČ, Nina, **GABERŠČIK, Alenka**. Photochemical efficiency of amphibious plants in an intermittent lake. Aquat. bot.. [Print ed.], 2005, letn. 83, str. 281-288.
3. KUHAR, Urška, GREGORC, Tatjana, RENČELJ, Miran, KRŽIČ, Nina, **GABERŠČIK, Alenka**. Distribution of macrophytes and condition of the physical environment of streams flowing through agricultural landscape in north-eastern Slovenia. Limnol., 2007, vol. 37, str. 146-154.

prof. dr. Ivan Kos:

1. POTOČNIK, Hubert, KLJUN, Franc, RAČNIK, Joško, SKRBINŠEK, Tomaž, ADAMIČ, Miha, **KOS, Ivan**. Experience obtained from box trapping and handling wildcats in Slovenia. Acta Theriol., 2002, vol. 47, no. 2, str. 211-219.
2. RAČNIK, Joško, SKRBINŠEK, Tomaž, TOZON, Nataša, NEMEC, Alenka, POTOČNIK, Hubert, KLJUN, Franc, **KOS, Ivan**, BIDOVEC, Andrej. Blood and urine values of free-living European wild cats in Slovenia. Z. Jagdwiss., 2004, vol. 50, no. 1, str. 44-47.
3. GRGIČ, Tanja, **KOS, Ivan**. Influence of forest development phase on centipede diversity in managed beech forests in Slovenia. Biodivers. Conserv., 2005, letn. 14, št. 8, str. 1841-1862.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKONOMIKA IN PRAVO OKOLJSKEGA MANAGEMENTA**
Coursetitle:	Economic and Law of Environmental Managment

Študijski program in stopnja Studyprogrammeandlevel	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
InterdisciplinaryDoctoralProgramme in EnvironmentalProtection	**/**	**1, 2**	**/**

Vrsta predmeta / Coursetype Temeljni predmet/ Core course

Univerzitetna koda predmeta / Universitycoursecode: /

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
7	**3**				**240**	**10**

Nosilec predmeta / Lecturer: Bogomir Kovač, Senko Pličanič

Jeziki / Languages: slovenski		
	Predavanja / Lectures:	**Slovenski, angleški Slovenian/ English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Ni posebnih pogojev.	No special requirements

Vsebina:	**Content (Syllabusoutline):**
Vsebina predmeta: 1. Ekonomski vidiki varstva okolja. Okolje in trajnostni razvoj. Regulacija in samoregulacija ekonomskih sistemov. Stroški in okoljska učinkovitost. Problem družbenih stroškov. Ekološke in ekonomske politike. Politična ekonomija izrabe naravnih virov. 2. Pravni okviri trajnostnega razvoja. Okoljske institucije in razvoj zakonodaje. Regulacija in samoregulacija pravno ekonomskih sistemov. Okoljska regulacija in konkurenčnost. 3. Evropski okoljski pravni red. Evropske okoljske razmere. Globalne institucije. Multilateralni okoljski sporazumi. Stroški okoljske učinkovitosti in tržni instrumentarij.	Course content: 1. Economics and Environmental Protection. Environment and Sustainable Development. Regulation and Self-Regulation. The Problem of Social Cost. Ecological and Economic Policies. Political Economy of Natural Resource Extraction. 2. Legal Framework for Sustainable Development. Environmental Institutions and Legislation. Regulation and Self-Regulation of Legal Systems. Environmental Regulation and Competitiveness 3. European Environmental Legal System. European Environmental Conditions. Global Environmental Institutions. Multilateral Environmental Agreements. Costs and Benefits of Environmental Efficiency and Market Mechanism

4. Slovenski okoljski pravni red. Okoljska regulacija 2000-2010. Okoljske strategije in politike. Koncept zelene reforme. 5. Institucionalno okolje in okoljski managerski sistemi. Managerianje okoljskih sistemov. Trajnostni razvoj in organizacije. Kontingetno vrednotenje. Vrednost vsakdanjega življenja s pravnega vidika. 6. Managerska orodja za okoljski ekonomski in pravni management. Strateško vrednotenje in obvladovanje tveganj. Komuniciranje z deležniki. 7. Ključne okoljske teme in managiranje rešitev. Onesnaženje, biodiverziteta, klimatske spremembe in energetika. Okoljska prihodbnsot in tragedija skupnega. Vpliv ekonomije in prava na managerske okoljske politike.	4. Slovenian Legal Framework for Environmental Protection. Environmental Regulation 2000-2010. Environmental Strategies and Public Policies. Green Reform Concept. 5. Institutional Environment and Environmental Managerial Systems. Managing Environmental Systems. Organizations and Sustainable Development. Contingency Valuation. Legal Aspect of Statistical Value of Life. 6. Managerial Tools for Environmental Economics, Law and Management. Strategic Evaluation and Risk Assessment. Stakeholder Communication. 7. Key Topics and Managing Solutions. Pollution, Biodiversity, Climate Change, Energy Economics, Environmental Future and Tragedy of the Commons. Economic and Legal Effects on Managerial Environmental Policies.

Temeljni literatura in viri / Readings:

- R. Turner, D.Pearce, Environmental Economics, Prentica Hall, London, (1994), 2007
- Burns,Witoszek,Burtland Report Revisited, Journal of Human Ecology, 2012, 39
- A. Magerholm, Environmental Management Tools and their Applications Environmental, NTNU, 2010
- John Brady, Environmental management in organizaitons, IEMA, Earthscan, London: 2005
- R. Lopez, M. Toman, Economic development&Environmental Sustainability, New Policy Options, Oxford UP, 2006
- Okoljsko poročilo za celovito presojo vplivov na okolje, Vlada RS, 2012
- Ustava RS
- zakonodaja s področja varstva okolja,prostorskega načrtovanja
- aktualni tekoči članki
- zapiski predavanj

Cilji in kompetence:	**Objectives and competences:**
Predmet razvija ekonomska in pravna znanja s področja managementa okolja na ravni organizacij (podjetje, lokalne skupnosti, država). Razumevanje logike pravnega in ekonomskega okolja, uporaba orodij okoljskega menedžmenta pri reševanju okoljskih problemov, oblikovanje strateških vidikov trajnostnega razvoja.	To develop economic and legal knowledge of environmental management on different layers of organization. To understand the logic behind economic and legal environment. To apply the tools of environmental management in solving environmental problems. To facilitate the understanding of strategic aspects of sustainable development

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje okoljskih problemov in politik za njihovo reševanje. Rešitve posameznih problemov s pravnega in ekonomskega vidika. Analiza in uporaba različnih analitičnih orodij pri reševanju okoljskih problemov.	Knowledge and understanding: Understanding environmental issues and policies to tackle environmental dilemmas Problem solutions from a legal and economic standpoint Analysis and the use of analytical tools in solving environmental issues

Metode poučevanja in učenja:	**Learningandteachingmethods:**
Predavanja, seminarsko delo, vaje v obliki debatnih diskusij Obravnava problemov iz managerske prakse. Analiza pravnih in ekonomskih vsebin okoljskih politik na državni in lokalni ravni.	Lectures, paper assignment, problem sets based on debate and discussion Discussion of key managerial issues Analysis of legal and economic aspects of environmental policies at different layers of government

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit	**70%**	Written assignment
Seminarsko delo	**30%**	Paper assigment

Reference nosilca / Lecturer's references:

1.Senko Pličanič, 2012, The Law of Sustainable Development – recent trends and developments; objavljen referat na mednarodni konferenci: Law and Society Association The Law and Society Association; Hawaii, Honolulu, USA, 1.6.2012.
2..Senko Pličanič, 2010, The Role of State in Facing Climate Change., objavljen referat na mednarodni konferenci: Law and Society Association, Ilinois, Chicago, USA, 27.5. 2010.
3.Senko Pličanič, 2004, Temelji ekološkega prava: (kako uzakoniti zmernost pri človekovih odnosih z živalmi, rastlinami in neživim svetom), (Zbirka Scientia iustitia,), Ljubljana, Cankarjeva založba.

1. Janez Cerar, Bogomir Kovač, Transdisciplinary and circumstances for finding sustainable development solutions, M Sphere, Dubrovnik, 2012
2. Bogomir Kovač, Podnebne spremembe in vpliv na menedžment sprememb – primer PS Gorenje, Gorenje Velenje, Velenje, 2009
3. Green economy and pricing climate change, WP, Carlifornian Conservation Foundation - CCF, Berkley, 2008

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**KEMIJA IN TEHNOLOGIJA OKOLJA**
Course title:	ENVIRONMENTAL CHEMISTRY AND TECHNOLOGY

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet/ Core course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
50	**10**				**190**	**10**

Nosilec predmeta / Lecturer:	**Andreja Žgajnar Gotvajn**

Jeziki / Languages:		
	Predavanja / Lectures:	**Slovenski, angleški / Slovenian, English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Diplomanti študijskih programov tehniške ali naravoslovne smeri	Finished second level of university study in technical or natural sciences.

Vsebina:	**Content (Syllabus outline):**
– *Prenos snovi in energije. Kemija okolja. Ekosistem*, trajnostni razvoj, vplivi človeka, inženirski pristop, etična izbira, ekonomski principi. – *Onesnaženje:* viri, tipične vrste in vplivi onesnaženja, dinamika onesnaženja, mehanizmi transporta, elementi in principi ekologije, kinetika (bio)kemijskih reakcij, večfazni sistemi in interakcije, masne in toplotne bilance ekosistemov, zakonodaja. – *VODE: Vrednotenje kvalitete vod:* vzorčevanje in osnovne preiskave ter njihov pomen. *Preskrba z vodo:* hidrološki cikel, podtalnica in površinske vode kot vir za pridobivanje pitne vode, priprava vode,	– *Mass and energy transfer. Environmental chemistry. Ecosystem*, sustainability, human impacts, engineering aproaches, ethics and engineering decisions, economics and the environment. – *Pollutants*: origins, types, effects, fate in the environment, transport mechanisms, transformation, elements and principles of ecology, kinetics of (bio)chemical reactions and interactions. Mass and energy balances in the environment. Legislation. – *WATER. Water quality assessment:* sampling, basic investigation. *Water supply and treatment.* Hidrological cycle, resources – groundwater and surface water and their

koagulacija in flokulacija, usedanje, filtracija, desinfekcija. *Procesne vode:* hladilne vode, energetske vode (napajalne vode, kotlovne vode, kondenzat). *Odpadne vode:* zbiranje odpadnih vod, vrste in karakteristike odpadnih vod, čiščenje odpadnih vod. *Obdelava in odlaganje blata iz čistilnih naprav:* stabilizacija, zgoščevanje in odvodnavanje, kompostiranje, deponije, sežig. *Zakonodaja.*

- *TRDNI ODPADKI. Komunalni trdni odpadki:* zbiranje, možnosti dispozicije, sanitarne deponije, zmanjšanje volumna pred odlaganjem. *Recikliranje odpadkov:* separacija pri viru, procesi seaparacije trdnih odpadkov. *Nevarni odpadki:* problematika, procesiranje, ravnanje, transport, možnosti recikliranja, naprave za upravljanje z nevarnimi odpadki: izbira lokacije, incineratorji, deponije. *Zakonodaja.*
- *ZRAK. Onesnaženje zraka*: tipi onesnaženja, viri onesnaženja, primarni in sekundarni polutanti, vpliv na zdravje ljudi, vegetacijo, živali, materiale in atmosfero. *Meteorologija in onesnaženje zraka:* horizontalna in vertikalna disperzija polutantov, atmosferska disperzija, čiščenje atmosfere. *Kontrola onesnaženja zraka:* korekcije pri viru nastajanja, recikliranje, čiščenje. *Zakonodaja.*

treatment-coagulation, flocculation, sedimentation, filtration, disinfection. *Process water:* steam production and cooling water treatment. *Wastewater:* collection, types and characteristics, treatment. *Sludge treatment and disposal:* stabilisation, thickening, dewatering, composting, landfilling, vitrification, incineration. Legislation.

- *SOLID WASTE*: *municipal solid waste* collection and disposal, resource recovery. *Hazardous waste* processes and handling, resource recovery alternatives, management facilities, regulatory aspects. Remediation of contaminated soils and groundwater. Legislation.
- *AIR. Pollution:* types and sources, primary and secondary pollutants, influence on humans, vegetation, animals, materials and atmosphere. *Meteorology and air pollution:* horizontal and vertical dispersion of pollutants, atmospheric dispersion, measurement of air quality, treatment. *Air pollution control. Legislation.*
- *Practical case discussions.* The environmental isues in chemical industry.

Temeljni literatura in viri / Readings:

- Vesilind, P. A., Morgan, S. M.: *Introduction to Environmental Engineering,* 2nd Ed., Thomson Brooks/Cole, London, 2004.
- Davis, M. L, Masten, S. J.: *Principles of Environmental Engineering and Science,* McGraw-Hill, 2004.
- Masters G.M., Wendel E: *Introduction to Environmental Engineering and Science*. 3rd Ed., Prentice-Hall International, London, 2008.
- Baird,C., Cann, M.: *Environmental Chemistry*, 4th Ed., W.H. Freeman and Company, New York, 2008.
- Sawyer C.N., McCarty P.L., Parkin G.F.: *Chemistry for Environmental Engineering*, 5th Ed. McGraw-Hill, New York, 2003.
- Revijalni članki s področja, tekoča periodika, učna gradiva.

Cilji in kompetence:

Slušatelj se seznani s problematiko okolja, ki je prisotna v vsaki tovarni oziroma obratu. Pridobi si osnovna znanja, ki so potrebna za aplikativno tehnološko reševanje okoljskih problemov na področju celovitega gospodarjenja z okoljem. To pa zahteva razumevanje metod sodobne ekološke tehnologije, ki obravnavajo zakonitosti in kinetiko fizikalnih, kemijskih in biokemijskih

Objectives and competences:

To familiarise students with the principles underlying environmental protection. To recognise engineering approach as the means of realising solutions to a range of environmental issues. To provide an understanding of the practice of integrated pollution control.

procesov v naravnem okolju, čistilnih napravah ter deponijah.	

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent pridobi znanja na naslednjih področjih: – poznavanje osnovnih procesov v okolju – znanje o modernih konceptih trajnostnega razvoja: minimiziranje, recikliranje, obdelava odpadkov, koncept BAT (Best Available Technology), industrijska ekologija. – znanje o implementaciji inženirskih orodij za reševanje okoljskih problemov na področju celovitega gospodarjenja z okoljem (zrak, voda, tla) ob upoštevanju ekonomskih in etičnih kriterijev – sistematični pristop k ustvarjanju, pridobivanju in prenosu znanja v prakso.	Knowledge and understanding: – on basic environmental processes – on modern concepts of sustainable development: minimization, recycling, wastetreatment, concept of BAT (Best Available Technology), industrial ecology – on implementation of engineering tools in solving environmental problems including integrated pollution control considering economic and ethic criteria – capability for critical application of gained knowledge during solving scientific, professional and other social problems

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, konzultacije, projektno delo, seminar	Lectures, consultations, project work, seminar

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
– pisni in ustni izpit	**40%**	– examination, oral
– izdelava seminarja (projekt) z njegovo predstavitvijo in zagovorom	**40%**	– project with its presentation
– aktivna udeležba na predavanjih, seminarjih in pri drugih aktivnostih predmeta	**20%**	– active participation at lectures and other activities of the course

Reference nosilca / Lecturer's references:

doc. dr. Andreja Žgajnar Gotvajn:

1. **ŽGAJNAR GOTVAJN, Andreja**, BISTAN, Mirjana, TIŠLER, Tatjana, ENGLANDE, A. J., ZAGORC-KONČAN, Jana. The relevance of bisphenol A adsorption during Fenton's oxidation. *Int. j. environ. sci. technol. (Tehran)*, str. 1-8. http://download.springer.com/static/pdf/230/art%253A10.1007%252Fs13762-012-0153-4.pdf?auth66=1362473356_f591f7a0aaadd32780648ebe076b4b9f&ext=.pdf, doi: 10.1007/s13762-012-0153-4.
2. **ŽGAJNAR GOTVAJN, Andreja**, ZAGORC-KONČAN, Jana, DERCO, Ján, ALMÁSIOVÁ, Beáta, KASSAI, Angelika. Oxidative pretreatment of fresh and mature landfill leachate. *Journal of advanced oxidation technologies*, 2009, vol. 12, no. 1, str. 1-10, graf. prikazi.
3. KALČÍKOVÁ, Gabriela, VÁVROVÁ, Milada, ZAGORC-KONČAN, Jana, **ŽGAJNAR GOTVAJN, Andreja**. Evaluation of the hazardous impact of landfill leachates by toxicity and biodegradability tests. *Environ. technol.*, 2011, vol. 32, no. 12, str. 1345-1353, doi: 10.1080/09593330.2010.536785.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**OKOLJE, ZDRAVJE IN BLAGOSTANJE**
Course title:	ENVIRONMENT, HEALTH, AND WELLBEING

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet / Core course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**	**15**			**175**	**10**

Nosilec predmeta / Lecturer:	**Ivan Eržen**, Marko Polič, Martin Dobeic, Mirko Čudina, Marjan Bilban

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski/ angleški Slovenian/ English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Študenti doktorskega študija	PhD students
Vsebina:	**Content (Syllabus outline):**
Metodološki pristopi pri raziskovanju vplivov okolja na zdravje in blagostanje. Toksikologija in povezava med toksikologijo in epidemiologijo. Ocenjevanje tveganja za zdravje. Odnos doza-učinek. Škodljivi dejavniki in njihova narava ter vrste (mikrobiološki, kemijski, fizikalni). Možne zdravstvene zaradi izpostavljenost škodljivim dejavnikom. Pomen ravnovesja med okoljem, ljudmi in posameznimi dejavniki, ki vplivajo na zdravje in blagostanje Medsebojni vplivi človeka, živali in okolja v	Methodological approaches in the research of environmental impact on health and wellbeing. Toxicological and epidemiological approaches in assessing the health impact. Dose –effect relationship. Hazardous factors and their nature (biological, chemical and physical). Possible health effects coused due the environmental factors. The importance of the balance between environment, environmental factors and human being. Interactions between humans, animals and the environment in terms of health and

smislu zdravja in varovanja okolja Ekološko epidemiološki vidiki kmetijstva s posledično uporabo in varnostjo biogenih odpadkov in odpadnih zdravil ter vplivi na človeka in okolje z vidikov onesnaževanja zraka, tal in talnice. Elementi sistemov biovarnosti na lokalnih področjih in v globalnem prostoru Trajnostni razvoj kot socialni precep; dejavniki trajnostno usmerjenega vedenja; upravljanje s kompleksnimi sistemi; previdnostno načelo . Dojemanje okolja in odnos do njega; miselni modeli procesov v okolju; odzivi na okoljske spremembe; družbeni procesi v okolju; socialno načrtovanje; izkušnja narave in dejavniki odnosa do narave; psihologija vrednotenja okolja. Ovire za okolju prijazno vedenje; vplivanje; ozaveščanje o trajnostnem razvoju okolja; okoljsko izobraževanje. Ovire za okolju prijazno vedenje; vplivanje; ozaveščanje o trajnostnem razvoju okolja; okoljsko izobraževanje. Definicija zvoka in hrupa. Spektralna analiza hrupa. Definicije ravni, decibel in dB(A) skala. Viri hrupa, definicija in pojavne oblike. Mehanizmi nastajanja hrupa in širjenje hrupa v zraku, vodi in strukturi. Komunalni hrup. Meritev in analiza hrupa. Merjenje zvočnega tlaka, zvočne intenzivnosti in zvočne moči vira hrupa. Metode in tehnike za zmanjševanje hrupa: na mestu vira, na poti širjenja in na mestu sprejema. Vpliv hrupa na ljudi (in živali).	environmental protection Eco-epidemiological aspects of agriculture due to subsequent application and security of biogenic wastes and waste products, and to impactions on human health and environment in the aspect of the air, soil and ground water pollution. The elements of biosecurity systems in local areas and in the global arena Sustainable development as social dillema; factors of sustainable behaviour; managing complex system; precautionary principle. Perception of environment and attitudes toward it;mental models of environmental processess; reactions to environmental changes; social processess in the environment; social planning; nature experience and factor influencing attitudes toward it; psychology of environmental impact assessment. The obstacles to environmentally friendly behavior, influence, awareness on sustainable development of the environment, environmental education. Definition of sound and noise. Spectral analysis of the noise. Definitions of levels and decibel dB (A) scale. Noise sources, definitions and forms. Mechanisms of noise generation and propagation in air, water and structure. Communal noise. The measurement and analysis of noise. Measurement of sound pressure, sound intensity and sound power of noise source. Methods and techniques for noise reduction: on-site source, the spread on the road and at the receive site. The impact of noise on humans (and animals).

Temeljni literatura in viri / Readings:

Eržen in sod. Zdravje in okolje. Medicinska fakulteta Maribor 2010, 1-208
R. Beaglehole, R. Bonita, T. Kjelldstrom Basic Epidemiology. World Health Organisation (WHO). 1994
Greenberg, R.S. Daniels, F.W. Flanders, J.W. Eley, J.R. Boring: Medica1 Epidemiology, Appleton&Lange, East Norwalk, 1993.
Lilienfeld AM, Lilienfeld ED. Foundations of Epidemiogy, Oxford, New York: Oxford University Press, 1980.http://themes.eea.eu.int/
Bazerman M.H., Messick D.M., Tenbrunsel A.E., Wade-Benzoni K.A. (Eds.) (1997). Environment, Ethics, and Behavior, San Francisco: The New Lexington Press
Bennett P, Calman K. (Eds.) 2005). Risk Communication and Public Health, Oxford: Oxford University Press.
Kasperson J.X., Kasperson R.E.(2005). The Social Contours of Risk, vol. I. & II., London: EARTHSCAN.
Kahn P.H. (1999). The Human Relationship with Nature, Cambridge: The MIT Press.
Kaplan R., Kaplan S. (1989). The Experience of Nature:A Psychological Perspective. Cambridge: Cambridge University Press.
Kline M., Polič M., Zabukovec V. (1998). Javnost in nesreče, Ljubljana: ZIFF.
Kazimir Tarman. Osnove ekologije in ekologija živali, DZS, Ljubljana 1992.
Harold F. Hemond, Elizabeth J. Fechner. Chemical Fate and Transport in the Environment,

Academic, Presss, inc., 1994.
Kelley J. D., Thelin A. Agricultural medicine – Ocucupational and Environmental Health for the Health Professions. Ames, Iowa: Blackwell Publishing, 2006.
Jordening H.J., Winter J. Environmental Biotechnology. Weinheim: Wiley-VCH Verlag GmbH, 2005
Ford David E. Scientific method for Ecological researc. Cambridge: Cambridge University Press, 2000
Wackett P.L., Hershberger C.D. Biocatalysis and Biodegradadtion. Washington, d.c.: ASM Press, 2001
OIE. Animal Production Food Safety Challenges in Global markets. OIE Vol. 25 (2), 2006
Axford, I Fayez M. Marai, H Omed. Pollution in Livestock Production Systems, Edit. I. Ap Dewi, R.F.E, AB International, 1994
Čudina, M.: Tehnična akustika, Fakulteta za strojništvo, Ljubljana, 2001.
Crocker, M.J., Čudina, M. et al: Handbook of noise and vibration control. Hoboken, New Jersey, USA: John Wiley & Sons, cop. 2007.
Beranek, L.L.: Noise and Vibration Control, Institute of Noise Control Engineering, Washington, DC, 1999.
Bilban, M. Medicina dela. Ljubljana: ZVD - Zavod za varstvo pri delu, 1999. 605 str., ilustr., tabele. ISBN 961-90350-4-6.
Möser M.: Technical Acoustics, SPRINGER, BERLIN, 2004.

Cilji in kompetence:	**Objectives and competences:**
Udeleženci bodo: razumeli pomen zdravega naravnega in družbenega okolja za blagostanje posameznika in prebivalstva v celoti, obvladali uporabo ustreznih raziskovalnih metod in pristopov pri ugotavljanju vplivov okolja, obvladali pristope, probleme in rešitve pri pridobivanju podatkov za raziskave v okviru zdravstvene in veterinarske ekologije ter okoljske psihologije znali razpoznavati, meriti in vrednotiti vire hrupa in zvočne signale v časovni in frekvenčni domeni.	Participants will: understand importance of healthy natural and social environment for the wellbeing of individual and whole population learn use of relevant research methods and approaches in environmental impact assessment, mastering of approach to resolve the problems and solutions how to collect the data for experimental work in the medical and veterinary ecology and in the environmental psychology know how to recognize, measure and assess sources of noise and sound signals in temporal and frequency domain.
Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: Udeleženci: dosežejo poglobljeno razumevanje medsebojnih vplivov posameznikov, družbe in okolja predvsem z ozirom na zagotavljanje uravnoteženega družbenega in okoljskega razvoja, razumejo človeško dojemanje okolja in njegovih tveganj ter dejavnike, ki vplivajo na okoljsko ozaveščenost, spoznajo načela in metode presoje različnih vplivov na okolje in ljudi, spoznajo fizikalne lastnosti zvoka in hrupa ter njune pojavne oblike, mehanizme nastajanja hrupa in metode za zmanjšanje hrupa ter učinke hrupa na zdravje ljudi	Knowledge and understanding: The participants will: achieve in deep understanding of mutual influences of individuals, society and environment mainly regarding assurance of balanced social and environmental development. understand human environmental cognition and its risks, as well as the factors influencing environmental consciousness get acquainted with principles and methods of assessment of different impact on environment and people get acquainted with physical properties of sound and noise and their forms of appearance, mechanisms of noise generation and methods for noise decreasing as well as noise influences on people's health.
Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah, reševanje konkretnih problemov, individualne naloge.	Lectures, seminars, case study, student's presentations, small group work, consultations, team work, individual work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit (več kot 5 kandidatov) Ustni izpit (manj kot 5 kandidatov)	**100%** **100%**	written exam (more than 5 kandidates) oral exam (les than 5 kandidates)

Reference nosilca / Lecturer's references:

Ivan Eržen

ERŽEN, Ivan. Ocena izpostavljenosti otrok svincu v celjskih vrtcih = An assessment of lead exposure among children attending kindergartens in Celje. Zdravstveno varstvo. [Tiskana izd.], 2011, letn. 50, št. 2, str. 113-120

ERŽEN, Ivan, KUKEC, Andreja, ZALETEL-KRAGELJ, Lijana. Air pollution as a potential risk factor for chronic respiratory diseases in children: a prevalence study in Koper municipality. HealthMed, 2010, vol. 4, no. 4, suppl. 1, str. 945-954

ŠTUPAR, Janez, DOLINŠEK, Franci, **ERŽEN, Ivan**. Hair-Pb longitudinal profiles and blood-Pb in the population of young Slovenian males. Ecotoxicol. environ. saf., 2007, letn. 68, št. 1, str. 134-143

Marko Polič

BUCIK, Valentin, FEKONJA PEKLAJ, Urška, MARJANOVIČ UMEK, Ljubica, MIHELJAK, Vlado, MUSEK, Janek, PEČJAK, Sonja, **POLIČ, Marko**, PRAPER, Peter, REPOVŠ, Grega, SABADIN, Argio, POLIČ, Marko (ur.). Podobe psihologije, (Zbirka Razprave FF). Ljubljana: Znanstvena založba Filozofske fakultete, 2009

POLIČ, Marko. Risk, crises and control : between fear and negligence. V: KAJFEŽ-BOGATAJ, Lučka (ur.), MÜLLER, Karl H. (ur.), SVETLIK, Ivan (ur.), TOŠ, Niko (ur.). Modern RISC-societies : towards a new paradigm for societal evolution, (Complexity design society, vol. 14). Vienna: Echoraum, cop. 2010, str. 325-338

POLIČ, Marko. Od zaznavanja nevarnosti do kriznega upravljanja. V: ZORN, Matija (ur.), KOMAC, Blaž (ur.), PAVŠEK, Miha (ur.), PAGON, Polona (ur.). Od razumevanja do upravljanja,

(Naravne nesreče, knj. 1). Ljubljana: Založba ZRC, 2010, str. 139-148

Martin Dobeic
KRAPEŽ, Uroš, SLAVEC, Brigita, FRATNIK STEYER, Adela, PINTARIČ, Štefan, **DOBEIC, Martin**, ZORMAN-ROJS, Olga, DOVČ, Alenka. Prevalence of pigeon circovirus infections in feral pigeons in Ljubljana, Slovenia. Avian dis., 2012, vol. 56, no. 2, str. 432-435
DOBEIC, Martin, PINTARIČ, Štefan, VLAHOVIĆ, Ksenija, DOVČ, Alenka. Feral pigeon (Columbia livia) population management in Ljubljana. Vet. arh, 2011, vol. 81, no. 2, str. 285-298
DOBEIC, Martin, PINTARIČ, Štefan. Laying hen and pig livestock contribution to aerial pollutin of Slovenia. Acta vet. (Beogr.), 2011, vol. 61, no. 2/3, str. 283-293

Mirko Čudina
ČUDINA, Mirko, PREZELJ, Jurij. Detection of cavitation in operation of kinetic pumps : use of discrete frequency tone in audible spectra. Appl. Acoust.. [Print ed.], Apr. 2009, vol. 70, issue 4, str. 540-546
ČERNETIČ, Jan, **ČUDINA, Mirko**. Estimating uncertainty of measurements for cavitation detection in a centrifugal pump. Measurement. [Print ed.], 2011, vol. 44, iss. 7, str. 1293-1299
PREZELJ, Jurij, **ČUDINA, Mirko**. Quantification of aerodynamically induced noise and vibration-induced noise ina suction unit. Proc. Inst. Mech. Eng., C J. mech. eng. sci., Mar. 2011, vol. 225, no. 3, str. 617-624

Marjan Bilban
VENDRAMIN, Andreja, **BILBAN, Marjan**. Poklicna izpostavljenost zdravstvenega osebja ionizirajočemu sevanju = Occupational exposure to ionizing radiation for medical workers. Zdravstveno varstvo. [Tiskana izd.], 2012, letn. 51, št. 3, str. 182-189
RATKAJEC, Tihomir, **BILBAN, Marjan**, STARC, Radovan. Influence of Psychosocial Work-Related Factors on Conventional Risk Factors of Ischemic Heart Disease and Homocysteine in Slovenian Male Workers = Utjecaj psihosocijalnih, s radom poveyanih, čimbenika na uobičajene rizične čimbenike ishemijskih srčanih bolesti i homocistein kod slovenske muške radničke populacije. Coll. antropol., 2008, letn. 32, št. 2, str. 391-396
ZALETEL-KRAGELJ, Lijana, PAHOR, Majda, **BILBAN, Marjan**. Identification of population groups at very high risk for frequent perception of stress in Slovenia. Croat. med. j., 2005, letn. 46, št. 1, str. 137-145

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**OKOLJSKI IN SOCIOLOŠKI VIDIKI TRAJNOSTNEGA RAZVOJA**
Course title:	ENVIRONMENTAL AND SOCIOLOGICAL ASPECTS OF SUSTAINABLE DEVELOPMENT

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet / Core course
Univerzitetna koda predmeta / University course code:	/

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
45	**15**				**190**	**10**

Nosilec predmeta / Lecturer:	Drago Kos, Dušan Plut (nosilstvo je izmenično)

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Requirements:**
Vpis v doktorski študij.	Enrolment in the doctoral study programme

Vsebina:	**Content (Syllabus outline):**
Raziskovanje okoljskih dilem in problemov v radikalni varianti uvaja paradigmatski obrat v razumevanju sodobnih družb. Okoljski problemi presegajo operativni repertoar modernih družbenih sistemov. Pritiski na okolje so v številnih območjih sveta presegli zmogljivosti okolja, okoljska globalizacija je prinesla izčrpavanje naravnih virov, podnebne spremembe in zmanjševanje pokrajinske in biotske raznovrstnosti. Kot alternativa sedanjemu načinu materialne in prostorske organizacije družbe se postopoma oblikuje trajnostni, sonaravni razvojni model, zasnovan na upoštevanju nosilne zmogljivosti okolja. Obravnavani bodo primeri trajnostnega načina reorganizacije družbe v smeri materialne zmernosti, socialne pravičnosti in okojske odgovornosti. Predstavljene bodo potrebne razvojne strategije, ki bi omogočile trajnostno, sonaravno organizacijo materialnega življenja	Research into environmental dilemmas and problems in a radical form introduces a paradigmatic turn to our understanding of modern societies. Environmental issues transcend the operative repertoir of modern social systems. In many areas of the world the pressures on the environment have exceeded its capacities, environmental glablisation has led to the exhaustion of natural resources, climate change, and a reduction of landscape and biotic diversity. As an alternative to the present way our society is materially and spatially organised, a sustainable development model is gradually taking shape, based on consideration of the environment's carrying capacity. The course will look into examples of sustainable ways of reorganising society towards material restraint, social justice, and environmental responsibility. It will present the required development strategies that will facilitate a

Slovenije in njenih regij. Očitno postaja, da v obstoječem sistemskem okviru ni mogoče zastaviti niti pravih vprašanj, kaj šele ponuditi delujoče odgovore nanj. Takšna situacija poglablja razpon med benignimi površinskimi pristopi in globinskimi radikalnimi zastavitvami problematike. Temeljno izhodišče sociologije okolja je razvijanje sistemsko integrativnih pristopov, t.j. načina, ki celotno družbeno prakso opazuje in interpretira z vidika varovanja in ohranjanja okolja. Takšen integrativen pristop je se povsem prilega zasnovi interdisciplinarnega univerzitetnega študija varstva okolja. Kritična obravnava koncepta trajnostnega razvoja je ključna predmetna tematika. Trajnostni razvoj je integrativni deklarativni cilj večine razvitih sodobnih družb. Navkljub temu refleksija tega radikalnega koncepta močno zaostaja za implementacijskimi potrebami. Predmet predstavi temeljne konceptualne zamisli trajnostnega razvoja in najbolj aktualne dileme njegovega praktičnega uvajanja. Nato se posveti trodelni obravnavi trajnostnega razvoja – analitski, normativni in strateški ravni. Tak pristop vnaša pregledno refleksijo ter radikalne zamisli, kar je bila in je še vedno ključna pomanjkljivost dosedanjih obravnav. Analitično bodo obravnavani »trajnostno« naravnani razvojni projekti. Družbena konstrukcija okolja, dojemanje tveganj, ne/pripravljenost na spreminjanje uveljavljenih družbenih praks, problem kolektivnega delovanja pri varovanju okolja, paradoksi preseganja antropocentrizma , vrednotni preskoki oz. trdovratnost modernih vrednotnih usmeritev, komunikativno delovanje kot možna oblika preseganja disciplinarne zamejenosti pri varovanju okolja ipd. so nekatere izbrane teme, ki bodo podrobneje predstavljene. Glede na širok disciplinarni razpon predvidnih študentov, bo obravnavana vsebina prilagojena interesom in predznanjem študentov.	sustainable organisation of material life in Slovenia and its regions. It is increasingly obvious that the framework of the present system does not even enable us to ask the right questions, let alone provide working answers to them. This situation deepens the gap between benign superficial approaches and in-depth, radical exposure of the issues. The fundamental starting-point of the sociology of the environment is to develop systemic integrative approaches, i.e. ways to observe the entire social practice and interpret it from the viewpoint of environment protection and preservation. Such an integrative approach is perfectly adapted to the concept of interdisciplinary university study of environment protection. Critical discussion of the concept of sustainable development is the course's key theme. Sustainable development is the declared integrative objective of most developed modern societies. Nevertheless, reflection on this radical concept lags far behind its implementation requirements. The course presents the basic conceptual ideas of sustainable development and the most current dilemmas of its practical introduction. It then turns to a three-part discussion of sustainable dvelopment – at the analytical, normative, and strategic levels. Such an approach provides for clear reflection and radical ideas – the key deficiency of the discussions on the theme in the past and present. The analysis will address „sustainably“ designed development projects. The social construction of the environmnent, the perception of risk, the (un)willingness to change established social practices, the problem of collective operation in environment protection, the paradoxes of moving beyond anthropocentrism, value leaps or the obstinacy of modern value orientations, communicative operation as a possible form of surpassing the delimitations of individual disiciplines in environment protection, and the like, are some selected themes that will be presented in greater detail. In view of the widely diverse disciplines from which the expected students come, the contents will be adapted to their interests and pre-knowledge.

Temeljni literatura in viri / Readings:

Beck, Ulrich (2001) Družba tveganja. Krtina, Ljubljana.
- Kirn, Andrej (2012) Družbenoekološki obrat ali propad. FDV Ljubljana.
- Kos, Drago 2004, Tri ravni trajnostnega razvoja TIP let. XLI, št. 1-2, Ljubljana.
- kos, Drago (2012) Sustainable Development – Implepenting Utopia? Sociologija vol. 55, no. 1, str. 7-20, Beograd.
- Brown Lester, 2006, Plan B 2.0, Earth Policy Institute, New York-London.

Plut, Dušan (2010) Geografija sonaravnega razvoja (univ. učbenik), Znanstvena založba FF, Ljubljana.

Cilji in kompetence:

Cilj predmeta je seznaniti študente s temeljnimi dilemami okoljskih in socioloških razsežnosti trajnostnega razvoja, t.j. z dilemami vseh sodobnih družb, ki deklarativno razglašajo trajnostno razvojno usmeritev. Študenti se bodo seznanili s potrebnimi, večplastnimi spremembami v prostorski in materialni organizaciji družbe, ki bi bila zasnovana na trajnostnih, sonaravnih principih. Zaradi kopičenja in globalnega širjenja okoljsko neprilagojenih družbenih praks so legitimizacijski problemi sodobnih družb že dosegli stopnjo, ki ogroža zmožnost refleksije in smiselnega strukturiranja problematike. Temeljni cilj predmeta je usposabljanje slušateljev za teoretsko konsistentno analizo nevzdržnih trendov ter uporabno aplikacijo motivacij za spreminjanje uveljavljenih netrajnostnih družbenh praks. Študentje bodo sposobni simulirati učinke okoljskih in prostorskih projektov na družbeno okolje, presojati legitimizacijske potenciale preventivnih in kurativnih posegov na lokalni, regionalni, nacionalni in nadnacionalni – globalni ravni.

Objectives and competences:

The objective of the course is to introduce the students to the basic dilemmas of the environmental and sociological dimensions of sustainable development, i.e the dilemmas of all modern societies which declare themselves to be oriented towards sustainable development. The students will be introduced to the necessary, multilayered changes in the spatial and material organisation of society, which would be based on sustainable principles.
Because of the accumulation and global spread of environmentally detrimental social practices, the legitimation problems of modern societes have reached a level that threatens their ability to reflect on and sensibly structure the issues. The basic objective of the course is to train the students to theoretically and consistently analyze unsustainable trends and the practical application of motivations for changing unsustainable social practices. The students will be capable of simulating the effects of environmental and spatial projects on the social environment, assess the legitimation potentials of preventive and curative interventions at the local, regional, national, and supranational, i.e. global, levels.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti bodo seznanjeni z interdisciplinarno problematiko antropogenega preseganja nosilnih zmogljivosti okolja in modeli trajnostne reorganizacije družbe. Obenem bodo sposobni razumeti okoljsko in sociološko razsežnost trajnostnega razvoja in s tem povezano večplastnost razmerja človek – okolje /narava.	Knowledge and understanding: The students will be introduced to the interdisciplinary issues of anthropogenic exceeding of the carrying capacities of the environment and to models of a sustainable reorganisation of society. They will also be able to understand the environmentral and sociological dimensions of sustainable development and the related multi-layered relationships between man and the environment/nature.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Dve tretjini ur namenjenih za predmet se bosta izvajali kot klasična predavanja, ena tretjina ur pa bo namenjena za seminarje, v katerih bodo z aktivno udeležbo v naprej pripravljenih slušateljev obravnavane izbrane teme iz učnega programa.	Two thirds of the course's hours will be conducted as classical lectures and one third will be dedicated to seminars in which selected themes from the course syllabus will be addressed with the active participation of students prepared in advance.

Načini ocenjevanja:	Delež (v %) Weight (in %)	**Assessment:**
Ustni zagovor seminarske naloge in izpit.	**60%** **40%**	Oral presentation of seminar paper and examination.

Reference nosilca / Lecturer's references:

prof. dr. Drago Kos:

1. KOS, Drago. Sustainable development : implementing utopia? *Sociologija* 2012, vol. 55, no. 1, str. 7-20, Beograd.
2. **Kos, Drago** et al. (2005): A cognitive map of Slovenia: perceptions of the regions. *International journal of psychology.* vol. 40, no. 1, str. 27-35, ilustr. ISSN 0020-7594
3. **Kos, Drago**, Polič, Marko (2007) The framing of radioactive waste risk : a comparative analysis. The 8th Conference of the ESA, Glasgow UK, v: *Abstract book*. [S. l.: s. n., 2007], str. 169.

prof. dr. Dušan Plut:

1. **Plut, Dušan.,** Špes M., Brečko V., (2002) Slovenia-Country Studies-Northern Group. Environmental Problems of East Central Europe, Routledge Studies of Societies in Transition, London–New York.
2. **Plut Dušan.,** Špeh N., (2002) Sustainable Landscape Management in Slovenia: Environmental Improvements for the Velenje Coal V: Geojournal 55, Dordrecht/Boston/London, str. 569-578. ISSN 0343-2521.
3. **Plut, Dušan**., (2010) Environmental aspects of sustainable development in Slovenia. *Morav. Geogr. Rep.*, 2010, vol. 18, no. 3, str. 26-32.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Tla in geologija okolja**
Course title:	Soils and Environmental Geology

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet / Core Course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40	**20**				**190**	**10**

Nosilec predmeta / Lecturer:	**Franc Lobnik,** Nina Zupančič, Metka Suhadolc, Helena Grčman, Andrej Šmuc in drugi vabljeni gostujoči profesorji / invited guest professors

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrolment in the doctoral study programme.

Vsebina:	**Content (Syllabus outline):**
Geologija (osnovni pojmi, pomen za okolje: geološka podlaga kot njegov materialni nosilec, in kot vir za napovedovanje njegovih bodočih sprememb). Zemljina zgradba in sestava (zgradba planeta, Zemljine lupine: litosfera, pedosfera, hidrosfera, atmosfera in biosfera). Geološko dogajanje (endogeni in eksogeni procesi, magmatizem s poudarkom na vulkanizmu, erozija in transport, sedimentacija, metamorfoza, tektonika in potresi, tektonika plošč). Zemljin razvoj (geološka zgodovina, razvoj življenja, razvoj ekosistemov, pomen načela aktualizma za napoved prihodnjega razvoja). Geokemično	Geology (basic concepts, importance for the environment: geological basis as its material carrier, and as a source of prediction of its future changes). Earth's structure and composition (Planet composition, Earth layers: the lithosphere, pedosphere, hydrosphere, atmosphere and biosphere). Geological processes (endogenous and exogenous processes, magmatism with emphasis on volcanic activity, erosion and transportation, sedimentation, metamorphosis, tectonics and earthquakes, plate tectonics). Earth development (geological history, development of life and ecosystems, importance of the

modeliranje (naravni in antropogeno vplivni sistemi, matematični modeli, modeliranje več komponentnih sistemov). Naravne nevarnosti (geološke osnove vulkanizma, potresov, erozije, preperevanja rudišč, poplav, zavarovanje in napovedovanje). Geološke danosti pri oceni stanja okolja (strukturno-geološka, geokemična, inženirsko-geološka, seizmološka, hidrogeološka in ekonomsko-geološka merila). Tlotvorni dejavniki in procesi. Klasifikacija tal glede na samoočiščevalno sposobnost in degradacijske procese. Parametri in indikatorji kakovosti tal. Fizikalnomorfološke lastnosti tal. Gibanje vode, zraka, toplote in raztopin skozi tla. Interakcije med organskimi in anorganskimi komponentami tal. Interakcije med trdno, tekočo in plinasto fazo v tleh: talni koloidi, ionska izmenjava, sorptivne lastnosti tal in njihova vloga v transportnih procesih, mehanizmi izmenjave plinov v tleh. Ekologija tal s poudarkom na kroženju ogljika in toku energije v ekosistemu tal. Vpliv klimatski razmer na procese mineralizacije in humifikacije organske snovi. Talni organizmi kot indikatorji kakovosti in zdravja tal. Biogeokemijski procesi, ciklusi in kroženje hranil v ekosistemu tal. Definicije, izvori in načini onesnaževanja. Razvrščanja onesnažil. Usoda potencialno nevarnih snovi v sistemu tla-rastlina-podtalnica: mehanizmi vezave, transformacij, razgradnje ter prenosa v tleh. Učinki onesnažil na organizme. Interpretacija podatkov o okolju na podlagi okoljskih standardov in normativov. Osnove ekotoksikologije in bioindikacije onesnaženih tal. Zgradba Slovenije (poglavitne kamnine in vrste tal v Sloveniji s posebnim poudarkom na krasu, okoljsko pomembne lastnosti geološke in pedološke zgradbe, mineralni viri, geološke in pedološke karte, karte onesnaženosti tal, geografski informacijski sistemi v geologiji in pedologiji in pomen informacije za smotrno rabo prostora, ugotavljanje, oceno in saniranje stanja okolja, za napovedovanje sprememb okolja, za zagotavljanje trajnostnega razvoja.	principle of actualism to predict future development). Geochemical modelling (natural and anthropogenic influenced systems, mathematical models, modelling of multi-component systems). Natural hazards (geological basis of volcanism, earthquakes, erosion, weathering of ore deposits, flooding, protection and forecasting). Geological conditions in the evaluation of environmental status (structural-geological, geochemical, engineering-geological, seismic, hydrogeological and geo-economic criteria). Soil forming factors and processes. Soil classification according to the filtering capability and degradation processes. Parameters and indicators of soil quality. Physical and morphological soil properties. The movement of water, solutes, air and heat trough the soil. Interactions between organic and mineral soil components. Interactions between soil solid, liquid and gaseous phase: soil colloids, ion exchange, sorption properties and their role in transport processes, mechanisms of gas exchange in the soil. Soil ecology with an emphasis on the carbon cycle and energy flow in the soil ecosystem. Climate effects on soil organic matter mineralisation and humification. Soil organisms as indicators of soil quality and health. Biogeochemical processes, cycles and nutrient cycling in the soil ecosystem. Definitions, sources and means of pollution. Classification of pollutants. Fate of pollutant in the plant-soil-groundwater system: mechanisms of adsorption, transformation, degradation and transport in soil. The effect of pollutants on soil organisms. The interpretation of environmental data using environmental standards and norms. Fundamentals of ecotoxicology and bioindication of contaminated soil. Geological setting of Slovenia (main rock and soil types in Slovenia, with special emphasis on Karst, environmentally relevant properties of geological and soil composition, mineral resources, geological and soil maps, maps of soil pollution, geographic information systems in geology and soil science and importance of the information for the rational space use , for identification, assessment and remediation of the environment, to predict the changes in the environment, to ensure sustainable development.

Temeljni literatura in viri / Readings:

- **Aust,H, Becker,J.D. 1985**. *Angewandte Geowissenschaften in Raumplanung und Umweltschutz*, Enke Verlag
- **Brown,G.C, Hawkesworth,C.J, Wilson, R.C.L**., 1992. *Understanding the Earth*, Cambridge University Press.
- **Hocevar, H., Vidic, N.J.,** 1998. *Izbrana poglavja iz osnov geologije*, UL BTF, OA.
- **Murck, B.W., Skinner, B.J., Porter, S.C**., 1996. *Environmental Geology*, John Wiley
- **Pavšic, J., 1999**. *Osnove geologije za študente gradbeništva in rudarstva*., zapiski predavanj, UL NTF, OG.
- **Pirc, S., 1999**. *Uvod v geokemijo*, skripta, UL NTF, OG.
- **Pezdic, J., 1999.** *Izotopi in geokemijski procesi*, Univerzitetni učbenik, NTF.
- **Ribicic, M., 1996.** *Inženirska geologija*, skripta, UL NTF, OG.
- **Veselic, M.,** 1984. *Hidrogeologija*, skripta, UL NTF, OG.
- **Šušteršic, F**. 2001. *Predloge k predmetu Geologija krasa*. Int. izdaja OG NTF.
- **Osnovna geološka karta 1:100.000**, *posamezni listi in vodniki k njim.*
- **Periodika**, *zlasti Geologija, GZL, Ljubljana, RMZ-Materials and Geoenvironment, Ljubljana, Environmental* geology, Journal of Geochemical Exploration, Environmental Geochemistry and Health.
- **Brady, C. N., Weill, R.R**. 1999. *The Nature and Propreties of Soils*. Prentice Hall, New Jersey.
- **Bromley, P. 1997.** *Nature Conservation in Europe*. E&FN SPON. London, OK.
- **Van Elsas, J.D., Trevors, J.T., Wellington, E.M.H**. 1997. *Modern Soil Microbiology*. Marcel Dekker, New York.
- **Sawhney. B.L, Brown. K,.** 1989. *Reactions and Movement of Organic Chemicals in Soils*. SSSA, Madison.
- **Campbell.G.S.,** 1985. *Soil Physics with Basics*. Elsevier, Amsterdam. 148 strani.
- **Bohn.L.H., McNeal.B.L. Oconor.G.A**-. 1985. *Soil Chemistry*. Willey Publication, New York.
- **McRae. 1988.** *Practical Pedology, Studying Soils in the Field*. Ellis Horwood Limited, Chichester.
- **Bernhardsen T.** 1999. *Geographic Information Systems. An Introduction*. John Wiley&Sons, Inc. New York.
- ***Soil Protection Policies within the European Union*.** 1998. Bonn, Germany. European Commission, Directorate-General XI & German Federal Environmental Agency.
- **McRae** 1988. *Practical Pedology, Studying Soils in the Field*. Ellis Horwood Limited, Chichester.
- **Francis, C., Butler., C., Kong, L**. 1990. *Sustainable Agriculture in Temperate Zones*. John Wiley&Sons, Inc. New York.
- **Le Bas C., Jamagne M.,** 1996: *Soil databases to Support Sustainable Development*, EU JRC Ispra, Italy.
- **Lobnik. F**, *sodelavci, Študijski pripomocki za študente na CD-ju.*
- **Digitalna pedološka karta** *v merilu 1: 25 000*
- **Digitalna pedološka karta** *v merilu 1: 250.000*

Cilji in kompetence:

Človekovo življenjsko okolje je proizvod razvoja Zemljine skorje, ki je z njim tesno povezana. Naravne nevarnosti in človekovi posegi v okolje imajo geološko podlago. Geologija kot historična veda tudi omogoča znanstveno napovedovati prihodnje spremembe okolja iz preteklih geoloških dogodkov ter pomaga znanstveno utemeljeno načrtovati sonaravni razvoj okolja.
Iz kamnin nastanejo tla, kot glavno križišče živega in mrtvega sveta, ki poleg preperevanja kamnin omogočajo tudi razgradnjo organskih ostankov in kroženja snovi na tem planetu.

Objectives and competences:

Human living environment is a product of Earth's crust development, which is closely connected to it. Natural hazards and human interventions in the environment are geologically based. Geology as historical science enables scientifically prediction of the future changes in the environment on the basis of the past geological events, and help science-based planning of the sustainable development of the environment.
From rocks soil is formed, as the main crossroads of the living and the dead world, in addition to the weathering of rocks allow the

Zato je cilj prikazati tla kot naravni vir in kot element varstva okolja. Študentje pridobijo znanja osnov geologije in biogeokemijskih ter fizikalnih procesov v tleh, posebno tistih, ki vplivajo na transport, vezavo na talne delce, bio-, kemo- in foto-transformacije in bioakumulacijo snovi v sistemu tla, rastlina, podtalnica. Študentje spoznajo procese degradacije okolja, seznanijo se z definicijami in pojmi onesnaževanja, potencialno nevarnimi snovmi in njihovimi škodljivimi učinki, geogenimi in antropogenimi viri teh snovi, procesi transporta in transformacij snovi v sistemu tla-rastlina podtalnica. Nadalje študentje znajo pridobiti, uporabljati in interpretirati javno dostopne geološke in pedološke podatkovne zbirke (geološka, pedološka karta RS, podatki monitoringa kakovosti/onesnaženosti tal…).	decomposition of organic residues and cycling of elements on the planet. Therefore, the objective is to evaluate soil as a natural resource and an element of environmental protection. Students get knowledge of basic geology and soil biogeochemical and physical processes, especially those that affect the transport, adsorption to soil particles, bio-, chemo-and photo-transformations and bioaccumulation of substances in the soil, plant and groundwater system. Students get an insight in processes of environment degradation and environmental pollution. They receive information on pollutants and their harmful effects, geogenic and anthropogenic sources, transport and transformations in the plant-soil-groundwater system. Further students get an insight how to obtain, use and interpret the publicly available databases (national geology and soil maps, soil quality/pollution monitoring data…).

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje pridobijo teoretična in praktična znanja. Prenos znanj v prakso, kreacija razvoja in raziskav.	Knowledge and understanding: The students obtain theoretical and practical knowledge. Transfer the knowledge into practice, creation of new development and research.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Poleg predavanj, ki vključujejo multimedijske pripomočke (ppt, video, spletne strani, izvedeni projekti) so sestavni del tudi seminarji in vaje, ki od študenta zahtevajo individualno delo in skupinsko diskusijo.	Lectures with multimedia support and seminars, exercises which require individual work and group discussion.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
-seminar - izpit	50% 50%	seminar - exam

Reference nosilcev / Lecturer's references:

Franc Lobnik:

1. PINTAR, Marina, **LOBNIK, Franc.** The impact of nitrate and glucose availability on the denitrification at different soil depths. *Fresenius environ. bull.*. [Print ed.], 2005, vol. 14, no. 6, str. 514-519.

2.SUHADOLC, Marjetka, SCHROLL, Reiner, HAGN, Alexandra, DÖRFLER, Ulrike, SCHLOTER,

Michael, **LOBNIK, Franc.** Single application of sewage sludge - Impact on the quality of an alluvial agricultural soil. *Chemosphere (Oxford)*. [Print ed.], 2010, vol. 81, no. 11, str. 1536-1543, ilustr. http://dx.doi.org/10.1016/j.chemosphere.2010.08.024, doi: 10.1016/j.chemosphere.2010.08.024.
3. PINTAR, Marina, VELIKONJA BOLTA, Špela, **LOBNIK, Franc.** Nitrogen isotope enrichment factor as an indicator of denitrification potential in top and subsoil in the Apače Valley, Slovenia. *Aust. J. Soil Res.*, 2008, vol. 46, no. 8 , str. 719-726, ilustr.

Marjetka Suhadolc:
1. **SUHADOLC, Marjetka**, SCHLOTER, Michael, SCHROLL, Reiner, BERGMÜLLER, Claudia, VELIKONJA Bolta, Špela, LOBNIK, Franc, LEŠTAN, Domen. Fate of isoproturon in two heavy metal contaminated soils in an microcosm experiment. Fresenius environ. bull., 2000, vol. 9, no. 11-12, str. 691-700.
2. **SUHADOLC, Marjetka**, DÖRFLER, U., LOBNIK, Franc, SCHROLL, Reiner. Glyphosate degradation in an alluvial soil amended with sewage sludge. V: DEL RE, Attilio (ur.), CAPRI, Ettore (ur.). *Environmental fate and ecological effects of pesticides*. Pavia: La Goliardica Pavese: Syngenta, cop. 2007, str. 146-151.
3. SUHADOLC, Marjetka, SURDYK, N., VAVOULIDOU-THEODOROU, Evangelia. Developing tools for pesticide risk assessment and management at three different scales in Europe: the FOOTPRINT project. V: DEL RE, Attilio (ur.), CAPRI, Ettore (ur.). *Environmental fate and ecological effects of pesticides*. Pavia: La Goliardica Pavese: Syngenta, cop. 2007, str. 966-973.

Helena Grčman:
1. LEŠTAN, Domen, **GRČMAN, Helena**, ZUPAN, Marko, BAČAC, Nadja. Relationship of soil properties to fractionation of Pb and Zn in soil and their uptake into Plantago lanceolata. *Soil sediment contam.*. [Print ed.], 2003, vol. 12, no. 4, str. 507-522.
2. **GRČMAN, Helena**, PERSOLJA, Jolanda, LOBNIK, Franc, LEŠTAN, Domen. Modifying lead, zinc and cadmium bioavailability in soil by apatite and EDTA addition. *Fresenius environ. bull.*. [Print ed.], 2001, vol. 10, no. 9, str. 727-730.
3. **GRČMAN, Helena**, VELIKONJA BOLTA, Špela, VODNIK, Dominik, KOS, Boštjan, LEŠTAN, Domen. EDTA enhanced heavy metal phytoextraction: metal accumulation, leaching and toxicity. *Plant soil*. [Print ed.], 2001, 235, str. 105-114.

Nina Zupančič:
1. **ZUPANCIČ, Nina**, PIRC, Simon. Calcium distribution in soil and stream sediments in Istria (Croatia) and the Slovenian littoral. *J. geochem. explor*., 1999, vol. 65, str. 205-218, ilustr.
2. **ZUPANČIČ, Nina.** Lead contamination in the roadside soils of Slovenia. *Environ. geochem. health*, 1999, no. 1, vol. 21, str. 37-50.
3. **ZUPANČIČ,** Nina, PIRC, Simon. Calcium distibution in soil and stream sediments in Istria (Croatia) and the Slovenian littoral. *J. geochem. explor.*. [Print ed.], 1999, vol. 65, str. 205-218, ilustr.

Andrej Šmuc:
1. ŠMUC, Andrej, GORIČAN, Špela. Jurassic sedimentary evolution of a carbonate platform into a deep-water basin, Mt. Mangart (Slovenian-Italian border). Riv. ital. paleontol. stratigr., 2005, letn. 111, št. 1, str. 45-70
2. ŠMUC, Andrej, ROŽIČ, Boštjan. Tectonic geomorphology of the Triglav Lakes Valley (easternmost Southern Alps, NW Slovenia). Geomorphology (Amst.). [Print ed.], 2009, issue 4, vol. 103, str. 597-604
3. ŠMUC, Andrej, ROŽIČ, Boštjan. The Jurassic Prehodavci Formation of the Julian Alps: easternmost outcrops of Rosso Ammonitico in the Southern Alps (NW Slovenia). Swiss journal of geosciences, 2010

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Upravljanje z naravnimi in energijskimi viri**
Course title:	Energy and Natural Resource Management

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1**	**1, 2**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1**	**1, 2**

Vrsta predmeta / Course type	Temeljni predmet/ Core Course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40	**10**	**10**			**190**	**10**

Nosilec predmeta / Lecturer:	**Sašo Medved**, Andrej Bončina, Andrej Udovč

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski, angleški / Slovenian, English
	Vaje / Tutorial:	Slovenski, angleški / Slovenian, English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij	Enrolment in the doctoral study programme

Vsebina:	**Content (Syllabus outline):**
- naravni viri: opredelitev in pregled - obnovljivi in neobnovljivi naravni viri - ekološke osnove upravljanja obnovljivih naravnih virov - trajnostno gospodarjenje z naravnimi viri - gospodarski, ekološki in socialni vidiki upravljanja obnovljivih naravnih virov - javne politike na področju upravljanja obnovljivih naravnih virov (prostorsko načrtovanje, varstvo okolja...) - primeri upravljanja naravnih virov (gozdovi, kmetijska zemljišča, populacije živalskih in rastlinskih vrst..) - zasnova adaptivnega upravljanja: načrtovanje in monitoring - raba naravnih virov, varstvo okolja in ohranjanje narave	- natural resources: definition and review - renewable and non-renewable natural resources - methods of ecological management of renewable natural resources - sustainable management of natural resources - economic, ecological and social aspects of renewable natural resources management - public policy in the field of renewable natural resources management (spatial planning, environmental protection ...) - case studies of natural resources management (forests, agricultural land, population of fauna and flora...) - design of adaptive management: planning and monitoring - use of natural resources, environmental

- razvoj in scenarij prihodnje rabe obnovljivih naravnih virov - vrste energij in njihovo vrednotenje; - pomen zanesljive oskrbe z energijo, kazalniki rabe energij; - energija in trajnostni razvoj; - uravnoteženje med dobavo in porabo enerije; - neobnovljivi in obnovljivi viri energije - vrste, lastnosti, modeliranje zalog, modeliranje potencilov; - procesi, tehnologije in učinkovitost za pretvarjanja neobnovljivih in obnovljivih virov energije; - vplivi na okolje pri pretvarjanju energij; - načela in tehnologije varčne rabe energije v različnih segmentih potrošnikov;	protection and nature conservation - development and future scenario of renewable natural resources utilization - energy sources; - the importance of reliable energy supply, indicators of energy consumption; - energy and sustainable development; - balance between supply and consumption of energy; - non-renewable and renewable energy sources - types, properties, modeling of stock, modeling of potentials; - processes, technologies and efficiency for the conversion of non-renewable and renewable energy sources; - environmental impacts of energy conversion; - principles and technologies of rational energy use;

Temeljni literatura in viri / Readings:

Kimmins, J. P., 1997. Forest Ecology: A Foundation for Sustainable Management. Prentice Hall, Upper Saddle River, New Jersey, 596 str.
Williams, B.K., Szaro, R.C., Shapiro, C.D., 2007. Adaptive management: the U.S. Department of the Interior. Technical guide. Adaptive working group, U.S. Department of the Interior, Washington, DC.
Ronald D. Knutson, 2007 AGRICULTURAL and food policy. - 6th ed. - Upper Saddle River, N. J. : Pearson : Prentice Hall, cop. 2007. - XIV, 188 str.
Sharpe, G.W. e tal. 2003. Introduction to forest and renewable resources. McGraw-Hill, Inc.
T. Ohta; Energy technology Sources, Systems and Frontier Conversion; Elsevier Science Ltd. 1994;
G.M.Masters; Introduction to Environment Engineering and Science; Prentice-Hall International Editions, 1991
T.D.Eastop, D.R. Croft; Energy efficiency for engineers and technologists; 1990, John Wiley & Sons, UK
P. Ih, F. Liu; Introduction to Energy and Environment, 1993, International Thomson Publishing, USA
M.J. Moran, H. N. Shapiro, Fundamentals of Enginnering Thermodinamics; 1998, John Wiley & Sons, UK
J. J. Kraushaar, R. A. Ristinen; Energy and Problems of Technical Society, 1993John Wiley&Sons, UK

Cilji in kompetence:	**Objectives and competences:**
Študent dobi pregled o naravnih virih. Spozna osnovne značilnosti gospodarjenja z obnovljivimi naravnimi viri, ki je zasnovano na načelu trajnosti. Seznani se z načini presoje trajnostnega gospodarjenje ter spozna gospodarske, ekološke in socialne vidike trajnostnega gospodarjenja. Seznani se z zasnovo gospodarjenja s posameznimi naravnimi viri (gozd, kmetijska zemljišča, itd). Spozna zasnovo adaptivnega upravljanja in načrtovanja. Seznani se z javnimi politikami na področju upravljanja z obnovljivimi naravnimi viri. Kandidat spozna zgodovinski razvoj	Student obtains an overview of natural resources. Learns basic characteristics of the renewable natural resources management, based on the principle of sustainability. Student is acquainted with assessment methods of the sustainable management and obtains the economic, ecological and social aspects of the sustainable management. Student is introduced in the management of specific natural resources (forest, agricultural land, etc.). Learns the concept of the adaptive management and planning. Student also learns about public policies related to the management of

oskrbe človeštva z energijo in pomen zanesljive oskrbe v sodobni družbi. Spozna naravne obnovljive in neobnovljive vire energij. Predstavljen mu je odnos med proizvodnjo in porabo energentov. Seznani se s principi, teoretičnimi in realnimi učinkovitostmi tehnologij za pretvarjanje energijskih virov v oblike energij, ki jih potrebujejo sodobne družbe. Spozna metode modeliranja procesov pretvarjanja energij. Za posamezne energetske tehnologije spozna, kako vplivajo na okolje in kako te vplive zmanjšamo. Seznani se z modeliranjem širjenja emisij energetskih sistemov v okolju. Spozna ukrepe za varčno rabo energije in energetskimi perspektivami.	renewable natural resources. Candidate learns about the historical development of energy supply of mankind and the importance of the reliable supply in modern society. Learn about natural renewable and non-renewable sources of energy. The relationship between the production and the consumption of energy is presented. Learns about the principles, theoretical and technical efficiencies of technologies for the energy resources conversion in the form of energy needed by modern society. Student is acquainted with methods of the modeling of processes for energy conversion. Learns how energy technologies effect environment and how can these impacts be reduced. Is introduced to modeling of emission spreading of energy systems. Learns measures of rational use of energy and with energy perspectives.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razume pomen trajnostnega ravnanja z naravnimi in energijskimi viri, pridobi znanje za vrednotenje potencialov naravnih in energijskih virov, osvoji metode presoje trajnostnega ravnanja z naravnimi viri, razume fizikalne, kemijske in biološke procese, ki se pojavljajo pri pretvarjanju in uporabi energijskih virov, osvoji metode preverjanja energijske učinkovitosti izbranih sistemov, zna vrednotiti procese in tehnologije ravnanja z naravnimi in energijskimi viri z LCA in LCC metodami, zna uporabiti metode modeliranja.	Knowledge and understanding: Student understands the importance of sustainable management of natural and energy resources, acquires the knowledge to evaluate the potential of natural and energy resources, learns assessment methods of sustainable management of natural resources, understands the physical, chemical and biological processes that occur during conversion and use of energy resources, gains knowledge of methods for validation of energy performance of arbitrary systems, is able to evaluate process and technologies of management of natural and energy resources with LCA and LCC methods, student has the knowledge to implement those methods.

Metode poučevanja in učenja:	**Learning and teaching methods:**
avditorna predavanja, individualni seminar, osebna komunikacija	auditorial lectures, individual seminar , personal communication

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit, ustni zagovor, javna predstavitev seminarske naloge s področja teme doktorske disertacije	60% 25% 15%	Examen writen and oral, public presentation of project report

Reference nosilca / Lecturer's references:

prof. dr. Sašo Medved:

1. MEDVED, Sašo. Present and future ecological footprint of Slovenia : the influence of energy demand scenarios. *Ecol. model.*. [Print ed.], 2006, letn. 192, št. 1/2, str. 25-36

2. VIDRIH, Boris, **MEDVED Sašo**. The effects of changes in climate on the energy demands of buildings; *Int. j. energy res.*, 2008, letn. 32, št. 11, str. 1016-1029
3. DOVRTEL, Klemen, **MEDVED, Sašo**. Weather-predicted control of building free cooling system. *Appl. energy*. [Print ed.], Sep. 2011, vol. 88, iss. 9, str. 3088-3096

prof. dr. Andrej Bončina:
1. FICKO, Andrej, **BONČINA, Andrej**. Probabilistic typology of management decision making in private forest properties. *Forest Policy and Economics*, 2013, 27: 34-43.
2. KLOPČIČ, Matija, **BONČINA, Andrej**. Recruitment of tree species in mixed selection and irregular shelterwood forest stands. *Ann. for. sci.*, 2012, 69, 8: 915-925.
3. KLOPČIČ, Matija, POLJANEC, Aleš, **BONČINA, Andrej**. Modelling natural recruitment of European beech (Fagus sylvatica L.). *For. Ecol. Manage.*, 2012, 284: 142-151.

prof. dr. Andrej Udovč:
1. **UDOVČ, Andrej**, BALDWIN, Richard A. Development of institutions supporting the agricultural land market in Slovenia and the EU accession process. V: DIMITROVA, Antoaneta L. (ur.). *Driven to change : the European Union's enlargement viewed from the East*. Manchester: Manchester University Press, 2004, str. [112]-130, ilustr.
2. BARBIČ, Ana, **UDOVČ, Andrej**, MEDVED, Andrej. Protection of the environment and biodiversity for sustainable future of rural areas : the case of planned Regional park Trnovski gozd, Slovenia. *Sociol. sela*, srpanj-prosinac 2004, broj. 165/166 (3/4), god. 42, str. 277-307.
3. ELLIOTT, Craig, **UDOVČ, Andrej.** Nature conservation and spatial planning in Slovenia: continuity in transition. *Land use policy*. [Print ed.], 2005, vol. 22, str. 265-276, ilustr. JCR IF: 1.035, SSE (15/51), environmental studies, x: 0.865

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**ZRAK, KLIMA IN VODE**
Coursetitle:	AIR, WATER AND CLIMATE

Študijski program in stopnja Studyprogrammeandlevel	**Študijska smer Studyfield**	**Letnik Academicyear**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
InterdisciplinaryDoctoralProgramme in EnvironmentalProtection	**/**	**1, 2**	**/**

Vrsta predmeta / Coursetype	Temeljni predmet/ core course
Univerzitetna koda predmeta / Universitycoursecode:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40	**20**				**190**	**10**

Nosilec predmeta / Lecturer:	**Jože Rakovec**, Lučka Kajfež-Bogataj, Mitja Brilly, Matjaž Mikoš

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/ angleški Slovenian, English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrolment in doctoral studies.

Vsebina:	**Content (Syllabusoutline):**
Dinamika in termodinamika ozračja: Sestava atmosfere, osnovne meteorološke količine, polje zračnega pritiska in njegove spremembe, kvazistacionarna polja vetrov v višinah in vetrovi pri tleh, sinoptične meteorološke tvorbe. Diabatne in adiabatne spremembe, hidrostatična stabilnost, konvekcija, vlaga v zraku, fazne spremembe za vodo v ozračju, nastanek oblakov, megle in padavin. Energijska bilanca tal. Sinoptični pojavi in tvorbe (cikloni, anticikloni, fronte, frontogeneza) in mezo meteorološki pojavi (nevihte). Analiza in prognoza, osnove vremenske napovedi, numerična napoved vremena. Sevanje v ozračju: EM spekter, zakoni sevanja, prehod sevanja	Dynamics and thermodynamics of the atmosphere: Composition of the atmosphere, basic meteorological quantities, air pressure fieldand its changes,quasistationarywind fields at upper levels and at close to the ground, synoptic meteorological phenomena. Diabatic and adiabatic processes, hydrostatic stability, convection, moisture in the air, phase change of water in the atmosphere, formation of clouds, fog and precipitation. Energy balance of the soil. Synoptic phenomena and processes (cyclones, anticyclones, fronts, frontogenesys) and meso-meteorological phenomena (storms). Weather analysis and forecast, concept of weather forecast, numerical weather prediction. Radiation in the atmosphere:

skozi medij. Sončno sevanje pri jasnem nebu, solarna konstanta, oslabitev pri prehodu skozi ozračje. Aerosol in sipanje ter absorpcija sončnega sevanja. Planetarni albedo. Dolgovalovno sevanje, absorptivnost ozračja, emisivnostza pretok, divergenca toka sevanja in segrevanje oz. ohlajanje plasti zraka ter tal. Povečevanje absorptivnosti ozračja zaradi emisij “plinov tople grede”, delež vodne pare, aerosolov in antropogenih plinov pri tem. Sevalna bilanca Zemlje danes, v preteklih geoloških obdobjih in izgledi za bodočnost. Onesnaženost zraka: Viri, trajektorije in disperzija, lokalno gibanje zraka pod temperaturno inverzijo. Modeliranje polja vetra; razne interpolacije meteoroloških polj, variacijska analiza in masno konsistentni modeli vetra, splošna zgradba numeričnega modela za ozračje. Vertikalna stabilnost ozračja, kapacitete konkavnih reliefnih oblik in plasti zraka pri tleh pod stabilnimi plastmi ozračja za onesnaževanje. Difuzijska enačba - analitične in numerične rešitve, poenostavitve pri tem in uporabnost enačbe. Spoznavanje modeliranja vetrovnih polj v prostem ozračju in pri tleh ter s turbulentno disperzijo. Pridobitev zmožnosti za kritično oceno kdaj je primerna uporabo različnih modelov transporta in disperzije primesi v zraku. Klima: Fizikalni dejavniki, ki oblikujejo klimo. Klimatski sistem in njegovo modeliranje: principi in problemi, vrste modelov. Modeli energijske bilance, enodimenzionalni sevalno-konvekcijski modeli in modeli splošne cirkulacije ozračja. Vzroki variabilnosti klime, fluktuacije klime, klimatske spremembe. Antropogeni vplivi na klimo, emisije plinov tople grede. Opazovana klimatska nihanja v 19. in 20. stoletju, prognoze klime 21. stoletja. Rezultati GCM in prognoze regionalnih ter lokalnih klimatskih sprememb. Hidrologija (definicije, pomen in zgodovinski razvoj), Kroženje vode in energije v naravi (energijska in vodna bilanca, hidrološki krog, porazdelitev vode v prostoru, izkoriščanje vodnih virov, podnebna spremenljivost), Lastnosti vode (fizikalne in kemične lastnosti vode ter njihov pomen za pojave v naravi). Površinski odtok (osnovne zakonitosti površinskega toka vode, koeficient odtoka, hidrogram odtoka). Erozija in transport sedimentov (izvori plavin, rečna erozija, prodonosnost in kalnost, človekovi vplivi). Podpovršinske vode (oblike vode v tleh,	EM spectrum, radiation laws, transferof radiation through a medium. Solar constantsolarradiation at clear sky, attenuation through the atmosphere. Aerosol and scattering, absorption of solar radiation. Planetary albedo. Long-wave radiation, atmospheric absorptivity, emissivity for radiation flux, flux divergence and heating/cooling of air layers and of soil by radiation. The increase in absorptivity/emissivity atmosphere due to increased emissions of "greenhouse gases", the share of water vapour, aerosols and anthropogenic gases at it. Radiation balance of the Earth today, in past geological periods and outlook for the future. Air pollution: Sources, trajectories and dispersion, local air movement below temperature inversion. Modelling of wind fields, various interpolation of meteorological fields, variational analysis and mass-consistent wind models, the general structure of the numerical model of the atmosphere. Vertical stability of the atmosphere, pollution potentials of concave relief forms and of the air below stable layers. Diffusion equation - analytical and numerical solutions to simplify this equation and its use. Understanding the modelling of wind fields in the free atmosphere and of the turbulent dispersion. Acquisition of the ability to critically evaluate which models of transport and dispersion of pollutants are appropriate for a particular case. Climate: Physicalfactorsthatshapeclimate. Theairconditioningsystemanditsmodeling: principlesandproblems, typesofmodels. Energybalancemodels, one-dimensionalradiation-convectionmodelsandatmospheric general circulationmodels. Thecausesofclimatevariability, climatefluctuations, climatechange. Anthropogenicinfluences on climate, emissionsofgreenhousegases. Theobservedclimateoscillations in the 19th and 20 century, climateforecasts 21st century. GCM resultsandprognosisofregionalandlocalclimatechange. Hydrology (definition, importance and historical development), water cycle and energy in nature (energy and water balance, hydrological cycle, water distribution in space, the exploitation of water resources, climate variability), water characteristics (physical and chemical properties of water and their significance for

lastnosti poroznega prostora, dinamika vode in snovi v topljivih v vodi). Hidrometrija (Meritve gladin, hitrosti, pretokov in kakovosti vode, meritve vodne erozije, meritve kalnosti in prodonosnosti, metode in točnost meritev). Uporaba statistike v hidrologiji (povratna doba, testiranje hidroloških hipotez, analize vzorcev). Hidrološki modeli (klasifikacija, uporaba, osnove teorije sistemov, regionalizacija, HEC modeli, Modflow, eksperimentalana povodja, napovedi hidroloških pojavov, vodna bilanca). Vplivi na vodni režim (vplivi na količine in kakovost voda in njihovo vrednotenje). Informacijski sistemi voda (hidrografski šifrant, registri in katastri objektov in pojavov, kategorizacije vodotokov). Dejavnosti na vodah (izkoriščanje vodnih sil, zaščita pred škodljivim delovanjem voda, ribištvo, rekreacija, melioracije, oskrba z vodo, čiščenje voda, plovba). Vodna infrastruktura (vodne zgradbe, kataster, vzdrževanje). Vodarstvo (izhodišča za politiko na vodah, doktrine vodnega prava, vodne pravice in soglasja, standardi, načrti, reševanje problemov).	phenomena in nature). Surface runoff (basic laws of overland flow, runoff coefficient, runoff hydrograph). Erosion and sediment transport (sources of sediments, river erosion, bedload transport and turbidity, human impacts). Subsurface water (water forms in the soil pore space properties, the dynamics of water and substances in water - solubles). Hydrometry (measurements of water level, velocity, flowrate and water quality, water erosion measurements, measurements of turbidity and bedload transport, methods and accuracy of the measurements). The use of statistics in hydrology (return period, hydrologic testing hypotheses, analysis of samples). Hydrological models (classification, application, and systems theory, regionalization, HEC models, MODFLOW, experimental river basins, hydrologic phenomena predictions, water balance). Impacts on the water regime (effects on quantity and quality of water and heir evaluation). Information systems water (hydrographic coding, registers and inventories of objects and phenomena, the categorization of rivers). Activities on waters (use water forces, protection against harmful effects of water, fisheries, recreation, land drainage, water supply, water treatment, navigation). Water infrastructure (water building cadastre maintenance). Hydrology (baseline for policy on water, the doctrine of water law, water rights and approvals, standards, plans, problem solving).

Temeljni literatura in viri / Readings:

Rakovec J., Vrhovec T.: Osnove Meteorologije za naravoslovce in tehnike. Ljubljana, DMFA-založništvo, 2007, 313 str., ISBN978-961-212-111-2
- S. Gaberšek, G. Skok, R. Žabkar: Rešene naloge iz osnov meteorologije, DMFA-založništvo, 2007, 85 str. ISBN 978-961-212-199-0
- Kajfež-Bogataj, L.: Vaje iz meteorologije. Ljubljana: Oddelek za agronomijo Biotehniškefakultete, 1996. 98 str., ISBN.961-90148-6-3
- C. D. Ahrens, Essentials ofMeteorology (withMeteorologyNowandInfoTrac). 2004. ISBN-10 0534422640 ISBN-13 9780534422646
- J. Houghton: ThePhysicsofAtmospheres, Cambridge Univ. Press, 2002, ISBN 0-512-80456-6.
- J. Houghton: Globalwarming : thecompletebriefing. Cambridge UniversityPress, 1997, XV+251 str ISBN 0-521-62089-9
- Warneck P.: ChemistryoftheNaturalAtmosphere. San Diego [etc.], AcademicPress,1988. – XIII, 757 str., ISBN 0-12-735630-4
- M. Z. Jacobson: Atmosphericpollution : history, science, andregulation, Cambridge UniversityPress, 2002
- XI +399 str. ISBN 0-521-81171-6
- MIKOŠ, Matjaž, MASTNAK, Martin. Navodila za program HEC-RAS : verzija 2.1. Ljubljana: FGG, Katedra za splošno hidrotehniko, 1998. 97 f., ilustr.
- Gardiner J.L.: 1991 River Projects and Conservation - A Manual for Holistic Appraisal, John

Wiley&Sons, N.Y
- Grigg N.S., 1996, Water resources management, , McGraw-Hill, Inc.,
- McCuen, R W.:. 1986, Hydrologic Modeling, Snyder
- Maidment D. R., 1993, Handbook of Hydrology, McGraw-Hill, Inc.,
- UNESCO: 1994, Applied Hydrology for Technicians

Cilji in kompetence:	**Objectives and competences:**
Spoznavanje tistih fizikalnih procesov v ozračju, ki opredeljejo vreme in vremenske tvorbe, gibanje zraka in disperzijo v ozračju. Spoznavanje procesov sevanja v ozračju. Spoznavanje fizikalnih dejavnikov klime. dejavnikov. Razumevanje celovitosti vodnega režima, spoznavanje značilnosti posameznih vrst dejavnosti na vodah, razumevanje načel in metod urejanja. Seznanjanje s hidrološkimi modeli, modeliranje vodne bilance in onesnaženja voda. Ugotavljanje vplivov na vodni režim vključno s podnebno spremenljivostjo.	Getting to knowthosephysicalprocesses in theatmosphere, definedweatherandweatherformations, airmovementanddispersion in theatmosphere. Understandingtheprocessesofradiation in theatmosphere. Understandingthephysicalfactorsofclimate. factors. Understandingtheintegrityofthewaterregime, getting to knowthecharacteristicsofcertaintypesofactivities in watersunderstandingoftheprinciplesandmethods ofregulation. Pairwithhydrologicalmodels, modelingthewaterbalanceandwaterpollution. To determinetheimpact on thewaterregimeincludingclimatevariability.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pridobivanje znanja o dinamiki v ozračju in klimatskih spremembah, režimu voda v okolju in delovanju naravnih in antropoloških vplivov. Meritve hidroloških pojavov.	Knowledge and understanding: The acquisition of knowledge about the dynamics of the atmosphere and climate change, water regime in the environment and operation of natural and anthropological impact. Measurements of hydrological phenomena.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja inseminarske vaje.	Lectures and tutorials

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
pisni izpit	**50%**	examination,
seminarska naloga	**50%**	coursework

Reference nosilca / Lecturer's references:

ŽABKAR, Rahela, **RAKOVEC, Jože**, KORAČIN, Darko. Therolesofregionalaccumulationandadvectionofozoneduringhighozoneepisodes in Slovenia : a WRF/Chemmodellingstudy. *Atmos. environ. (1994)*. [Printed.], 2011, vol. 45, issue 5, str. 1192-1202, doi: 10.1016/j.atmosenv.2010.08.021.

RAKOVEC, Jože, GABERŠEK, Saša, VRHOVEC, Tomaž. Relief shapes and and precipitation on the south side of the Alps. Part 1, Relief characteristics and dry sensitivity simulations. *Meteorol. Z. (Berl.)*, 2004, 13, str. 83-90.

RAKOVEC, Jože, MERŠE, Janko, JERNEJ, Silvester, PARADIŽ, Boštjan. Turbulent dissipation of the cold-air pool in basin : comparison of observed and simulated development. Meteorol. atmos. phys., 2002, 79, str. 195-213.

ŠRAJ, Mojca, DIRNBEK, Luka, **BRILLY, Mitja**. The influence of effective rainfall on modeled runoff hydrograph. Journal of Hydrology and Hydromechanics, 2010, letn. 58,
ŠRAJ, Mojca, **BRILLY, Mitja**, MIKOŠ, Matjaž. Rainfall interception by two deciduous Mediterranean forests of contrasting stature in Slovenia. Agric. for. meteorol.. [Print ed.], 2008, letn. 148,
ŠTRAVS, Luka, **BRILLY, Mitja**. Development of a low-flow forecasting model using M5 machine learning method. Hydrol. sci. j.. [Print ed.], 2007

KURNIK, Blaž, **KAJFEŽ BOGATAJ, Lučka**, CEGLAR, A.. Correcting mean and extremes in monthly precipitation from 8 regional climate models over Europe. Clim. past (Print), 2012, vol. 8, no. ?, str. 953-986. http://dx.doi.org/10.5194/cpd-8-953-2012, doi: 10.5194/cpd-8-953-2012.
CEGLAR, A., **KAJFEŽ-BOGATAJ, Lučka**. Simulation of maize yield in current and changed climatic conditions: addressing modelling uncertainties and the importance of bias correction in climate model simulations. Eur. J. agron.. [Print ed.], 2012, vol. 37, issue 1, str. 83-95.
ČREPINŠEK, Z, ŠTAMPAR, F, KAJFEŽ-BOGATAJ, Lučka, SOLAR, A. The response of Corylus avellana L. phenology to rising temperature in north-eastern Slovenia. Int. j. biometeorol., 2012, vol. 56, no. 4, str. 681-694

RUSJAN, Simon, **MIKOŠ, Matjaž**. Seasonal variability of diurnal in-stream nitrate concentration oscillations under hydrologically stable conditions. Biogeochemistry (Dordrecht), 2010, letn. 97, št. 2-3, str. 123-140, doi: 10.1007/s10533-009-9361-5.
REPNIK MAH, Petra, **MIKOŠ, Matjaž**, BIZJAK, Aleš. Hydromorphological classification of Slovenian rivers = Hidromorfološka tipizacija slovenskih rek. Acta geogr. Slov., 2010, letn. 50, št. 2, str. 201-229, http://giam.zrc-sazu.si/sites/default/files/ags50202.pdf, doi: 10.3986/AGS50202.
ŠRAJ, Mojca, BRILLY, Mitja, **MIKOŠ, Matjaž.** Rainfall interception by two deciduous Mediterranean forests of contrasting stature in Slovenia. Agric. for. meteorol., 2008, letn. 148, št. 1, str. 121-134

IZBIRNI PREDMETI

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**ANALIZNA KEMIJA V KONTROLI OKOLJA**
Course title:	**ENVIRONMENTAL ANALYTICAL CHEMISTRY**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**20**	**20**			**190**	**10**

Nosilec predmeta / Lecturer:	**Marjan Veber**, Helena Prosen

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski / Slovenian**
	Vaje / Tutorial:	**slovenski / Slovenian**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.	Enrolment in the doctoral study programme. Prerequisite knowledge of basic natural sciences.

Vsebina:	**Content (Syllabus outline):**
Vzorčenje. Plinasti, tekoči in trdni vzorci. Laboratorijska obdelava vzorcev (absorpcija, adsorpcija, ekstrakcije tekoče-tekoče, ekstrakcije tekoče-trdno, mikroekstrakcije, raztapljanje, razkroji). Analizne metode za določanje onesnažil. Plinska in tekočinska kromatografija z različnimi detektorji. Primer določanja hlapnih pesticidov v živilih. Avtomatizirane analize. Metode atomske spektroskopije v analitiki okolja. Povezava spektroskopskih in kromatografskih metod. Pomen določanja različnih kovinskih zvrsti v vodah in v zemlji. Vrednotenje analiznih rezultatov.	Sampling. Gaseous, liquid and solid samples. Laboratory sample preparation (absorption, adsorption, liquid-liquid extractions, liquid-solid extractions, microextractions, dissolving, digestions). Analytical methods for pollutant determination. Gas and liquid chromatography with different detectors. Example of volatile pesticides determination in the foodstuffs. Automated analyses. Methods of atomic spectroscopy in the environmental analysis. Hyphenation of spectroscopic and chromatographic methods. Usefulness of metal speciation in water bodies and soil.

Standardizacija analiznih metod in zagotavljanje kakovosti rezultatov.	Validation of analytical results. Standardization of analytical methods and quality assurance.

Temeljni literatura in viri / Readings:

Environmental Analytical Chemistry, Ed. F.W. Fifield, P.J. Haines, Blackwell Science, 2000, 483 str./pages

Cilji in kompetence:	**Objectives and competences:**
Seznaniti študente s pristopi v okoljski analitiki ter principi najpomembnejših analiznih metod za določanje organskih in anorganskih onesnažil v okolju.	Present students with the approaches in the environmental analytics and principles of the most important analytical methods for the determination of the organic and inorganic pollutants in the environment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje bodo spoznali značilnosti (prednosti, slabosti in uporabnost) različnih analiznih metod in pristopov za določevanje sledov anorganskih in organskih spojin v okoljskih vzorcih. Na osnovi pridobljenih znanj bodo sposobni izbrati in predlagati ustrezni analizni pristop za reševanje konkretnih analiznih problemov ter kritično oceniti in ovrednotiti analizne rezultate.	Knowledge and understanding: Students will gain knowledge of the properties (advantages, disadvantages, applicability) of different analytical methods and approaches for the determination of trace inorganic and organic compounds in the environmental samples. On the basis of the gained knowledge, they will be able to select and propose a suitable analytical approach to solve real-life analytical problems, as well as to critically evaluate the analytical results.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, seminarji in laboratorijske vaje, konzultacije	lectures, seminar coursework, laboratory tutorial, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
ustno izpraševanje	**60%**	oral exam
seminarska naloga	**40%**	seminar coursework

Reference nosilca / Lecturer's references:

Marjan Veber :

1. P. Razpotnik, **M. Veber**, Investigations into nonspectroscopic effects of organic compounds in inductively coupled plasma mass spectrometry, *Acta Chim. Slov.* 2003, vol. 50, no. 4, 633-644.

2. M. Kovačevič, W. Goessler, N. Mikac, **M. Veber,** Matrix effects during phosphorus determination with quadrupole inductively coupled plasma mass spectrometry. *Anal. Bioanal. Chem.*, 2005, vol. 383, no. 1, 145-151.

3. J. Kristl, **M. Veber**, B. Krajnćič, K. Orešnik, M. Slekovec, Determination of jasmonic acid in *Lemna minor* (L.) by liquid chromatography with fluorescence detection. *Anal. Bioanal. Chem.* 2005, vol. 383, no 5, 886-893.

Helena Prosen:

1. **PROSEN, Helena**, ZUPANČIČ-KRALJ, Lucija. Evaluation of photolysis and hydrolysis of

atrazine and its first degradation products in the presence of humic acids. *Environ. pollut. (1987)* 2005, vol. 133, no. 3, 517-529.

2. **PROSEN, Helena**, FINGLER, Sanja, ZUPANČIČ-KRALJ, Lucija, DREVENKAR, Vlasta. Partitioning of selected environmental pollutants into organic matter as determined by solid-phase microextraction. *Chemosphere (Oxford)*. 2007, vol. 66, no. 8, 1580-1589.

3. KRALJ CIGIĆ, Irena, **PROSEN, Helena**. An overview of conventional and emerging analytical methods for the determination of mycotoxins. *Int. J. Mol. Sci.* 2009, vol. 10, no. 1, 62-115.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Biogeokemijska kroženja**
Course title:	Biogeochemical cycles

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
60	**60**				**130**	**10**

Nosilec predmeta / Lecturer:	**Jadran Faganeli**, Jože Pezdič

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje temeljev kemije, mikrobiologije, biologije in geologije.	Inscription in the doctoral study programme. The basic knowledge of chemistry, microbiology, biology and geology.

Vsebina:	**Content (Syllabus outline):**
Nastanek in razvoj Zemlje ter primerjava s sosednjima planetoma (Mars in Venera), Razvoj metabolnih poti, Molekulski geokemijski) biomarkerji, Biološki nastanek mineralov (biomineralizacija), Primarna produkcija, Razgradnja in ohranjanje, Anaerobni metabolizem in biogeni plini, Kroženje ogljika in globalne spremembe, Kroženje kisika, Kroženje dušika, Kroženje žvepla, Kroženje fosforja, Kovine in radionuklidi, Modeli biogeokemijskih kroženj, Človekov vpliv na biogeokemijska kroženja	The formation of Earth and comparisom with neighbour planets (Venus and Mars), The origin and evolution of metabolic pathways, Molecular (geochemical) biomarkers, Biological formation of minerals (biomineralization), Primary production, Degradation and preservation, Anaerobic metabolism and biogenic gases, Carbon cycling and global changes, Oxygen cycling, Nitrogen cycling, Sulphur cycling, Phosphorus cycling, Metals and radionuclides, Modelling of biogeochemical cycles, Human impact on biogeochemical cyclings.

Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig/Selected book chapters
W.H. Schlesinger, 2004. Biogeochemistry, Treatise on geochemistry, Vol. 8, Elsevier, Amstetrdam, 720 pp. (ISBN: 0080446426)
S.S. Butcher, R.J. Charlson, G.H. Orians, G.V. Wolfe, 1992. Global biogeochemical cycles, Academic, London, 379 pp. (ISBN: 0-12-147685-5)
S.D. Killops, V.J. Killops, 2005. Introduction to organic geochemistry, 2nd edition, Blackwell, Malden, 393 pp. (ISBN: 978-0-6320-6504-2)
J. Faganeli. *Osnove geomikrobiologije in mikrobne biogeokemije : zapiski s predavanj za študente mikrobiologije BF UL*. https://vis.bf.uni-lj.si/ , Piran, maj 2010. 1 el. optični disk (CD-ROM).
Revije/Journals
Biogeochemistry, Springer
Biogeosciences, Copernicus
Global Biogeochemical Cycles, AGU
Organic Geochemisty, Elsevier
Geomicrobiology Journal, Taylor&Francis
Geobiology, Blackwell
Applied Geochemistry, Elsevier
Elements, MSA

Cilji in kompetence:

Predmet seznanja študenta z dejavniki in procesi, vključno s človekovimi, ki uravnavajo biogeokemijska kroženja elementov v hidrosferi, litosferi, atmosferi in biosferi. Pomemben poudarek je na prikazu biogeokemijskega razvoja Zemlje v primerjavi s sosednjima planetoma, metodah študija biogeokemijskih tokov v preteklosti in danes, kemijskih, bioloških in geoloških reakcijah in procesih, ki uravnavajo porazdelitev, speciacijo in tokove elementov v glavnih rezervoarjih (sferah) in med njimi, pomenu speciacije elementov v kontroli mobilnosti in vlivu na biološke sisteme ter človekovih vplivih in spremembah v biogeokemijskih kroženjih pomembnih elementov.

Objectives and competences:

In this course, students are informed about factors and processes, including anthropogenic, controlling the biogeochemical cycling of elements in hydrosphere, lithosphere, atmosphere and hydrosphere. Importnat aspects are devoted to biogeochemical evolution of Earth in comparison to neighbour planets, study of present and past biogeochemical fluxes, chemical, biological and geological reactions and processes that govern the distribution, speciation and fluxes of elements in the main reservoirs (spheres) and between them, the role of speciation of elements in their mobility and impact on biological systems as well as the human role and global changes .

Predvideni študijski rezultati:

Znanje in razumevanje:
Pridobljeno znanje bodo študenti sposobni uporabiti v eksperimentalnih pristopih za študij biogeokemijskih procesov in razumeti procese v biogeokemijskih kroženjih pomembnih elementov vključno z globalnimi spremembami.

Intended learning outcomes:

Knowledge and understanding:
The students will be able to use the acquisited knowledge in experimental studies of biogeochemical processes and to understand processes involved in biogeochemical cyclings of importnat elements including their global changes.

Metode poučevanja in učenja:

Predavanja, seminarji, nastop, sodelovanje na predavanjih vabljenih domačih in tujih predavateljev

Learning and teaching methods:

Courses, seminars, presentations,, attendance at lectures of invited lecturers

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predstavitev seminarske naloge in ustni izpit	**40%** **60%**	Presentation of seminar work and oral exam

Reference nosilca / Lecturer's references:

Prof.dr. Jadran Faganeli

MANDIĆ-MULEC, Ines, GORENC, Katja, GAMS PETRIŠIČ, Marinka, **FAGANELI, Jadran**, OGRINC, Nives. Methanogenesis pathways in a stratified eutrophic alpine lake (Lake Bled, Slovenia). *Limnol. oceanogr.*, 2012, vol. 57, no. 3, str. 868-880. http://www.aslo.org/lo/pdf/vol_57/issue_3/0868.pdf, doi: 10.4319/lo.2012.57.3.0868.,

HINES, Mark E., POITRAS, Erin N., COVELLI, Stefano, **FAGANELI, Jadran**, EMILI, Andrea, ŽIŽEK, Suzana, HORVAT, Milena. Mercury methylation and demethylation in Hg-contaminated lagoon sediments (Marano & Grado Lagoons, Italy). *Estuar., coast. shelf sci.*, 2012, vol. 113, issue 10, str. 85-95, doi: 10.1016/j.ecss.2011.12.021.,

BRATKIČ, Arne, BURNIK ŠTURM, Martina, **FAGANELI, Jadran**, OGRINC, Nives. Semi-annual carbon and nitrogen isotope variations in the water column of Lake Bled, NW Slovenia. *Biogeosciences (Print)*, 2012, vol. 9, no. 1, str. 1-11, doi: 10.5194/bg-9-1-2012.

Prof.dr. Jože Pezdič

UHAN, Jože, VIŽINTIN, Goran, **PEZDIČ, Jože**. Groundwater nitrate vulnerability assessment in alluvial aquifer using proces-based models and weihgts-of-evidence method : lower Savija valley case study (Slovenia). *Environmental earth sciences*, 2011, vol. 64, no. 1, str. 97-105. http://dx.doi.org/10.1007/s12665-010-0821-y, doi: 10.1007/s12665-010-0821-y.,

KANDUČ, Tjaša, **PEZDIČ, Jože**. Origin and distribution of coalbed gases from the Velenje basin, Slovenia. *Geochem. J.*, 2005, vol. 39, str. 397-409.,

OGRINC, Nives, FAGANELI, Jadran, **PEZDIČ, Jože**. Determination of organic carbon remineralization in near-shore marine sediments (Gulf of Trieste, Northern Adriatic) using stable carbon isotopes. *Org. geochem.*. [Print ed.], 2003, vol. 34, str. 681-692.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**BIOINDIKACIJA IN VARSTVO KOPENSKIH EKOSISTEMOV**
Course title:	**BIOINDICATION AND CONSERVATION OF TERRESTRIAL ECOSYSTEMS**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**15**			**15**	**190**	**10**

Nosilec predmeta / Lecturer:	**Franc Batič**, Hojka Kraigher, Zvonka Jeran, Boštjan Pokorny, Davorin Tome

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski ali angleški/ Slovenian or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment in the doctoral study programme.

Vsebina:	**Content (Syllabus outline):**
Osnove bioindikacije v primerjavi z ekotoksikologijo. Uporaba bioindikacije v fitocenologiji. Uporaba bioindikacije za ugotavljanje stanja okolja v kopenskih ekosistemih kot posledice onesnaženja okolja (zraka in tal) in sprememb v rabi tal. Ravni in načini bioindikacije (kazalci, akumulatorji in monitorji). Onesnaženje zraka in bioindikacija. Bioindikacija v gozdnih ekosistemih - popis propadanja gozdov. Indikatorji stanja okolja v agroekosistemih. Bioindikacija z epifitskimi lišaji in mahovi. Višje rastline kot indikatorji onesnaženosti zraka. Uporaba bioindikatorjev za primere onesnaženja zraka z žveplovimi	Basics of bioindication in comparison with ecotoxicology. Bioindicators in phytocenology. Use of bioindicators for environmenta assessments in terrestrialecosystems as a consequence of environmental pollution and changes in land use. Types and levels of bioindication (indicators, accumulators, monitors).Air pollution and bioindicatio. Bioindication in forest ecosystems-forest die-back inventories. Bioindicators in agroecosystems. Bioindication with lichens and mosses. Higher plants as indicators of air pollution. Use of bioindicators for air pollution with sulphur and nitrogen compounds,

spojinami, dušikovimi spojinami, fotooksidanti, halogeni, obstojnimi organskimi polutanti in kovinami. Plevelne združbe kot indikator stanja kmetijskih površin. Indikatorske vrste in funkcionalni znaki traviščnih vrst kot indikatorji stanja travišč. Onesnaženje tal in bioindikacija. Glive kot indikatorji stanja tal – mikobioindikacija indikacija stanja tal z uporabo/analizo gliv in mikorize. Vretenčarji – sesalci (primer srnjadi) in ptiči kot indikatorji stanja kopenskih ekosistemov. Bioindikacija, biomonitoring in okoljska zakonodaja v Evropi in Sloveniji.	halohens, photooxidants, persistant organic pollutants and metals. Weed associations as indicators in agriculture. Indicator species and functional traits of plants in grasslands.Soil pollution and bioindication. Fungi as soil bioindicators-mycobioindication of soil condition by fungi and mycorrhizas. Vertebrates-mammals (a case with roe-deer) and birds as indicators in terrestrial ecosystems. Bioindication, biomonitoring and environmental legislation in Slovenia and Europe.

Temeljni literatura in viri / Readings:

Anonimous, 1991. Bioindikation ein wirksames Instrument der Umweltkontrole. VDI Berichte 901. VDI verlag, 688 str.; ISBN 3-18-090901-3
Arndt, U., Nobel, W. & B. Schweizer, 1987. Bioindikatoren. Möglichkeiten, Grenzen und neue Erkenntnisse. Ulmer, 388.s.; ISBN 3-8001-3079-3
Bell,J.N.B., Treshow, M., 2003. Air Pollution and plant life. Wiley& Sons, Ltd., 463; ISBN 0-471-49091-1
Markert, B. A., Breure, A. M., Zechmeister, H. G. (Eds.), 2003. Bioindicators & biomonitors: principles, concepts and applications. Elsevier Science, Amsterdam, 997 str., ISBN 0-08-044177-7.
Mulgrew, A., Williams, P., 2000. Biomonitoring of air quality using plants.. Air Hygiene Report 10, Monitoring and Assessment Research Centre WHO Collaborating Cetre for Air Quality Management and Air Pollution Control FEA Berlin & Monitoring and Assessment Researcg Centre WHO Collaborating Centre for Monitoring and Assessment, King's College London, 164 str., ISSN 0938-9822.
Nimis, P. L., Scheidegger, C., Wolseley, P. (Eds.), 2002. Monitoring with Lichens – Monitoring Lichens, Kluwer Academics, Dordrecht, 403 str., ISBN 1-4020-0430-3.

Cilji in kompetence:	**Objectives and competences:**
Študent spozna osnove ugotavljanja stanja v kopenskih ekosistemih v povezavi z antropogenimi vplivi s pomočjo rastlin, gliv in živali kot indikatorskih organizmov. Seznani se z nivoji in načini bioindikacije in biomonitoringa stanja v kopenskih ekosistemih kot dopolnilne ali nadomestne metode predvsem v povezavi z onesnaževanjem okolja in spremembo rabe tal.	Student learns basics of environmental assessment in terrestrial ecosystems in relation to human impacts by plants, fungy and animals as indicators. Student is acquainted with types and levels of bioindication in terrestrial ecosystems as additional or complementary methods of environmental assessments in relation to environmental pollution and changes in land use.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent spozna pricipe in pomen uporabe organizmov za sledenje stanja okolja v kopenskih ekosistemih v primerjavi s fizikalno kemičnimi meritvami. *Uporaba.* Spozna različne načine (odzivne, akumulatorske, monitorje) in ravni (celica, organizem, populacija, ekosistem; zgradba funkcija) uporabe bioindikatorjev za sledenje	*Knowledge and understanding*: Student learns principles and importance of organisms' use in environmental monitoring in terrestrial ecosystems in comparison with physical and chemical measurements. *Use.* Students is acquainted with types (reactive, accumulative and monitoring) and levels (cell, organism, population, ecosystem; structure, function) of bioindicator use in

vnosa najpogostejših zračnih onesnažil v naravne in antropogene kopenske ekosisteme, glede na vrsto onesnaženja in rabo tal. *Refleksija*. Poznavanje metod bioindikacije študentu omogoča sledenje stanja okolja v naravnih kot antropogenih ekosistemih in študenta usmerja k uporabi sonaravnih tehnologij. *Prenosljive spretnosti*. Pri predmetu se študent nauči povezovati podatke, znanja in informacije s področja biologije-bioindikacije z različnimi tehnološkimi procesi in drugimi metodami spremljanja stanja okolja ob uporabi različnih virov (predavanj, laboratorijskih vaj, terena, podatkovnih baz s področja okoljskega monitoringa, literature,..) in jih uporabiti v različni obliki in situacijah.	monitoring of air pollution in natural and antropogenic ecosystems in relation to type of pollution and land use. *Reflection.* Knowledge of bioindication methods enables student environmental monitoring in natural and antropogenic ecosystems and directs him to use more sustainable technologies. *Tranferable skills.* Student learns to connect data, knowledge and informations from different sources and use the obtain knowledge in various situation and cases.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja potekajo na klasičen način ob uporabi računalnika in interneta. Terenski pouk bo potekal na izbrana območja v Sloveniji s perečo okoljsko problematiko, kjer je uporaba bioindikatorjev potrebna (močno onesnažena območja, območja z večjimi spremembami v rabi tal in prostora, območja velikih disturbanc v naravi in zaradi človekove dejavnosti,..). Na osnovi terenskega pouka ali zaradi interesa študenta se izbere naslov seminarske naloge, ki jo pripravi študent samostojno in jo predstavi na najprimernejši način.	Lectures are given by use of computer and internet. Field course is organised to chosen districts of Slovenia with challenging environmental issues, where use of bioindicators is necessary (very polluted and degraded areas, areas with big changes in land use, areas with high frequences of disturbances, etc). On the basis of field course or interest of student the topic of seminar is given, which is presented by each student.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Udežba pri terenskem pouku je obvezna. Študent mora pripraviti seminar iz izbrane tematike in ga predstaviti. Za pristop k izpitu mora imeti uspešno predstavljen seminar in poročilo iz terenskega pouka. Iz predavanih vsebin opravi pisni izpit. Predavanja: - ocena samostojnega dela študenta - preverjanje znanja Seminar: - ocena samostojnega dela študenta in poročilo iz vaj - seminar in predstavitev seminarja Končna ocena je povprečje ocen iz	**20%** **80%** **20%** **40%** **40%**	Attendance of field course is compulsory. Student has to prepare and present the seminar and written report from field course before admision to written exam. Lectures: students individual efforts assessment of the written exam Seminar: students individual efforts and report from practical course written seminar and its presentation. Final mark is average from marks on lectures and seminar.

predavanj in seminarja Ocenjevalna lestvica, ki velja za vse preizkuse znanja: 51-60 %-zadostno (6), 61-70 %-dobro (7), 71-80 %-prav dobro (8), 81-90 %-prav dobro (9), 91-100 %-odlično (10).		Assessment scale: 51-60% sufficient (6), 61-70% good (7), 71-80% very good (8), 81-90% outstanding good (9), 91-100% excellent (10).

Reference nosilca / Lecturer's references:

prof. dr. Franc Batič:

1. GRABNER, Boštjan, RIBARIČ-LASNIK, Cvetka, ROMIH, Nadja, PFEIFHOFER, Hartwig W., **BATIČ, Franc**. Bioaccumulation capacity for Pb, Cd and Zn from polluted soil in selected species of the Brassicaceae family in different vegetation types. *Phyton (Horn)*, 2011, vol. 50, fasc. 2, str. 287-300.
2. POLIČNIK, Helena, SIMONČIČ, Primož**, BATIČ, Franc**. Monitoring air quality with lichens: A comparison between mapping in forest sites in open areas. *Environ. pollut. (1987)*. [Print ed.], 2008, issue 2, vol. 151, str. 395-400. tipologija 1.08 -> 1.01
3. GLASENČNIK, Erika, RIBARIČ-LASNIK, Cvetka, SAVINEK, Karin, ZALUBERŠEK, Marjeta, MUELLER, Maria, **BATIČ, Franc**. Impact of air pollution on genetic material of shallot (Allium cepa L. var. ascalonicum) exposed at differently polluted sites in Slovenia. *J. atmos. chem.*, 2004, vol. 49, str. 363-376.

doc. dr. Zvonka Jeran:

1. **JERAN, Zvonka,** JAĆIMOVIĆ, Radojko, BATIČ, Franc, MAVSAR, Robert. Lichens as integrating air pollution monitors. *Environ. pollut. (1987)*. [Print ed.], 2002, vol. 120, str. 107-113.

2. **JERAN, Zvonka**, MRAK, Tanja, JAĆIMOVIĆ, Radojko, BATIČ, Franc, KASTELEC, Damijana, MAVSAR, Robert, SIMONČIČ, Primož. Epiphytic lichens as biomonitors of atmospheric pollution in Slovenian forests. *Environ. pollut. (1987)*. [Print ed.], 2007, vol. 146, str. 324-331, ilustr. http://dx.doi.org/10.1016/j.envpol.2006.03.032.

3. MRAK, Tanja, SIMČIČ, Jurij, PELICON, Primož, **JERAN, Zvonka**, REIS, Miguel A., PINHERO, T. Use of micro-PIXE in the study of arsenate uptake in lichens and its influence on element distribution and concentrations. *Nucl. instrum. methods phys. res., B Beam interact. mater. atoms*. [Print ed.], 2007, 5 str.

prof. dr. Hojka Kraigher:

1. GREBENC, Tine, **KRAIGHER, Hojka**. Types of ectomycorrhiza of mature beech and spruce at ozone-fumigated and control forest plots. *Environ. monit. assess.*, 2007, vol. 128, no. 1/3, str. 47-59. http://dx.doi.org/10.1007/s10661-006-9414-3.

2. **KRAIGHER, Hojka,** AL SAYEGH-PETKOVŠEK, Samar, GREBENC, Tine, SIMONČIČ, Primož. Types of ectomycorrhiza as pollution stress indicators : case studies in Slovenia. *Environ. monit. assess.*, 2007, vol. 128, no. 1, str. 31-45, ilustr. http://dx.doi.org/10.1007/s10661-006-9413-4.

3. HABERER, Kris, **KRAIGHER, Hojka**, GREBENC, Tine et al.. Effects of long-term free-air ozone fumigation on [delta]15N and total N in Fagus sylvatica and associated mycorrhizal fungi. *Plant biol. (Stuttg.)*, 2007, vol. 9, no. 2, str. 242-252, ilustr. http://dx.doi.org/10.1055/s-2006-924758.

doc.dr.Boštjan Pokorny:

1**. POKORNY, Boštjan**, GLINŠEK, Andrej, RIBARIČ-LASNIK, Cvetka. Roe deer antlers as a historical bioindicator of lead pollution in the Šalek Valley, Slovenia. *J. atmos. chem.*, 2004, issues

1-3, vol. 49, str. 175-189.

2**. POKORNY, Boštjan**, AL SAYEGH-PETKOVŠEK, Samar, RIBARIČ-LASNIK, Cvetka, VRTAČNIK, Jaroslav, DOGANOC, Darinka Z., ADAMIČ, Miha. Fungi ingestion as an important factor influencing heavy metal intake in roe deer: evidence from faeces. *Sci. total environ.*. [Print ed.], 2004, vol. 324, no.1-3, str. 223-234.

3. KUGONIČ, Nives, **POKORNY, Boštjan.** Impact of heavy metal pollution on soils and plants in the vicinity of the abandoned lead smelter in the Upper Meza Valley (Slovenia). *Mitt. Österr. Bodenkd. Ges.*, 2006, heft 73, str. 113-119.

doc. dr. Davorin Tome:
1. **TOME, Davorin.** Nest site selection and predation driven despotic distribution of breeding long-eared owls Asio otus. *J. avian biol.*, 2003, vol. 34, no. 2, str. 150-154, graf. prikazi.

2. VREZEC, Al, **TOME, Davorin.** Altitudinal segregation between Ural owl Strix uralensis and tawny owl S. aluco : evidence for competitive exclusion in raptorial birds. *Bird study*, 2004, letn. 51, str. 264-269.

3. **TOME, Davorin**. Nest defense and some rare breeding events in long-eared owls (Asio otus). *J. raptor res.*, 2007, letn. 41, št. 2, str. 170-173.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**BIOMONITORING**
Course title:	BIOMONITORING

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**			**30**	**160**	**10**

Nosilec predmeta / Lecturer:	Romana Marinšek Logar

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.	Enrollment in a doctoral study. Knowledge of basic science disciplines.

Vsebina:	**Content (Syllabus outline):**
Študenti se najprej pregledno seznanijo z načini za spremljanje stanja v okolju in določanja stopenj onesnaženosti. Dalje predmet seznani s prednostmi bioloških načinov spremljanja stanja v okolju v primerjavi s čisto kemijsko in fizikalno analitiko in z osnovnimi zakonitostmi, ki jih je potrebno upoštevati pri razvijanju in uporabi metod okoljskega biomonitoringa. Študenti dobijo pregled nad indikatorskimi organizmi po skupinah (mikrobi, rastline, živali) in se seznanijo z metodami pasivnega in aktivnega biomonitoringa za spremljanje stopenj onesnaževanja zraka, voda in tal. Sledi seznanitev z najpogosteje uporabljanimi specifičnimi in priznanimi metodami okoljskega	Students are first informed about theprinciples of environmental monitoring and determining the levels of pollution. Next, the subject informs about the benefits of biological methods of environmental monitoring in comparison with traditional chemical and physical analyses and the basic principles that should be considered when developing and applying methods of environmental biomonitoring. Students get an overview of test and indicator organisms (microbes, plants, animals) and get acquainted with the methods of passive and active biomonitoring for monitoring levels of air pollution, water and soil. Followed by familiarization with the most commonly used and recognized specific environmental

biomonitoringa (ki vključuje tudi humani biomonitoring) ter zaključni del, ki obravnava vrednotenje in interpretacijo z analizami dobljenih rezultatov in ocenjevanje okoljskih tveganj. Zaradi sodobnega 3R koncepta (reduction, replacement, refinement) v toksikologiji in genotoksikologiji danes na področju spremljanja stanja okolja uporabljamo številne nativne ali genetsko modificirane mikroorganizme kot testne organizme in na tem področju intenzivno iščemo in razvijamo nove in še boljše pristope. 3R koncept vzpodbuja uporabo mikroorganizmov zaradi njihove enostavne kultivacije, študij na velikih populacijah in odsotnosti etičnih ovir. Predmet zajame uporabo bakterij, protozojev, alg in gliv v klasičnih biotestnih konceptih, ki temeljijo na fiziologiji mikroorganizmov, v testih za dokazovanje genotoksičnosti, nadaljuje z imunotesti in biotesti za endokrine motilce in zaključi z novejšimi genomskimi in proteomskimi prostopi v monitoringu okolja. Podamo tudi pregled uporabe posameznih biomonitoring metod v Sloveniji in študente seznanimo z inštitucijami, ki jih izvajajo. V zaključku sledi pregled in analiza možnosti za ustanavljanje majhnih biotehnoloških podjetij s tovrstno dejavnostjo.	biomonitoring methods (which also includes human biomonitoring) and the final part, which deals with the evaluation and interpretation of analyses results and assessment of environmental risks. Due to the modern 3R concept (reduction, replacement, refinement) in toxicology and genotoxicology today a number of native or genetically modified micro-organisms are used for this area and we are looking intensively for the develop of new and better approaches. 3R concept promotes the use of micro-organisms due to their easy cultivation, studies on large populations and the absence of ethical obstacles. The subject covers the use of bacteria, protozoa, algae and fungi in classical biotest concepts based on the physiology of microorganisms, in the test for the genotoxicity continues with the immunotests and bioassays for endocrine disrupters, and ends up with recent genomic and proteomic approaches in environmental monitoring. An overview of the use of certain methods of biomonitoring in Slovenia is given, too, and the students are fammiliarized with the institutions that implement them. In conclusion, an overview and analysis of options for the creation of small biotech companies with this type of activity is discussed.

Temeljni literatura in viri / Readings:

-Biomonitoring in the water environment. 1997. (Ed.: Zimmer, R.), NY, Water Environment Federation, ISBN 157278038X, 159 pp.
- Environmental biomonitoring: Exposure assessment and specimen banking. 1997.(Ed.: Subramanian, K.S., Iyengar, G.V.) NY, American Chemical Society, ISBN 0-8412-3477-9, 298 pp.
-Environmental Biomonitoring: The biotechnology ecotoxicology interface. 1998. (Ed.:Lynch, J.M., Wiseman, A.), London, Cambridge University Press, ISBN 0521621410, 299 pp.
-relevantni novejši znanstveni čalnki/relevant recent scientific articles

Cilji in kompetence:	**Objectives and competences:**
Slušatelji se teoretično in praktično seznanijo z metodami biološkega monitoringa in njihovim pomenom za relevantno spremljanje stanja v okolju, tudi stopenj onesnaženosti. Seznanijo se s kriteriji za testne in indikatorske organizme, z ekonomičnostjo in zakonitostmi, ki veljajo pri razvoju novih biomonitoring metod. Poudarek bo na novejših metodah (genomski in proteomski pristopi). Pridobljeno znanje naj bi v povezavi z ostalimi pridobljenimi znanji v okviru doktorskega študija Varstva okolja slušateljem omogočalo tudi načrtovanje lastnih malih biotehnoloških podjetij.	Students gain theoretical and practical knowlege about the methods of biological monitoring and their importance for relevant environmental monitoring and pollution levels. Students will learn the criteria for test and indicator organisms, the economics and the laws valid for the development of new biomonitoring methods. Emphasis will be given on modern methods (genomic and proteomic approaches). The acquired knowledge should, in conjunction with other lessons learned in the context of doctoral study of environmental protection allow students to plan their own small biotechnology companies that offer services of

	biomonitoring.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: -študent razume osnovne principe biomonitoringa in 3R koncept -pozna najbolj uporabljane metode biomonitoringa - pozna potrebne lastnosti testnih organizmov za biomonitoring -pozna in razume bioindikacijo -zna načrtovati in razvijati nove metode biomonitoringa	Knowledge and understanding: -students understand the basic principles of biomonitoring and 3R concept -know the most frequently used methods of biomonitoring - know the necessary properties of test organisms for biomonitoring -know and understand bioindication -know how to design and develop new methods of biomonitoring

Metode poučevanja in učenja:	**Learning and teaching methods:**
- predavanja - konzultacije - priprava seminarja - priprava načrta za krajše projektno delo - izvedba krajšega projektnega dela v laboratoriju - priprava poročila o izvedenem krajšem projektnem delu	- lectures - consultations - preparation of a seminar - preparation of a short project work plan - a short project work in the laboratory - Preparation of a report on the short project work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- seminar	30%	-semminar
- projektno delo s poročilom	30%	- project work with the report
- ustni izpit	40%	-oral exam

Reference nosilca / Lecturer's references:

LAH, Barbara, VIDIC, Tatjana, GLASENČNIK, Erika, ČEPELJNIK, Tadej, GORJANC, Gregor, MARINŠEK-LOGAR, Romana. Genotoxicity evaluation of water soil leachates by Ames test, Comet assay, and preliminary trandescantia micronucleus assay. *Environ. monit. assess.*, 2008, 1-3, 139, str. 107-118.

VIDIC, Tatjana, LAH, Barbara, BERDEN ZRIMEC, Maja, MARINŠEK-LOGAR, Romana. Bioassays for evaluating the water-extractable genotoxic and toxic potential of soils polluted by metal smelters. *Environ. toxicol.*, 2009, 5, 24, str. 472-483

RAJAPAKSE, Katarina, DROBNE, Damjana, KASTELEC, Damijana, MARINŠEK-LOGAR, Romana. Experimental evidence of false positive Comet test results due to TiO2 particle - assay interactions. *Nanotoxicology*, 2012, 32 str., [in press], doi: 10.3109/17435390.2012.696735.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKOFIZIOLOGIJA RASTLIN**
Course title:	**PLANT ECOPHYSIOLOGY**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30		**10**		**20**	**190**	**10**

Nosilec predmeta / Lecturer:	**Dominik Vodnik**, Franc Batič in vabljeni predavatelji

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski ali angleški/ Slovenian or English
	Vaje / Tutorial:	Slovenski ali angleški/ Slovenian or English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Immatriculation to the doctoral study programe.

Vsebina:	**Content (Syllabus outline):**
Rastlina in okolje. Vodna bilanca rastline, regulacija. Vodna bilanca pri različnih tipih rastlin in na nivoju rastlinskih združb. Vodni stres. Meritve vsebnosti vode, vodnega potenciala rastlin, ksilemskega toka, transpiracije in stomatalne prevodnosti. Mineralna prehrana: razpoložljivost mineralnih hranil v tleh, procesi v rizosferi, minerali ter razporejanje asimilatov v rastlini (razmerja vir:ponor). Vpliv okoljskih dejavnikov na sprejem, premeščanje in asimilacijo mineralnih hranil. S habitatom povezani vidiki mineralne prehrane, kroženje mineralnih hranil na nivoju rastlinskih združb. Mineralna prehrana rastlin in stres (interakcije). Uporaba fizioloških meritev, izotopskih sledilcev in molekularnih metod pri proučevanju mineralne prehrane.	Plants and environment. Plant water regime and its regulation. Water balance of different plant species types and their communities. Measurements of plant water content, plant water potential, xylem flow, transpiration and stomatal conductance. Mineral nutrition: availability of nutrients in soil and proceses in the rhizosphere, distribution and translocation of minerals and assimilates in plants (source-sink relations). Effect of environmental factors on uptake, translocation and assimilation of mineral nutrients. Habitat related aspects of mineral nutrition, cycling of minerals on the level of plant community. Stress and mineral nutrition. Use of physiological measurements, isotopic tracers and molecular methods in study of mineral

Asimilacija ogljika, primarna produkcija: vpliv okoljskih dejavnikov na fotosintezo (C_3, C_4, CAM) in respiracijo; bilanca ogljika na nivoju rastline ter rastlinske združbe, pretvorbe energije na nivoju rastlinske odeje. Meritve fotosinteze (izmenjava plinov, fluorescence), meritve odvisnosti od različnih dejavnikov, diskriminacijska analiza $^{13}C/^{14}C$. Rast in razvoj, vpliv okoljskih dejavnikov. Fiziologija stresa: splošnen pregled, pregled po posameznih stresnih dejavnikih . Multipli stres.	nutrition. Carbon assimilation, primary productivity: impact of environmental factors on photosynthesis (C_3, C_4, CAM) and respiration; carbon balance on the plant level and plant community; energy transformation in the plant canopy. Measurements of photosynthesis (exchange of gasses, fluorescence) in relation to environmental factors; $^{13}C/^{14}C$ discrimination analysis. Plant growth and development; effects of environmental factors. Stress physiology: general aspects and overview of single stressors: Multiple stress.

Temeljni literatura in viri / Readings:

Temeljni vir

Larcher W. 2002. Physiological Plant Ecology. Ecophysiology and Stress Physiology of Functional Groups. četrta izdaja, Springer, Berlin: 506 s. ISBN 3-540-43516-6

Dopolnilni viri

Lambers H., Chapin III, F. S., Pons, T. L. 1998. Plant Physiological Ecology. Springer 540 s., ISBN 0-387-98326-0.

Epstein E, Bloom A.J. 2005- Mineral Nutrition of Plants: Principles and Perspectives. Sinauer, Sunderland. 400 s. ISBN 0-87893-172-4

Rengel Z. 1999. Mineral nutrition of crops: Fundamental Mechanisms and Implications. Food Products Press , New York , 399 s. ISBN: 978-1-56022-880-0

Marschner H. 1995. Mineral nutrtion of higher plants. Druga izdaja. Academic PressLondon, 889 s., ISBN 0-12-473543-6.

Reigosa Roger M. J. 2001. Handbook of Plant Ecophysiology Techniques. Kluwer Academic Publishers, Dordrecht, 452 s., ISBN 0-7923-7053-8

Pearcy RW, Ehleringer J, Mooney HA, Rundel PW 1989. Plant Physiological Ecology. Field Methods and Instrumentation, Chapman and Hall, London. 457 s., ISBN 0 412 40730 2

Cilji in kompetence:	**Objectives and competences:**
Spoznati, kako okoljski dejavniki vplivajo na različne procese v rastlinah; spoznati odzive in prilagoditve rastlin na stresne dejavnike, spoznati metode, s katerimi lahko spremljamo odziv fizioloških procesov v realnih razmerah.	To know how environmental factors influence on diverse processes in plant; to recognise the responses and adaptations and acclimatisation in plants to stressors; to get acquainted with methods for analysing and monitoring response of physilogical processes in plants in nature.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent pridobi znanje o odzivu rastlin na dejavnike rasti in razvoja v naravnih in antropogenih ekosistemih. Pozna vpliv dejavnikov na posamezne fiziološke procese ter mehanizme, s pomočjo katerih se rastlina odziva na spremembe v okolju, vključujoč odzive na stresne dejavnike. Pridobi in nadgradi znanje o mineralni prehrani rastlin. Omenjena znanja so, tudi s stališča varstva okolja, ključna za uspešno trajnostno	Knowledge and understanding: Student gets knowledge on plant response to parameters of growth and development in natural and antropogenic ecosystems. Knows influence of single parameters on separate physiological processes and mechanismes by which plants respond to environmental changes including to stressors. Obtains and improves knowledge on plant mineral nutrition, including knowledge connected to environmental protection and sustainable menagement of

upravljanje z ekosistemi.	ecosystems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja potekajo v predavalnici, opremljeni za računalniško projekcijo in z internetno povezavo. Praktične vaje potekajo v laboratoriju in na laboratorijskem polju ter v rastlinjaku Biotehniške fakultete. Pri vajah se uporablja laboratorijska tehnika (standardna oprema + spektrofotometer, mikroskop) in prenosna ekofiziološka oprema (tlačna komora za meritve vodnega potenciala, porometer, merilnik fotosinteze, fluorescence, ipd.). Vaje so metodološka priprava na izvedbo projektnega dela. Projektno delo se izvaja v manjših skupinah, ki rešujejo posamezne raziskovalne naloge (problemsko usmerjeno učenje). Poteka v laboratoriju ali na izbranih lokacijah v okviru laboratorijskega polja in na lokacijah izven BF. Pri projektnem delu se uporablja raziskovalna oprema Katedre za aplikativno botaniko, ekologijo in fiziologijo rastlin, Oddelka za agronomijo BF. Sestavni del projektnega dela so konzultacije in končna predstavitev poročil, ki je predvidena v okviru seminarja.	Lectures are given in classroom equiped with computer and internet. Practical par takes place in laboratory and in the field. In the laboratory courses standard technics and methods are used (standard laboratory equipment for plant physiology, microscope, transportable equipment for ecophysilogical measurements (pressure chamber, IRGA analyser for measurements of photosynthesis and transpiration and other parameters, fluorometer, etc.). Laboratory course is preparation for the project work which is carried out in smaller groups or individually, taking place in the laboratory or in the field. In the measurement for project all necessary equipment available at Chair of applied botany,.. Department of Agronomy BF is used. Consultations, presentations of reports and final presentation of the seminar are parts of the project work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predavanja: - ocena samostojnega dela študenta - preverjanje znanja Vaje: - ocena samostojnega dela študenta - projekt in predstavitev seminarja Končna ocena je povprečje ocen iz predavanj in vaj.	 20% 80% 20% 80%	Lectures: assessment of the student efforts examination Coursework: assessment of the student efforts project and seminar presentation Final mark is average of marks on lectures and coursework

Reference nosilca / Lecturer's references:

prof dr. Dominik Vodnik:

1. DEMŠAR, Jernej, OSVALD, Jože, **VODNIK, Dominik**. The effect of light-dependent application of nitrate on the growth of aeroponically grown lettuce (Lactuca sativa L.). *J. Am. Soc. Hortic. Sci.*, 2004, vol. 129, no. 4, str. 570-575.

2. MAČEK, Irena, PFANZ, Hardy, FRANCETIČ, Vojmir, BATIČ, Franc, **VODNIK, Dominik**. Root respiration response to high CO2 concentrations in plants from natural CO2 springs. *Environ. exp. bot.*. [Print ed.], 2005, vol. 54, str. 90-99.

3. **VODNIK, Dominik,** GRČMAN, Helena, MAČEK, Irena, ELTEREN, Johannes Teun van, KOVAČEVIČ, Miroslav. The contribution of glomalin-related soil protein to Pb and Zn sequestration in polluted soil. Sci. total environ.. [Print ed.], 2008, vol. 392, issue 1, str. 130-136

prof. dr. Franc Batič:

1. KRANNER, Ilse, ZORN, Margret, TURK, Boris, WORNIK, Sabine, BECKETT, Richard P., **BATIČ, Franc**. Biochemical traits of lichens differing in relative desiccation tolerance. *New phytol.*, 2003, no. 160, str. 167-176.

2. ŠIRCELJ, Helena, TAUSZ, Michael, GRILL, Dieter, **BATIČ, Franc**. Biochemical responses in leaves of two apple tree cultivars subjected to progressing drought. *J. plant physiol.*, 2005, no. 162, str. 1308-1318, graf. prikazi, tabele.

3. FERLAN, Mitja, ALBERTI, G., ELER, Klemen, **BATIČ, Franc**, PERESSOTTI, Alessandro, MIGLIETTA, Francesco, ZALDEI, A., SIMONČIČ, Primož, VODNIK, Dominik. Comparing carbon fluxes between different stages of secondary succession of a karst grassland. *Agric. ecosyst. environ.*. [Print ed.], 2011, vol. 140, no. 1/2, str. 199-207, ilustr. http://dx.doi.org/10.1016/j.agee.2010.12.003, doi: 10.1016/j.agee.2010.12.003.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKOHIDROLOGIJA**
Course title:	EKOHYDROLOGY

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**10**	**10**			**210**	**10**

Nosilec predmeta / Lecturer:	**Mitja Brilly**, Mihael J. Toman

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Predhodna izobrazba s področji hidrologije in biologije ali opravljeni ustrezni temeljni predmeti. Prednost: predhodna izobrazba BSc Biologija, BSc Vodarstvo in okoljsko inženirstvo, MSc Ekologija in biodiverziteta	Previous education in hydrology and biology, or subjected to the appropriate core courses. Priority: previous education BScf Biology, BSC Water Management and Municipal Engineering, MSc Ecology and Biodiversity

Vsebina:	**Content (Syllabus outline):**
Hidrološki parametri vodnega okolja, vodnatost, določanje vodnatosti, pomen vodnatosti. Pomen in določanje posameznih hidroloških parametrov pomembnih za vodne habitate. Pomen hitrosti vode za vodne organizme. Vplivi na različne združbe v tekočih vodah. Morfološke in fiziološke adaptacije organizmov na vodni tok. Ekoregije, ekotipi, definicije in določanje. Direktiva evropske unije za vode. Biološki parametri in podporni elementi določanja ekološkega stanja vodotokov. Harmonizacija directive in zakon o vodah.. Biološki minimum: definicije, pomen in določanje. Vpliv na samočistilno sposobnost vodotoka. Ekološko sprejemljivi pretok: definicije, pomen in določanje. Ekološko sprejemljivi vodni režim. Vpliv vodnih in obvodnih okolij na vodni režim in vodne združbe. Zaščita habitatov in združb. Metode terenskega monitoring in modeliranje ekohidroloških pojavov.	Hydrological parameters of the aquatic environment, water levels, water levels determination, the importance of water levels. The importance of determining individual and hydrological parameters important for aquatic habitats. The importance of water velocity to aquatic organisms. Effects on the various communities in running waters. Morphological and physiological adaptations of organisms to the water flow. Ecoregions, ecotypes, definition and determination. European Union Directive on water. Biological parameters and support elements of setting ecological status of rivers. Harmonisation Directive and the Water Act .. Biological minimum: definition, meaning and determination. Impact on the self-cleaning ability of the stream. Ecologically acceptable flow: definition, meaning and determination. Ecologically acceptable flow regime. Impact aquatic and riparian environments on the water regime and aquatic communities. Protection of habitats and communities. Methods of field monitoring and modeling ecohydrological phenomena.

Temeljni literatura in viri / Readings:

Environmental Hydrology 2003, Ward A.D. in Trimble S.W., Lewis Publishers
Ekohidrologija, 2003, Bonacci O, IGH d.d. Zagreb
Stream Coridor Restoration, 1998 , www.usda.gov/stream_restoration/
Limnology, Lake and River Ecosystems 2001, Wetzel R.G., Academic Press, San Diego
Hydrology and the river environment 1996, Newson, M., Clarendon Press, Oxford
objave v periodiki **ECOHYDROLOGY & HYDROBIOLOGY**

Cilji in kompetence:	**Objectives and competences:**
Pridobivanje znanja o hidroloških pojavih in procesih pomembnih za naravne življenjske združbe in njihocvo sukcesijo.	Gaining knowledge of hydrological phenomena and processes important for wildlife species and their succession.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Znanje potrebno za določanje ekoregij, ekološko sprejemljivega pretoka in ekološko sprejemljivega režima voda.	Knowledge and understanding: Knowledge necessary to determine the ecoregions, ecologically acceptable and ecologically acceptable flow regime water.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, seminarske in terenske vaje	lectures, tutorials and field work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Projekt	**40%**	Project
Ustni zagovor projekta	**60%**	Oral presentation of the project

Reference nosilca / Lecturer's references:

1. Mikoš, M., Četina, **M., Brilly**, M.. Hydrologic conditions responsible for triggering the Stože landslide, Slovenia. Eng. geol., 2004, letn. 73, št. 3/4, str. 193-213.
2. Šraj, M., **Brilly, M.**, Mikoš, M.. Rainfall interception by two deciduous Mediterranean forests of contrasting stature in Slovenia. Agric. for. meteorol.., 2008, letn. 148, št. 1, str. 121-134.
3. Rusjan, S., **Brilly, M**., Mikoš, M.. Flushing of nitrate from a forested watershed : An insight into hydrological nitrate mobilization mechanisms through seasonal high-frequency stream nitrate dynamics. J. Hydrol. (Amst.). .], junij 2008, letn. 354, št. 1-4, str. 187-202, ilustr

1. URBANIČ, Gorazd, **TOMAN, Mihael Jožef**. Influence of environmental variables on stream caddis larvae in three Slovenian ecoregions: Alps, Dinaric western Balkans and Pannonian lowland. *Int. rev. hydrobiol.*. [Print ed.], 2007, letn. 92, št. 4-5, str. 582-602.
2. ŽIŽEK, Suzana, HORVAT, Milena, GIBIČAR, Darija, FAJON, Vesna, **TOMAN, Mihael Jožef**. Bioaccumulation of mercury in benthic communities of a river ecosystem affected by mercury mining. *Sci. total environ.*, 2007, vol. 377, issues 2-3, str. 407-415
3. URBANIČ, Gorazd, **TOMAN, Mihael Jožef**. Caddisflies in watersourses of the northern part of a Dinaric western Balkans ecoregion in relation to environmental factors. *Verh. - Int. Ver. Theor. Angew. Limnol.*, 2006, letn. 29, str. 2172-2176.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKOLOGIJA PODZEMELJSKIH HABITATOV**
Course title:	ECOLOGY OF SUBTERRANEAN HABITATS

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**40**			**30**	**160**	**10**

Nosilec predmeta / Lecturer:	Boris Sket

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski/ Slovenian**
	Vaje / Tutorial:	**slovenski-angleški/Slovenian-English**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Diplomanti študijskega programa Biologija ter drugih študijskih programov, ki vključujejo znanja sistemske zoologije in ekologije.	Graduates of study programmes in Biology and other programmes that includes knowledge of zoology and ecology.

Vsebina:	**Content (Syllabus outline):**
- pregledni sistem podzemeljskih habitatov (votlinskih kopnih, votlinskih vodnih, intersticialnih voda) - abiotske značilnosti (kemijski in fizikalni ekološki parametri) podzemeljskega okolja - ekološke posebnosti posameznih habitatov – podzemeljski habitati kot življenjsko okolje - pregled podzemeljskih organizmov, njihove biološke posebnosti, biogeografija (vzorci razširjenosti, endemizem) - ogroženost podzemeljskega okolja in življa	- a systematic review of subterranean habitats (terrestrial in caves, aquatic in caves and firrures, interstitial) - abiotic characterristics (chemical and physical parameters) of the subterranean environment - ecological pecularities of individual habitats – subterranean habitats as living environment - a review of subterranean organizms, their biological pecularities, biogeography (distribution patterns, endemism)

	- endangerment of the subterranean environment and living world

Temeljni literatura in viri / Readings:

- Camacho, A.I. (ed.) 1992. The natural history of biospeleology. Madrid: Museo Nacional de Cienc- ias Naturales.

- Wilkens, H., Culver, D.C., Humphreys, W.S. (Eds.), 2000. Ecosystems of the world 30, Subterranean Ecosystems. Elsevier, Amsterdam.

- izbrana dela izvajalca / selected lecturer's papers

Cilji in kompetence:	**Objectives and competences:**
Razumeti obsežnost vplivov površinskega okolja na podzemlje in pomen podzemskega okolja (zlasti podzemeljskih vodnih virov) za človeka.	To comprehend the real extent of influences of the surface environment to the subterranean realm and the importance of the latter (particularly of the subterranean water resources) for the human population.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Okoljevarstvenik spozna posebnosti podzemeljskih habitatov, njihovo pestrost in razloge za potrebo po varovanju.	Knowledge and understanding: The environmentaist takes knowledge with peculiarities of subterranean habitats, their diversity and the reasons for the need for protection

Metode poučevanja in učenja:	**Learning and teaching methods:**
študij literature, konsultacije, terenske vaje	literature, consultations, field experience

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
ustni izpit ali seminarska naloga	**100%**	oral exam or a coursework

Reference nosilca / Lecturer's references:

SKET, Boris. The ecology of anchihaline caves. Trends ecol. evol. (Amst.). [Print ed.], 1996, let. 11, št. 5, str. 221-225

SKET, Boris. High biodiversity in hypogean waters and its endangerment - the situation in Slovenia, the Dinaric karst, and Europe. Crustaceana, 1999, letn. 72, št. 8, str. 767-779.

SKET, Boris. Diversity Patterns in the Dinaric Karst. In William B. White and David C. Culver, editors: Encyclopedia of Caves, Chennai: Academic Press , **2012**, pp. 228 - 238.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Ekološki procesi v morju**
Course title:	Marine ecological processes

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
60	**60**				**130**	**10**

Nosilec predmeta / Lecturer:	**Jadran Faganeli**, Lovrenc Lipej, Alenka Malej

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski, angleški Slovenian/ English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski program. Predznanje temeljev biologije, mikrobiologije, kemije in geologije.	Inscription in the doctoral study programme. The basic knowledge of biology, microbiology, chemistry and geology.

Vsebina:	**Content (Syllabus outline):**
Morska voda, Morski sediment Morski ekosistem, Struktura in funkcija, Stabilnost in nihanja ekosistemov, Principi odzivnosti, odpornost, vztrajnost Ekološka niša v morskem ekosistemu, Razporeditev biodverzitete, Epibioza, Simbioza in drugi ekološki odniosi, Prilagoditve morskih organizmov Biogeokemijska kroženja in masna bilanca, Biogeokemijski modeli morja, Uporaba stabilnih in radioaktivnih izotopov ter biomarkerjev (biogeokemijskih sledilcev), Paloeoocenaografske rekonstrukcije,	1. Seawater, marine sediment 2. Marine ecosystem, Structure and function, Stability and variability of ecosystems, Response, resistivity, persistence 3. Ecological niche in the marine ecosystem, Distiribution of biodiversity, Epibiosis, Simbiosis and other ecological relations, Adaptataion of marine organisms 4. Biogeochemical cyclings and mass balances, Biogeochemical models of the sea, Use of stable and radioactive isotopes and geochemical biomarkers (tracers), Paleoceanographical reconstructions,

Onesnaževanje in kroženje pomembnih polutantov v morju Ekološke lastnosti nekaterih pomembnih morskih bazenov (Sredozemlje, severni Jadran in Tržaški zaliv) Nove metode in pristopi v morski ekologiji	Pollution and cycling of major pollutants in the sea 5. Eclogical properties of some important marine basins; Mediterranean, northern Adriatic, Gulf of Trieste 6. New methods and approaches in marine ecology

Temeljni literatura in viri / Readings:

Knjige/Textbooks

S.M. Libes, 2009. Introduction to marine biogeochemistry, 2nd ed., Elsevier, Amsterdam, 909 pp. (ISBN: 978-0-12-088530-5)

J.W. Nybakken, 1997. Marine biology, An ecological approach, Addison Wesley Longman, Menlo Park, 481 pp. (ISBN: 0-673-99451-1)

F.K. McKinney, 2007. The northern Adriatic ecosyste, Deep time in a shallow sea. Columbia University Press, New York, 328 pp. (ISBN: 978-0231-13242-8)

T.C., Malone, A. Malej, L.W. Harding, N. Smodlaka, R.E. Turner, 1999. Ecosystems at the land-sea margin, Drainage basin to coastal sea, AGU Washington, 381 pp. (ISBN; 087590-269-3)

L. Lipej, R. Turk, T. Makovec, 2006. Ogrožene vrste in habitatni tipi v slovenskem morju. Zavod R Slovenije za varstvo narave, Ljubljana, 264 pp. (ISBN: 961-91505-4-6)

Revije/Journals

Marine Ecology Progress Series, Inter-Research
Limnology and Oceanography, ASLO
Marine Ecology, Wiley
Marine Biology, Springer
Journal of Experimental Marine Biology and Ecology, Elsevier
Vie et Milieu, Universite Pierre et Marie Curie
Marine Chemistry, Elsevier
Estuarine, Coastal and Shelf Science, Elsevier
Continental Shelf Research, Elsevier
Marine Geology, Elsevier
Progress in Oceanography, Elsevier
Oceanography, Oceanographical Society
Trends in Ecology and Evolution, Elsevier

Cilji in kompetence:	**Objectives and competences:**
Predmet seznanja študenta z dejavniki, vključno s človekovimi, ki uravanavajom ekološke procese v morju. Pomemben poudarek je na prikazu lastnosti morske vode in sedimentov, ekološki niši, biodiverziteti, ekoloških odnosih, prilagoditvam organizmov, strukturi in funkciji morskih ekosistemov, biogeokemijskih kroženj in masnih bilanc pomembnih biogenih elementov in polutantov, biogeokemijskih modelov, uporabe izotopov in biomarkerjev ter človekovih vplivov in sprememb.	In this course, students are informed about factors, including anthropogenic, controlling the marine ecological processes. Important aspects are devoted to description of seawater and sedimsnt properties, ecological niche, biodiversity, ecological relations, adaptation of organisms, structure and function of marine ecosystem, biogeochemical cyclings and mass balances of important biogenic elements and pollutants, biogeochemical models, use of isotopes and biomarkers as well as anthropogenic impacts and global changes.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pridobljeno znanje bodo študenti sposobni uporabiti v eksperimentalnih pristopih v morski ekologiji in razumeti ekološke procese v morju vključno z globalnimi spremembami.	Knowledge and understanding: The students will be able to use the acquisited knowledge in the experimental studies in marine ecology and to understand ecological processes in the sea including global changes

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, terenska ekskurzija, nastop, sodelovanje na predavanjih domačih in tujih predavateljev	Courses, seminars, field excursion, presentations,, attendance at lectures of invited lecturers

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predstavitev seminarske naloge in ustni izpit	**40%** **60%**	Presentation of seminar work and oral exam

Reference nosilca / Lecturer's references:

Prof. dr. Jadran Faganeli

FAGANELI, Jadran, OGRINC, Nives, KOVAČ, Nives, KUKOVEC, Katja, FALNOGA, Ingrid, MOZETIČ, Patricija, BAJT, Oliver. Carbon and nitrogen isotope composition of particulate organic matter in relation to mucilage formation in the Northern Adriatic sea. *Mar. Chem.*. [Print ed.], 2009, vol 114, str. 102-109, doi: http://dx.doi.org/10.1016/j.marchem.2009.04.005.,

FAGANELI, Jadran, MOHAR, Bojana, KOFOL, Romina, PAVLICA, Vesna, MARINŠEK, Tjaša, ROZMAN, Ajda, KOVAČ, Nives, ŠURCA VUK, Angela. Nature and lability of northern Adriatic macroaggregates. *Mar. drugs*, 2010, vol 8, str. 2480-2492. http://www.mdpi.com/1660-3397/8/9/2480/pdf.,

DE VITTOR, Cinzia, **FAGANELI, Jadran**, EMILI, Andrea, COVELLI, Stefano, PREDONZANI, Sergio, ACQUAVITA, Alessandro. Benthic fluxes of oxygen, carbon and nutrients in the Marano and Grado Lagoon (northern Adriatic Sea, Italy). *Estuar., coast. shelf sci.*, 2012, vol. 113, str. 57-70, doi: 10.1016/j.ecss.2012.03.031.,

Prof. dr. Lovrenc Lipej

LIPEJ, Lovrenc, MAVRIČ, Borut, PALISKA, Dejan, CAPAPÉ, Christian. Feeding habits of the pelagic stingray Pteroplatytrygon violacea (Chondrichthyes: Dasyatidae) in the Adriatic Sea. *J. Mar. Biol. Assoc. U.K.*, 2012, in press , str. 1-6, ilustr., doi: 10.1017/S0025315412000197.,

MAVRIČ, Borut, URBANIČ, Gorazd, **LIPEJ, Lovrenc**, SIMBOURA, Nomiki. Influence of sample size on ecological status assessment using marine benthic invertebrate-based indices. *Mar. ecol. (Berl.)*, 2012, str. 1-8, doi: 10.1111/j.1439-0485.2012.00526.x.,

LIPEJ, Lovrenc, MAVRIČ, Borut, ORLANDO-BONACA, Martina, MALEJ, Alenka. State of the art of the marine non-idigenous flora and fauna in Slovenia. *Medit. Mar. Sci.*, 2012, vol 13, str. 243-249.,

Prof.dr. Alenka Malej

DUARTE, Carlos M., PITT, Kylie A., LUCAS, Cathy H., PURCELL, Jennifer E., SHIN-ICHI, Uye, ROBINSON, Kelly L., BROTZ, Lucas, DECKER, Mary Beth, SUTHERLAND, Kelly R., **MALEJ, Alenka**, MADIN, Laurence P., MIANZAN, Hermes, GILI, Josep-Maria, FUENTES, Verónica, ATIENZA, Dacha, PAGÉS, Francesc, BREITBURG, Denise, MALEK, Jannafer, GRAHAM, William M., CONDON, Robert H. Is global ocean sprawl a cause of jellyfish blooms?. *Front. ecol. environ. (Print)*, 2012, let. 10, št. [8], str. 1-7, ilustr. http://www.esajournals.org/loi/fron, doi:

10.1890/110246.,

TINTA, Tinkara, KOGOVŠEK, Tjaša, **MALEJ, Alenka**, TURK, Valentina. Jellyfish modulate bacterial dynamic and community structure. *PloS one*, 2012, e39274, št. 6, str. 1-11. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0039274, doi: 10.1371/journal.pone.0039274.,

CONDON, Robert H., DUARTE, Carlos M., PITT, Kylie A., ROBINSON, Kelly L., LUCAS, Cathy H., SUTHERLAND, Kelly R., MIANZAN, Hermes, BOGEBERG, Molly, PURCELL, Jennifer E., DECKER, Mary Beth, SHIN-ICHI, Uye, MADIN, Laurence P., BRODEUR, Richard D., HADDOCK, Steven Harold David, **MALEJ, Alenka**, PARRY, Gregory D., ERIKSEN, Elena, QUIÑONES, Javier, ACHA, E. Marcelo, HARVEY, Michel, ARTHUR, James M., GRAHAM, William M. Recurrent jellyfish blooms are a consequence of global oscillations. *Proc. Natl. Acad. Sci. U. S. A.*, dec. 2012, str. 1-6, ilustr. http://www.pnas.org/content/early/2012/12/26/1210920110.full.pdf+html, doi: 10.1073/pnas.1210920110.,

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**EKOTOKSIKOLOGIJA**
Course title:	**ECOTOXICOLOGY**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	**Izbirni predmet/ elective course**
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
15	**40**	**10**	**/**	**60**	**125**	**10**

Nosilec predmeta / Lecturer:	**Tatjana Tišler,** Primož Zidar, Anita Jemec, Damjana Drobne

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.	Enrolment in PhD study. Knowledge of basic natural sciences.

Vsebina:	**Content (Syllabus outline):**
zgodovina ekotoksikologije, njena definicija in koncept razlike in smisel razlikovanja med ekotoksikologijo in okoljsko toksikologijo primeri vodnih in kopenskih ekotoksikoloških študij za različne kemikalije in mešanice kemikalij razumevanje in interpretacija rezultatov ekotoksikoloških študij aktualne tematike s stališča tveganja za okolje (nanomateriali, motilci hormonskega sistema) kvaliteta kemijskih in ekotoksikoloških podatkov pri raziskavah vplivov kemikalij na okolje nadomeščanje podatkov z »*in silico*« pristopi koncept ocene tveganja za okolje	history of ecotoxicology, its definition and concept differences and meaning of distinguishing between ecotoxicology and environmental toxicology examples of aquatic and terrestrial ecotoxicological studies with different chemicals and their mixtures understanding and interpretation of the results obtained in ecotoxicological studies emerging topics from the environmental risk point of view (nanomaterials, endocrine disrupting compounds) quality of chemical and ecotoxicological data in research studies dealing with effects on environment

multidisciplinaren pristop pri oceni tveganja za okolje kvaliteta okolja: ekotoksikološki, kemijski in sociološki vidiki ekotoksikološke študije v okoljski zakonodaji, interpretacija in soustvarjanje okoljske zakonodaje (regulative)	replacement of data by *in silico* approach concept of environmental risk assessment multidisciplinary approach in environmental risk assessment environmental quality: ecotoxicological, chemical and sociological point of view ecotoxicological studies in environmetal regulations, interpretation and co-creation of environmental regulation.

Temeljni literatura in viri / Readings:

C.H. Walker, S.P. Hopkin, R.M. Sibly and D.B. Peakall. Principles of ecotoxicology, 3rd edition; CRC Press 2006. (izbrana poglavja)
C.J. van Leeuwen and T.G. Vermeire. Risk assessment of chemicals: an introductions, 2nd edition; Springer 2007. (izbrana poglavja)
Aktualni znanstveni članki, učna gradiva

C.H. Walker, S.P. Hopkin, R.M. Sibly and D.B. Peakall. Principles of ecotoxicology, 3rd edition; CRC Press 2006. (selected chapters)
C.J. van Leeuwen and T.G. Vermeire. Risk assessment of chemicals: an introductions, 2nd edition; Springer 2007. (selected chapters)
Topical scientific papers, teaching materials

Cilji in kompetence:	**Objectives and competences:**
Cilji: Študenti se bodo seznanili z načini pridobivanja ekotoksikoloških podatkov, interpretacijo rezultatov in uporabo ekotoksikološkega znanja v praksi. Študent bo spoznal razlike med okoljsko toksikologijo in ekotoksikologijo. Predstavljeni bodo primeri ekotoksikoloških študij v vodnem in kopenskem okolju. Pokazane bodo razlike med evropsko in ameriško prakso in zakonodajo na področju okolja in uporabo ekotoksikoloških znanj na tem področju. Ekotoksikologija je multidisciplinarna veda, zato je za dosego željenega rezultata potrebno uspešno sodelovanje strokovnjakov iz področja naravoslovja, tehnike in razumevanje družboslovja. Praktični primeri bodo zasnovani tako, da bodo vključevali različna znanja in veščine. Pri predmetu bo poudarek na multidisciplinarnem pristopu pri reševanju okoljskih problemov. Velik poudarek bo namenjen kvaliteti podatkov. **Kompetence:** Študent bo sposoben poiskati in ustrezno interpretirati strokovno in znanstveno literaturo na področju ekotoksikologije ne glede na njegovo predizobrazbo in področje. Sposoben bo delovati v multidisciplinarnem timu pri reševanju okoljske problematike. Študent bo poglobil znanje iz svojega področja in dobil osnovno razumevanje drugih področij.	**Objectives:** Students will learn how to obtain ecotoxicological data, interpret the obtained results and apply ecotoxicological knowledge in practice. Student will recognise the differences between environmental toxicology and ecotoxicology. Examples of some ecotoxicological studies in aquatic and terrestrial environment will be presented. Students will know the differences between the European and American practices dealing with environment and use of ecotoxicological knowledge in this field. As ecotoxicology is a multidisciplinary science and the desired results could be obtained only by successful cooperation between experts from natural, technical and social sciences, a multidisciplinary approach will be emphasized. Students will learn practical examples that will incorporate different knowledge and skills. The importance of data quality will be pointed out. **Competences:** Students, irrespective of previous education, will be able to find and properly interpret scientific and professional ecotoxicological literature. Students will be able to work in a multidisciplinary team to solve environmental problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje osnovnih principov v ekotoksikologiji, uporaba pridobljenih ekotoksikoloških znanj v praksi, poznavanje aktualne okoljske problematike	Knowledge and understanding: Understanding the basic principles of ecotoxicology, application of ecotoxicological data in practice, information of the most emerging evironmental topics

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, konzultacije, seminarji, laboratorijske vaje in problemsko orientirano učenje- projekt.	Lectures, individual lectures, seminars, tutorials, problems oriented learning - project

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
izdelana in predstavljena seminarja	**40%**	Written and presented seminars
ustno preverjanje znanja po vseh končanih obveznostih.	**60%**	Oral exam

Reference nosilca / Lecturer's references:

doc. dr. Tatjana Tišler

TIŠLER, Tatjana, JEMEC, Anita, MOZETIČ VODOPIVEC, Branka, TREBŠE, Polonca. Hazard identification of imidacloprid to aquatic environment. *Chemosphere (Oxford)*. [Print ed.], 2009, vol. 76, no. 7, str. 907-914.

BISTAN, Mirjana, TIŠLER, Tatjana, PINTAR, Albin. Ru/TiO[sub]2 catalyst for efficient removal of estrogens from aqueous samples by means of wet-air oxidation. *Catalysis communications*, 2012, vol. 22, str. 74-78.

JEMEC, Anita, TIŠLER, Tatjana, ŽGAJNAR GOTVAJN, Andreja. Assessment of landfill leachate toxicity reduction after biological treatment. *Arch. environ. contam. toxicol.*, 2012, vol. 62, no. 2, str. 210-221.

doc. dr. Primož Zidar

ZIDAR, Primož, ŽIŽEK, Suzana. The impact of coccidiostats monensin and lasalocid on Cd and Pb uptake in the isopod Porcellio scaber. Appl. soil ecol. (Print), 2012, vol. 55, str. 36-43.

ZIDAR, Primož, HRIBAR, Monika, ŽIŽEK, Suzana, ŠTRUS, Jasna. Behavioural response of terrestrial isopods (Crustacea:Isopoda) to pyrethrins in soil or food. European Journal of Soil Biology. [Print ed.], 2012, vol. 51, str. 51-55.

ŽIŽEK, Suzana, HRŽENJAK, Rok, TAVČAR-KALCHER, Gabrijela, ŠRIMPF, Karin, ŠEMROV, Neva, ZIDAR, Primož. Does monensin in chicken manure from poultry farms pose a threat to soil in vertebrates?. Chemosphere (Oxford). [Print ed.], 2011, vol. 83, no. 4, str. 517-523, doi: 10.1016/j.chemosphere.2010.12.058.

doc. dr. Anita Jemec

JEMEC, Anita, TIŠLER, Tatjana, ERJAVEC, Boštjan, PINTAR, Albin. Antioxidant responses and whole-organism changes in *Daphnia magna* acutely and chronically exposed to endocrine disruptor bisphenol A. *Ecotoxicol. environ. saf.*, 2012, vol. 86, str. 213-218.

JEMEC, Anita, DJINOVIĆ, Petar, TIŠLER, Tatjana, PINTAR, Albin. Effects of four CeO_2 nanocrystalline catalysts on early-life stages of zebrafish "*Danio rerio*" and crustacean "Daphnia magna". *J. hazard. mater.*. [Print ed.], 2012, vol. 219-220, str. 213-220.

GOLOBIČ, Miha, JEMEC, Anita, DROBNE, Damjana, ROMIH, Tea, KASEMETS, Kaja, KAHRU, Anne. Upon exposure to Cu nanoparticles, the accumulation of copper in the isopod *Porcellio scaber* is due to the dissolved Cu ions inside the digestive tract. *Environ. sci. technol.*. [Print ed.], 2012, vol. 46, issue 21, str. 12112-12119.

prof. dr. Damjana Drobne

RAJAPAKSE, Katarina, DROBNE, Damjana, KASTELEC, Damijana, MARINŠEK-LOGAR, Romana. Experimental evidence of false positive Comet test results due to TiO2 particle - assay interactions. *Nanotoxicology*, 2012, 32 str., [in press],

RAJAPAKSE, Katarina, DROBNE, Damjana, VALANT, Janez, VODOVNIK, Maša, LEVART, Alenka, MARINŠEK-LOGAR, Romana. Acclimation of Tetrahymena thermophila to bulk and nano-TiO[sub]2 particles by changes in membrane fatty acids saturation. J. hazard. mater.. [Print ed.], 2012, vol. 221-222, str. 199-205.

ZUPANC, Jernej, DROBNE, Damjana, DRAŠLER, Barbara, VALANT, Janez, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, MAKOVEC, Darko, RAPPOLT, Michael, SARTORI, Barbara, KOGEJ, Ksenija. Experimental evidence for the interaction of C-60 fullerene with lipid vesicle membranes. *Carbon (N. Y.)*. [Print ed.], 2012, vol. 50, no. 3, str. 1170-1178.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Etični odnos do narave**
Course title:	The Ethics of Nature

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predemt / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	Borut Ošlaj

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študijski program.	Enrollment in doctoral program

Vsebina:	**Content (Syllabus outline):**
1. Človek in problem etičnega delovanja. Problem prehoda iz teorije (vednosti) k praksi (delovanju). 2. Kratka predstavitev etike kot filozofske discipline ter tistih teorij, šol in metod, ki posredno tematizirajo problem, okolja, narave ali življenja. 3. Temeljni naravoetični koncepti in metode: a) tradicionalne religije in narava (arhaične religije, judovska religija, budizem) b) kontroverza med biocentristi (zlasti globinska ekologija: Leopold, Naess) in antropocentristi (Descartes, Kant, Ferry) c) konceptualno-terminološka razlika med okoljem in naravo ter med sekundarno in primarno odgovornostjo. Človekova razpetost med okoljem in naravo ter moralno-etične dileme. d) utilitarizem (Bentham, Singer) e) etika življenja (Schweitzer) f) etika odgovornosti (Jonas) g) Wilberjeva kritika površinske ekologije h) Koncept svetosti življenja i) diaforična etika narave (telo kot estetični posrednik med naravo in umom) j) Nova vloga narave/življenja v možnem procesu humanizacije človeka in izhod iz postmoderne	1. Human being and the problem of ethical action. The problem of transition from theory (knowledge) to practice (action). 2. Short exposition of ethics as a philosophical discipline as well as those theories, schools of thought and methods which indirectly tackle issues relating to environment, nature or life. 3. Basic concepts and methods of Ethics of Nature: Traditional religions and nature (archaic religions, Jewish religion, Buddhism) The controversy among Biocentrists (especially depth ecology: Leopold Naess) and Anthropocentrists (Descartes, Kant,Ferry) Conceptual-terminological difference between environment and nature and between secondary and primary responsibility. The human being's tornness between environment and nature, and moral-ethical dilemmas. Utilitarianism (Bentham, Singer) Ethics of life (Schweitzer) Ethics of responsibility (Jonas) Wilbers criticism of shallow ecology The concept of the sanctity of life Diaphoric ethics of nature (body as the mediator between nature and mind) New role of nature/life in the possible humanisation process of humans and the way out of postmodernity

Temeljni literatura in viri / Readings:

1) Ferry, Luc: Novi ekološki red – Drevo, žival in človek, Ljubljana 1992.
2) Jonas, Hans: The Imperative of Responsibility, Chicago 1985.
3) Wilber, Ken: A Brief History of Everything, Boston 1996.
4) Schweitzer, Albert: Etika spoštovanja do življenja, Nova revija, št. 113-114, september-oktober 1991.
5) Lovelock, John, E.: Gaja, nov pogled na življenje na zemlji, Ljubljana 1994.
6) Singer, Peter: Animal Liberation, New York 2001.
7) Johnson, Lawrence E.: A Morally Deep World, Cambridge 1993.
8) Ošlaj, Borut: Človek in narava – Osnove diaforične etike narave, Ljubljana 2000
9) Ošlaj, Borut: Ethica, quo vadis? Albert Schweitzer in vprašanje renesanse etične kulture, Ljubljana 2010

Cilji in kompetence:	**Objectives and competences:**
Študenti se seznanijo s temeljnimi naravoetičnimi koncepti, metodami ter z njihovimi osnovnimi vprašanji in dilemami. Študenti spoznajo probleme etičnega delovanja in jih znajo kritično premisliti v kontekstu sodobnega odnosa posameznika in družbe do okolja oz. narave. Sposobnost razumevanja antropoloških predpostavk človekovega problematičnega odnosa do njegovega okolja. Študenti spoznajo temeljna izhodišča za možnost avtonomne etične drže in ravnanja do okolja oz. narave na sploh.	Students acquire the ability to understand basic concepts and methods of Ethics of Nature, as well as its basic questions and dilemmas. Students gain knowledge of the problems of ethical action, acquiring ability of their critical re-examination within the context of contemporary relation of individuals and society to their environment. Ability to understand anthropological presuppositions of human being's problematic attitude to their environment. Students acquire knowledge of basic starting points for the possibility of autonomous ethical stance and action towards environment or nature in general.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Osnovno poznavanje in kritično razumevanje razvoja teoretskih konceptov etike okolja in narave. Smiselno ločevanje in razumevanje razlike med okoljem in naravo, med biocentrizmom in antropocentrizmom, med sekundarno in primarno odgovornostjo.	Knowledge and understanding: Basic knowledge and critical understanding of the development of theoretical concepts of environment and nature. Meaningful differentiation between and understanding of the difference between environment and nature, Biocentrism and Anthropocentrism, secondary and primary responsibility.

Metode poučevanja in učenja:	**Learning and teaching methods:**
klasična predavanja in problemsko naravnane diskusije (sodelovalno učenje)	Lectures and issue-oriented discussions (cooperative learning)

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ali ustni izpit ali seminarsko delo – od 6-10 (pozitivno) oz. 1-5 (negativno)	Po dogovoru s študenti na začetku kurza/ as agreed with students at the beggining of the course	oral exam or seminar paper – 6-10 (positive) viz. 1-5 (negative)

Reference nosilca / Lecturer's references:

1. OŠLAJ, Borut. Hans Jonas und die Möglichkeit einer diaphorischen Natur-Ethik. V: Čović, Ante (ur.), Hoffmann, Thomas Sören (ur.). Bioethik und kulturelle Pluralität – Bioethics and Cultural Plurality. Sankt Augustin, Academia Verlag, 2005, str. 93-102.

2. OŠLAJ, Borut. Človek in narava : osnove diaforične etike narave, (Zbirka Sophia, 2000, 3). Ljubljana: Znanstveno in publicistično središče, 2000. 261 str. ISBN 961-6294-24-5.

3. OŠLAJ, Borut. Ethica, quo vadis? : Albert Schweitzer in vprašanje renesanse etične kulture, (Zbirka Razprave FF). Ljubljana: Znanstvena založba Filozofske fakultete, 2010. 231 str. ISBN 978-961-237-358-0.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Fitofarmacevtska sredstva in njihove alternative**
Course title:	Plant Protection Products and Their Alternatives

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20		60			170	**10**

Nosilec predmeta / Lecturer:	Stanislav Trdan

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski (možno angleški) Slovenian (English possible)
	Vaje / Tutorial:	Slovenski (možno angleški) Slovenian (English possible)

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment to Doctoral Study.

Vsebina:	**Content (Syllabus outline):**
Škoda na rastlinah zaradi škodljivcev, bolezni in plevelov. Zgodovina in etika uporabe FFS. Prednosti in slabosti uporabe FFS. FFS v vodi, tleh, zraku. Ostanki FFS v živilih. Strupenost FFS za neciljne organizme. Posledice zmanjšane uporabe FFS in uporaba FFS na vodozbirnih območjih. Preprečevanje škodljivega delovanja FFS. Zmanjševanje škodljivih posledic FFS. FFS in odpornost (rezistenca) škodljivih organizmov nanje. Načini preseganja rezistence škodljivih organizmov na FFS. Pridelava živeža brez FFS. Koncepti in mehanizmi delovanja naravnih sovražnikov pri biotičnem zatiranju škodljivih	Plant damage caused by pests, diseases and weeds (harmful organisms). History and ethics of plant protection products (PPPs) use. Benefits and problems of PPPs use. PPPs in the water, soil, and air. PPPs residues in food. Toxicity of PPPs to non-target organisms. Consequences of diminished use of PPPs and the use of PPPs in water collection areas. Preventing harmful activity of PPPs. Diminishing the harmful consequences of PPPs use. PPPs and resistance of harmul organisms. The ways of overcoming the resistance of harmful organisms to PPPs. Food production without the use of PPPs. Concepts and mechanisms of biological control agents activities in controlling

organizmov. Pomen agrotehnike pri gospodarskem pomenu rastlinskih škodljivih organizmov in njihovih biotičnih agensov: kolobar, obdelava tal, čas in gostota sajenja (setve). Mešane saditve in setve, naravna fitofarmacevtska sredstva. Pomen zavetišč (refugijev) za škodljive in koristne žuželke in druge organizme.	harmful organisms. The role of agrotechnics in economic importance of harmful organisms and their natural enemies: rotation, soil cultivation, time and density of sowing/seeding/plantation. Mixed cropping, natural PPPs. The role of refugia for harmful and beneficial insects and other organisms.

Temeljni literatura in viri / Readings:

Monografije / Učbeniki

Godfrey, C.R.A. 1995. Agrochemicals from natural products. Marcel Dekker, Inc., New York, Basel, Hong Kong: 418 str., ISBN 0-8247-9553-9.

Hawkins, B.A., Cornell, H.V. 1999. Theoretical approaches to biological control. Cambridge University Press: 412 str., ISBN 0 521 57283 5.

Krieger, R. 2001. Handbook of pesticide toxicology. 2nd Edition. Vol. 1-2. Academic Press, San Diego etc.: 1908 str., ISBN 0-12-426260-0.

Pimentel, D., Lehman, H. 1993. The pesticide question – environment, economics and ethics. Chapman & Hall, New York and London, 441 str. ISBN 0-412-03581-2 (izbrana poglavja)

Pimentel, D. 2002. Encyclopedia of pest management. Taylor & Francis, Boca Raton, London, New York, Singapore: 929 str., ISBN 0-8247-0632-3.

Pimentel, D. 2007. Encyclopedia of pest management. Volume II. CRC Press, Taylor & Francis Group, Boca Raton, London, new York: 728 str., ISBN 978-1-4200-5361-6.

Zalom, F.G. 1995. Food, crop pests, and the environement. APS Press, Minnesota: 179 str., ISBN 0-89054-140-X.

Revijalni članki s področja, tekoča periodika, učna gradiva (dostopno na Biotehniški fakulteti)

Cilji in kompetence:	**Objectives and competences:**
Temeljni izobraževalni cilj je poglobitev znanja za samostojno raziskovalno delo na področju fitofarmacevtskih sredstev in njihovih alternativ ter seznanjenje s problemi onesnaževanja okolja zaradi nestrokovne rabe fitofarmacevtskih sredstev (FFS) ter z načini varovanja okolja, s poudarkom na pravilni rabi FFS in uporabi alternativnih načinov zdravstvenega varstva rastlin pred škodljivimi organizmi. Predviden študijski rezultat je kandidata usposobiti za izvedbo omenjenih raziskav, rezultati katerih bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti na področju varstva okolja.	Basic aim of education is deepening the knowledge for the purpose of individual research work in the field of PPPs and their alternatives, and acquaintance with the problems of environmental pollution on account of unprofessional use of PPPs as well as with the ways of environmental protection, which are based upon suitable use of PPPs and alternative methods of plant protection against harmful organisms. Expected result of the study is to qualify the candidate for performing the researches, results of which will present important contributions to fundamental or applied science in the field of environmental protection.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Slušatelji spoznajo zgodovinski razvoj fitofarmacevtskih sredstev in njihovih alternativ ter pomen obeh skupin varstva rastlin nekoč in danes. Študenti spoznajo škodo, ki jo škodljivi organizmi povzročajo na rastlinah in posledice neustrezne rabe FFS za okolje. Študenti razumejo mehanizme delovanja naravnih	Knowledge and understanding: Students learn about the historical development of PPPs and their alternatives, as well as the role of both groups of plant protection in the past and today. They are acquainted with the types of plant damage caused by different harmful organisms and the environmental consequences of unsuitable use of PPPs. The

sovražnikov in drugih posrednih varstvenih ukrepov pri zmanjševanju gospodarskega pomena škodljivih organizmov. Uporaba. Študenti pridobijo poglobljeno znanje o prednostih in slabostih uporabe FFS in o alternativnih načinih zatiranja škodljivih organizmov za vodenje lastnih raziskav in strokovno podporo zainteresiranim inštitucijam in pridelovalcem živeža. Refleksija. Kritično spremlja/zaznava problematiko FFS, ki ji prej, zaradi pomanjkljivega znanja, ni namenjal pozornosti. Prenosljive spretnosti. Seznanijo se z osnovno domačo in tujo literaturo s področja FFS in alternativnih načinov zatiranja škodljivih organizmov, prav tako s strokovnjaki, ki v Sloveniji delujejo na omenjenih področjih. Usposobijo se za ustno in pisno poročanje, ko analizirajo izbrani strokovni problem, vezan na uporabo/neuporabo FFS.	students understand the mechanisms of activity of the biological control agents and other indirect measures of pest control in diminishing their economic importance. Use of knowledge: The students acquire deep knowledge on the benefits and problems of the PPPs use and on alternative methods for controlling harmful organisms. They are able to perform they own investigations and they are qualified to offer professional support to the interested institutions and food producers. Reflection: Students are able to critically percept the problems of the PPPs, which they were not able to do earlier, because of insufficient knowledge. Skills: Students are acquainted with the basic domestic and foreign professional literature from the field of PPPs and their alternatives as well with the Slovenian specialists from the mentioned fields. They are qualified for oral or written reporting, when analyzing the scientific problem connected with the use/unuse of PPPS.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje, laboratorijske vaje, samostojno delo.	Lectures, seminar exercises, laboratory exercises, individual work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- pisni izpit - samostojno delo študenta Pogoja za opravljanje študijskih obveznosti – pisnega izpita: - prisotnost na laboratorijskih vajah - zagovor seminarske vaje	70 % 30 %	written exam individual work of the student Conditions for performing study obligations - written exam: - practicals participation - seminar exercises performed

Reference nosilca / Lecturer's references:

ROJHT, Helena, HORVAT, Aleksander, ATHANASSIOU, Christos G., VAYIAS, Bill J., TOMANOVIĆ, Željko, **TRDAN, Stanislav**. 2010. Impact of geochemical composition of diatomaceous earth on its insecticidal activity against adults of *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae). Journal of Pest Science, 83, 4: 429-436

LAZNIK, Žiga, TÓTH, Tímea, LAKATOS, Tamás, VIDRIH, Matej, **TRDAN, Stanislav**. 2010. Control of the Colorado potato beetle (*Leptinotarsa decemlineata* [Say]) on potato under field conditions: a comparison of the efficacy of foliar application of two strains of *Steinernema feltiae* (Filipjev) and spraying with thiametoxam. Journal of plant diseases and protection, 117, 3: 129-

135.

BOHINC, Tanja, **TRDAN, Stanislav**. 2012. Trap crops for reducing damage caused by cabbage stink bugs (*Eurydema* spp.) and flea beetles (*Phyllotreta* spp.) on white cabbage: fact or fantasy?. International Journal of Food, Agriculture and Environment, 10, 2: 1365-1370.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Geokemija okolja**
Course title:	Environmental Geochemistry

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**35**				**190**	**10**

Nosilec predmeta / Lecturer:	Nina Zupančič

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/ angleški Slovenian/ English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje temeljev kemije in geologije	Inscription to PhD programe. Basic knowledge of geology and chemistry.

Vsebina:	**Content (Syllabus outline):**
- geokemija atmosfere in precipitatov, kisli dež, ozonska plast in nekateri onesnaževalci zraka - globalni ogljikov cikel, geokemija stabilnih izotopov, globalna klima: preteklost, sedanjost, prihodnost - energija, tehnologija, naravni viri - težke prvine kamninah, tleh in vodah – naravne in nenaravne porazdelitve, (bio)geokemija Fe-Mn - fosfati in nitrati v okolju - kemično preperevanje, nastanek tal, geokemija glin - jezera, reke – preobremenjenost s hranili, osiromašenja s kisikom, urbane odplake, rudniške vode	- Geochemistry of atmosphere and its precipitates, acid rain, ozone layer and selected air pollutants - The global carbon cycle, stable isotope geochemistry, global climate: past, present, future - Energy, technology, natural resources - Heavy elements in rocks, soils and waters - natural and unnatural distribution, (bio) geochemistry of Fe-Mn - Phosphates and nitrates in the environment - Chemical weathering, soil formation, clay geochemistry - Lakes, rivers - overload of nutrients, oxygen depletion, urban sewage, mine waters

- oceani, kemija morja, primarna produkcija, morski sedimenti – zapis globalne zgodovine okolja, geokemija lahkih izotopov - geomedicina	- Oceans, marine chemistry, primary production, marine sediments - record of global history of environmental, light isotope geochemistry - geomedicine

Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig/Selected chapters from books:
- Montgomery, C. W. 2006: Environmental geology. Mc Graw Hill, 540 pp., Boston.
- Li Y. H. 2000: A compendium of geochemistry. Princeton University Press, 475 str., Princeton.
- Albarède, F. 1995: Introduction to geochemical modelling. Cambridge University Press, 543 str., Cambridge.
- Hill, M. K. 2004: Understanding environmental pollution. Cambridge, 467 pp.
- Strangeways, I. 2003: Measuring teh natural environment. Cambridge, 534 pp.
- Wright, D. A. & Welbourn, P. 2002: Environmentla toxicology. Cambridge, 630 pp.

Revijalni članki s področja/Journal papers from the topics

Cilji in kompetence:	**Objectives and competences:**
Študentje spoznajo naravne geokemične procese na Zemljini površini in v notranjosti Zemlje, ki vplivajo na porazdelitev prvin na površini (kamnine, sedimenti, tla, voda) ter človeške vplive na okolje, ki te porazdelitve spreminjajo. Seznanijo se z metodami, rezultati in interpretacijo lokalnih in globalnih geoloških pojavov iz kemičnega vidika, interakcijo naravno in antropogeno spremenjega zraka, hidrosfere in trdne snovi s kamninami, sedimenti in tlemi.	Students learn about the natural geochemical processes of the Earth's surface and interior, which are affecting the distribution of elements on the surface (rocks, sediments, soil, water) and human impacts on the environment, which change these distribution. Get acquainted with the methods, results and interpretation of local and global geological phenomena from the chemical point of view, interaction of naturally and anthropogenically changed air, hydrosphere and solids with rocks, sediments and soils.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje ciklov posameznih geogeno-antropogenih prvin.	Knowledge and understanding: Understanding of selected geogene-anthropogene cycles of elements.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji in osebne konzultacije.	Lectures, seminars and personal consultations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predstavitev seminarske naloge in ustni izpit	40% 60%	Presentation of seminar work and oral examination

Reference nosilca / Lecturer's references:

1. **ZUPANČIČ, Nina**. Lead contamination in the roadside soils of Slovenia. Environ. geochem. health, 1999, no. 1, vol. 21, 37-50.

2. **ZUPANČIČ, Nina**, ŠEBELA, Stanka, MILER, Miloš. Mineralogical and chemical characteristics of black coatings in Postojna cave system. Acta carsol., 2011, vol. 40, no. 2, 307-317

3. SKOBE, Simona, MANIATIS, Yannis, DOTSIKA, E., TAMBAKOPOULOS, D., **ZUPANČIČ, Nina**. Scientific charaterization of the Pohorje marbles, Slovenia. Archaeometry, 2010, vol. 52, issue 2, 177-190.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Geologija okolja**
Course title:	Environmental Geology

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**35**				**190**	**10**

Nosilec predmeta / Lecturer:	**Nina Zupančič**, Andrej Šmuc

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/ angleški Slovenian/English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Inscription to PhD programe.

Vsebina:	**Content (Syllabus outline):**
Pregled okolja na Zemlji - Minerali in kamnine - Tektonika plošč - Potresi - Vulkani - Poplave - Plazovi - Geologija in klima: ledeniki, puščave in globalni klimatski trendi - Viri surovin: voda, mineralne surovine, energijske surovine – fosilna goriva in alternativni viri - Odlagališča odpadkov - Onesnaženje tal, vode in zraka	Overview of the Earth's environment - Minerals and rocks - Plate tectonics - Earthquakes - Volcanoes - Floods - Landslides - Geology and climate: glaciers, deserts and global climate trends - Sources of raw materials: water, mineral resources, energy - fossil fuels and alternative sources - Waste dumps - Contamination of soil, water and air

Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig/Selected chapters from books:
- Montgomery, C. W. 2006: Environmental Geology. Mc Graw Hill, 540 pp., Boston.
- Keller, E. A. 1999: Environmental Geology (8th Edition). Prentice-Hall, Inc., 562 pp., New Jersey.
- Foley, D., McKenzie, G. D. & Utgard, R. O. 1999: Investigations in Environmental Geology (2nd Edition) Prentice-Hall, Inc., 365 pp.., New Jersey.
- Perry, C., & Taylor, K. 2007: Environmental Sedimentology. Blackwell Publishing, 441 pp. Malden

Revijalni članki s področja/Journal papers from the topics

Cilji in kompetence:	**Objectives and competences:**
Študent se seznani z osnovami geologije (minerali, kamnine, zgradba Zemlje), spozna delovanje endogenih (tektonika plošč, potresi, vulkanizem) in eksogenih (preperevanje, erozija, transport, sedimentacija) procesov, ki oblikujejo Zemljino površje ter z nastankom, razporeditvijo in dostopnostjo virov koristnih surovin (kovinske, nekovinske, organske), ravnanjem z njimi ter vplivi geoloških faktorjev na onesnaženje okolja in človekovo zdravje.	Students learn about the basics of geology (minerals, rocks, structure of the Earth), realizes the action of endogenous (plate tectonics, earthquakes, volcanism) and exogenous (weathering, erosion, transportation, sedimentation) processes that shape Earth's surface; formation, distribution and accessibility of resources of raw materials (metals, non-metallic, organic), their handling and impacts of geological factors on contamination of the environment and human health.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razume delovanje sistemov na Zemlji ter zna geološko znanje interdisciplinarno uporabiti.	Knowledge and understanding: Understands functioning of the Earth's systems and can inter-disciplinary use geological knowledge.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji in osebne konzultacije.	Lectures, seminars and personal consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predstavitev seminarske naloge in ustni izpit.	40% 60%	Presentation of seminar work and oral examination

Reference nosilca / Lecturer's references:

Nina Zupančič

DOBNIKAR, Meta, DOLENEC, Tadej, **ZUPANČIČ, Nina**, ČINČ JUHANT, Breda. The Karavanke Granitic Belt (Slovenia) - a bimodal Triassic alkaline plutonic complex. Schweiz. Mineral. Petrogr. Mitt., 2001, bd. 81, str. 23-38.

MÁRTON, Emö, TRAJANOVA, Mirka, **ZUPANČIČ, Nina**, JELEN, Bogomir. Formation, uplift and tectonic integration of a Periadriatic intrusive complex (Pohorje, Slovenia) as reflected in magnetic parameters and palaeomagnetic directions. *Geophys. j. int. (Print)*, 2006, vol. 167, is. 3, str. 1148-1159.

JARC, Simona, **ZUPANČIČ, Nina**. A cathodoluminescence and petrographical study of marbles from the Pohorje area in Slovenia. *Chem. Erde*, 2008.

Andrej Šmuc

ŠMUC, Andrej, ROŽIČ, Boštjan. The Jurassic Prehodavci Formation of the Julian Alps: easternmost outcrops of Rosso Ammonitico in the Southern Alps (NW Slovenia). *Swiss journal of*

geosciences, 2010, vol.103, issue 2, str. 241-255,

ŠMUC, Andrej, ROŽIČ, Boštjan. Tectonic geomorphology of the Triglav Lakes Valley (easternmost Southern Alps, NW Slovenia). *Geomorphology (Amst.)*. [Print ed.], 2009, issue 4, vol. 103, str. 597-604

GALE, Luka, KOLAR-JURKOVŠEK, Tea**, ŠMUC, Andrej**, ROŽIČ, Boštjan. Integrated Rhaetian foraminiferal and conodont biostratigraphy from the Slovenian Basin, eastern Southern Alps. *Swiss journal of geosciences*, 2012, vol. 105, issue 3, str. 435-462,3.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Geologija življenjskega okolja**
Course title:	Geology of living environment

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**30**				**195**	**10**

Nosilec predmeta / Lecturer:	Nina Zupančič

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/ angleški Slovenian/ English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Inscription to PhD programe.

Vsebina:	**Content (Syllabus outline):**
Minerali kot nosilci esencialnih in toksičnih prvin - Struktura in stabilnost mineralov in kamnin - Biološka razpoložljivost mineralov - Tvorba biomineralov - Naravni : antropogeni viri kemijskih prvin - Načini vnosa prvin v žive organizme, - Pomanjkanje in toksičnost prvin - Aktualni primeri obolevnosti zaradi geogenih dejavnikov	Minerals as carriers of essential and toxic elements - Structure and stability of minerals and rocks - The bioavailability of minerals - Formation bio-minerals - Natural: anthropogenic sources of chemical elements - Ways of elements input s in living organisms, - Lack and toxicity of elements - Current examples of illness due to geogene factors

Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig/Selected chapters from books:
- Sahai, N., Schoonen, M.A.A, 2006: Medical mineralogy and geochemistry. MSA, Virginia, 332 p.p.
- Selinus, O. (ed.),2000: Essentials of medical geology. Elsevier, 545 p.p.

Revijalni članki s področja/Journal papers from the topics

Cilji in kompetence:	**Objectives and competences:**
Študent se seznani z geološkimi materiali (minerali, kamnine), ki gradijo ali preko hrane, vode in zraka vstopajo v človeško telo in so nosilci različnih kemijskih prvin. Seznanijo se z njihovo strukturo, sestavo, razpadom, načinom vstopanja v tla, vodo in zrak ter njihovim obnašanjem v transportnih medijih.	Students learn about geological materials (minerals, rocks) that build or through food, water and air enter the human body and are carriers of different chemical elements. They learn about their structure, composition, dissolution, ways of entering the ground, water and air as well as their behavior in the transport media.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razume vpliv geoloških dejavnikov življenjskega okolja na živa bitja in je sposoben sprejemanja varovalnih ukrepov	Knowledge and understanding: Understands the impact of geological factors of the environment on living organisms and is capable of taking protective measures

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, konzultacije, laboratorijske vaje in izdelava seminarske naloge v okviru seminarskih vaj.	Lectures, consultations, laboratory excersises and seminar work in frame of seminar.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelana seminarska naloga in ustni izpit.	40% 60%	Presentation of seminar work and oral examination

Reference nosilca / Lecturer's references:

ZUPANČIČ, Nina. Lead contamination in the roadside soils of Slovenia. Environ. geochem. health, 1999, no. 1, vol. 21, str. 37-50.

ZUPANČIČ, **Nina**, PIRC, Simon. Calcium distibution in soil and stream sediments in Istria Croatia) and the Slovenian littoral. J. geochem. explor.. [Print ed.], 1999, vol. 65, str. 205-218, ilustr.

ZUPANČIČ, Nina. The influence of vegetation type on metal content in soils = vpliv vrste vegatacije na vsebnost težkih kovin v tleh. *RMZ-mater. geoenviron.*, 2012, vol. 59, no. 2/3, str. 229-244.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Goriva, zgorevanje in okolje**
Course title:	Fuels, Combustion and Environment

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	**Andrej Senegačnik,** Ferdinand Trenc, Tomaž Katrašnik

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski ali angleški/ Slovenian or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje s področja tehnike ali naravoslovja.	Enrolment in doctoral studies. Background in engineering or science.

Vsebina:	**Content (Syllabus outline):**
Primarni energetski viri v svetu in v naši državi, delež fosilnih goriv pri preskrbi z energijami, prognoze za bodočnost, možnosti oskrbe z energijo v Sloveniji. Sestava in lastnosti trdnih, tekočih in plinastih goriv ter njihove kemične in fizikalne karakteristike. Skladiščenje, transport in priprava za zgorevanje. Vrste kurjav za premoge, kvaliteta mletja, kurjave za kapljevita in plinasta goriva in regulacija zgorevalnega zraka. Osnovni zakoni pri zgorevanju. Reakcije pri zgorevanju in temperature. Stehiometrija zgorevanja za trdna, tekoča in plinasta goriva.	Primary energy sources in the world and in Slovenia, share of fossil fuels in the present supply, future prognosis, future energy supply of Slovenia. Structure and properties of solid, liquid and gaseous fuels and their chemical and physical characteristics. Storage, transport and preparation for combustion. Types of coal heating, quality of grinding, use of liquid and gaseous fuels, combustion control. The basic laws of combustion. Reactions and combustion temperature. Stoichiometry of combustion of solid, liquid and gaseous fuels. Ignition processes, conditions, characteristics

Procesi vžiganja, pogoji, značilnosti in meje samovžiga. Produkti zgorevanja, sestava dimnih plinov, razmernik in presežek zraka. Zgorevalna toplota in kurilnost. Kontrola zgorevanja, merjenje sestave dimnih plinov in postopki za nadzor in krmiljenje kurjenja. Nastajanje polutantov pri zgorevanju. Nepopolno zgorevanje, ogljikov monoksid in nezgoreli ogljikovodiki. Dušikovi oksidi, ukrepi za preprečevanje nastajanja NO_X, low-NO_X kurjave, primeri uspešnih rekonstrukcij. Žveplovi oksidi in kisline, mokri in suhi postopki za razžvepljevanje. CO_2 in efekti tople grede, procesi za lovljenje in shranjevanja ogljikovega dioksida. Emisijski kuponi, trajnostna goriva, trajnostni razvoj. Vplivi na okolje pri izkopavanju premoga za kurjenje v termoelektrarnah, predstavitev ukrepov za preprečevanje emisij pri izkopu in možnosti za sanacijo okolja zaradi izkopavanja premoga in odlaganja pepela in žlindre. Biomasa, lesni ostanki in biogoriva kot primarni energetski vir, njihova priprava za zgorevanje, vrste zgorevalnih naprav. Etika uporabe biogoriv in ovrednotenje pozitivnih efektov pri njihovi uporabi. Napredne tehnologije za pridobivanje toplote in električne energije in okoljevarstveni vidiki.	and limits of self-ignition. Products of combustion, flue gas composition, and excess air ratio. Heat of combustion and calorific value. Control of combustion, flue gas composition measurement and procedures for the control of burning. Formation of pollutants, incomplete combustion, carbon monoxide and unburned hydrocarbons. Nitrogen oxides, measures to prevent NOX, low-NOX heating, examples of successful reconstructions. Sulphur oxides and acid, wet and dry desulphurisation processes. CO2 and the greenhouse effect, the processes for capturing and storing carbon dioxide. Allowances sustainable fuels, sustainable development. The environmental impacts of coal mining for burning in power plants, the presentation of mitigation actions in the excavation and the potential for environmental remediation of coal mining and disposal of ash and slag. Biomass, biofuels and wood waste as a primary energy source, their preparation for combustion, types of combustion sources. The ethics of biofuels and evaluation of the positive effects of their use. Advanced technologies for the production of heat and electricity and environmental aspects.

Temeljni literatura in viri / Readings:

Oman,J., Senegačnik,A., Mirandola,A., *Air, Fuels and Flue Gases*. Edizioni Libreria Progetto, Padova, Italy, 2006, (znanstvena monografija).
Oman,J., *Generatorji toplote.* Univerza v Ljubljani, Fakulteta za strojništvo, 2005, (uni. učbenik).
Warnatz,J., Maas,U., Dibble,R., *Combustion*. Springer-Verlag, 2001.
Tillman,D., Harding,S., *Fuels of Opportunity.*Elsevier, 2004.
Oman, J., Tacer,M., Tuma,M. *Overfeed fixed-bed combustion of wood*. Bioresour. technol, 1999, vol. 67, no. 2, str. 139-147.
Oman,J., Senegačnik,A., Dejanovič,B. *Influence of lignite composition on thermal power plant performance.* Part 1. Energy conversion manage,2001, vol. 42, no. 3, pp. 251-263.
Oman,J., at.all. ,*The reduction of nitrogen oxide emissions by the boiler firing system reconstruction at the Power Plant Ljubljana*. Stroj. vestn., 2005, letn. 51, št. 5, str. 240-251.

Cilji in kompetence:	**Objectives and competences:**
Vsebina predmeta in način podajanja omogočita študentu da pridobi znanje o razpoložljivosti goriv, virov primarnih energij, lastnostih in kartakteristikah goriv z energetskega stališča in načinih uporabe posameznih vrst goriv.	Course content and way of subject delivery allow students to gain knowledge about the availability of fuels, sources of primary energy, fuels properties and characteristics from the energy point of view and various types of fuel uses.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Kandidati pridobijo sposobnost razumevanja mehanizmov zgorevanja in znanje o stehiometričnih izračunih produktov zgorevanja, o kontroli zgorevanja in krmiljenju zgorevalnih naprav, usposobljeni so za razpoznavanje pogojev nastanka škodljivih emisij in osvojijo znanje o postopkih za njihovo odpravo in preprečevanje nastajanja. Pridobijo strokovno suverenost in sposobnost za avtonomno raziskovanje na področju energetike in varstva okolja ter sposobnost interdisciplinarnega povezovanja znanja.	Knowledge and understanding: Candidates acquire the ability to understand the mechanisms of combustion and knowledge of the stoichiometric calculations of combustion products, control of combustion and combustion control devices. They are trained for the identification of harmful emissions requirements and knowledge about procedures for their removal and prevention. An expert sovereignty and the ability to autonomously explore the field of energy and environmental protection, and the ability to interdisciplinary knowledge.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Seminar oz. predavanja pri večjem številu kandidatov.	Seminar work or lectures in a large number of candidates.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
izdelava in predstavitev projektne naloge, ustni izpit	**60 %** **40 %**	the preparation and presentation of a research paper, oral exam

Reference nosilca / Lecturer's references:

1. OMAN, Janez, **SENEGAČNIK, Andrej**, DEJANOVIČ, Boris. Influence of lignite composition on thermal power plant performance. Part 1, Theoretical survey. Energy convers. manage.. [Print ed.], 2001, vol. 42, no. 3, str. 251-263.
2. OMAN, Janez, **SENEGAČNIK, Andrej**, MIRANDOLA, Alberto. Air, fuels and flue gases: physical properties and combustion constants. Padova: Progetto, 2006. 172 str., graf. prikazi.
3. **SENEGAČNIK, Andrej,** OMAN, Janez, ŠIROK, Brane. Analysis of calcination parameters and the temperature profile in an annular shaft kiln. Part 2: Results of tests. Appl. therm. eng.. 2007, vol. 27, no. 8/9, str. 1473-1482.

1. **TRENC, Ferdinand**, BIZJAN, Frančišek, ŠIROK, Brane, HRIBERNIK, Aleš. Influence of the exhaust system design on scavenging characteristic and emissions of a four-cylinder supercharged engine. *J. eng. gas turbine power*, Oct. 2000, vol. 122, no. 4, str. 556-561.
2. KATRAŠNIK, Tomaž, **TRENC, Ferdinand**, RODMAN OPREŠNIK, Samuel. A new criterion to determine the start of combustion in diesel engines. *J. eng. gas turbine power*, October 2006, letn. 128, št. 4, str. 928-933.
3. KATRAŠNIK, Tomaž, **TRENC, Ferdinand**. Innovative approach to air management strategy for turbocharged diesel aircraft engines. *Proc. Inst. Mech. Eng., G J. aerosp. eng.*, 2012, vol. 226, no. 8, str. 966-979

1. **KATRAŠNIK, Tomaž**, TRENC, Ferdinand, RODMAN OPREŠNIK, Samuel. A new criterion to determine the start of combustion in diesel engines. *J. eng. gas turbine power*, October 2006, letn. 128, št. 4, str. 928-933.
2. RODMAN OPREŠNIK, Samuel, SELJAK, Tine, BIZJAN, Frančišek, **KATRAŠNIK, Tomaž**. Exhaust emissions and fuel consumption of a triple-fuel spark-ignition engine powered passenger car. *Transp. res., Part D Transp. environ.*. [Print ed.], 2012, vol. 17, iss. 3, str. 221-227.
3. SELJAK, Tine, RODMAN OPREŠNIK, Samuel, KUNAVER, Matjaž, **KATRAŠNIK, Tomaž**.

Wood, liquefied in polyhydroxy alcohols as a fuel for gas turbines. *Appl. energy*. [Print ed.], 2012, vol. 99, str. 40-49.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**GOSPODARJENJE Z ODPADKI**
Course title:	WASTE MANAGEMENT

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja	/	1, 2	/
Interdisciplinary Doctoral Programme in Environmental Protection	/	1, 2	/

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
25	30	5	-	-	190	10

Nosilec predmeta / Lecturer:	**Andreja Žgajnar Gotvajn**

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis na doktorski študijski program. Zaželena so naravoslovna oz. tehnična predznanja.	Fullfilment of entry conditions for the study. Basic knowledge in life and technical sciencies.

Vsebina:	**Content (Syllabus outline):**
- Strateške usmeritve EU za trajnostno rabo virov in gospodarjenje z odpadki, mednarodne konvencije o nevarnih odpadkih, direktive EU, nacionalna zakonodaja na področju odpadkov, operativni programi. - Katalogi odpadkov, nevarnostni razredi odpadkov, kriteriji za klasifikacijo odpadkov, metode za vzorčenje in karakterizacijo odpadkov, glavne vrste in izvori odpadkov. - Trajnostni koncepti za ravnanje z viri in odpadki: preprečevanje nastajanja na viru, ločeno zbiranje, ponovna uporaba uporabnih strukturnih komponent in recikliranje, energetska izraba odpadkov. - Načrti ravnanja z odpadki pri povzročiteljih; analize življenskega cikla (surovina-izdelek-odpadek). - Predelava odpadkov: mehansko-biološka obdelava (kompostiranje, anaerobna predelava); fizikalno/kemijska solidifikacija; incineracija (sežig v namenskih pečeh), sosežig v industrijskih napravah; goriva iz odpadkov (plinasta, tekoča, trdna), piroliza in uplinjanje; termična obdelava v plazmi. - Stabilizacija odpadkov z mehanskimi, biološkimi in termičnimi postopki (MBT) za potrebe odlaganja. - Odlaganje preostankov odpadkov; vrste odlagališč, konstrukcija, izcedne vode, bioplin, nadzor, ravnanje z deponijskimi izcednimi vodami. - Posebne vrste odpadkov (nevarni, bolnišnični, azbestni, radioaktivni, elektronski...) - Načrtovanje organizacijskih in tehnoloških sistemov za zbiranje, predelavo in odstranjevanje odpadkov.	- Definitions of wastes, waste sources and types, waste management strategies, policies and action plans; waste hierarchy; legislation on waste (European, national). - Waste lists and catalogues, waste classification according to various criteria (origin, hazard, physical form, chemical properties, recycling potential. - Waste sampling and testing; standard methods for waste analysis and testing. - Sustainable waste treatment: integral solutions; techniques for waste prevention and minimisation, separate waste collection, reuse, recovery and recycling. - Waste treatment in order to promote recycling of material or energy: biological treatment (composting, anaerobic digestion); biomass utilisation. - Detoxification, stabilisation, fixation, solidification of waste by physical-chemical methods. - Mechanical-biological treatment (MBT) of mixed solid waste prior to disposal or incineration. - Waste incineration: types of incinerators, design, construction and operation; gas treatment; monitoring; advanced thermal treatment: pyrolisis, gasification, plasma processes. - Waste disposal at landfills: types of landfills; design, construction and operation;; monitoring, landfill leachate management and treatment options. - Old landfills, contaminated sites remediation. - Management of selected types of wastes: C&D waste, packaging waste, hospital waste, WEEE, industrial hazardous waste…

Temeljni literatura in viri / Readings:

P.T.Williams: Waste treatment and disposal, Wiley, 2005
H.F.Lund: Recycling Handbook, McGraw-Hill, 1999
H.M.Freeman: Standard handbook of hazardous waste treatment and disposal, McGraw-Hill,1998
S.Fraenzle et al.:Introduction to environmental engineering, Wiley-VCH, 2012
revijalni članki s področja, tekoča periodika, učna gradiva / review papers in professional jounals; lecture handouts.

Cilji in kompetence:	**Objectives and competences:**
Spoznavanje z glavnimi vzroki za nastanek odpadkov in izvori odpadkov; lastnostmi in okoljskimi nevarnostmi odpadkov (neposrednimi in posrednimi); postopki za karakterizacijo in kriteriji za klasifikacijo odpadkov; trajnostno ravnanje z odpadnimi viri za zmanjševanje vplivov; načini preprečevanja nastajanja odpadkov na viru; ločeno zbiranje odpadkov na viru; ponovna uporaba *(reuse)* odpadkov ali njihovih strukturnih sestavin; centralizirana separacija mešanih odpadkov s ciljem	Sources of environmental pollution, sources and types of wastes; identification, characterisation and classification of wastes; waste lists and catalogues; international strategies and politics in waste management; waste management hierarchy; legislation on waste; sustainable waste management; waste prevention and minimisation; waste reuse and recycling; waste treatment options; waste information systems (databases, inventories), public awareness raising etc.

reciklaže snovnih sestavin ali energetske izrabe; predelava odpadkov: trdna goriva iz odpadkov, kompostiranje in anaerobna predelava (kompost, bioplin in digestat); incineracija mešanih odpadkov; integrirani mehanski, biološki in termični postopki obdelave odpadkov; odlaganje odpadkov; okoljevarstveni ukrepi pri ravnanju z odpadki. Zakonodaja, nacionalne strategije, operativni programi, načrti za ravnanje (gospodarjenje) z odpadki; informiranje, izobraževanje.	

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje vsebin, navedenih v vsebini predmeta in zmožnost prenašanja v prakso.	Understanding knowledge given in the lecture programme and transferring it into practice.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- Predavanja: Interaktivno v predavalnici. - Samostojna izdelava izbrane raziskovalne (seminarske) teme. - Konzultacije za potrebe izdelave seminarske naloge in opravljanje izpita. - Ogledi industrijskih in infrastrukturnih objektov za varstvo okolja v ljubljanski regiji.	- Interactive lectures, - Individual seminar work, - Consultancy at seminar work and final exam - Sightseeing of industrial and infrastructure plants for environmental protection in Ljubljana region.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
pisni izpit seminarska naloga	70% 30%	Written examination Seminar work

Reference nosilca / Lecturer's references:

1. DERCO, Ján, **ŽGAJNAR GOTVAJN, Andreja**, MENCÁKOVÁ, Angelika. Oxidative treatment of landfill leachate. V: CABRAL, Gustavo B. C. (ur.), BOTELHO, Beatriz A. E. (ur.). *Landfills : waste management, regional practices and environmental impact*, (Waste and waste management). New York: Nova Science, cop. 2012, str. 1-82.
2. , Gabriela, VÁVROVÁ, Milada, ZAGORC-KONČAN, Jana, **ŽGAJNAR GOTVAJN, Andreja**. Seasonal variations in municipal landfill leachate quality. *Management of environmental quality*, 2011, vol. 22, no. 5, str. 612-619, doi: 10.1108/14777831111159734.
3. **ŽGAJNAR GOTVAJN, Andr**eja, ZAGORC-KONČAN, Jana, COTMAN, Magda. Fenton's oxidative treatment of municipal landfill leachate as an alternative to biological process. *Desalination*. [Print ed.], 2011, vol. 275, no. 1/3, str. 269-275, doi: 10.1016/j.desal.2011.03.017.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**GOZD IN OKOLJE**
Course title:	FOREST AND ENVIRONMENT

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**30**	**10**			**190**	**10**

Nosilec predmeta / Lecturer:	Andrej Bončina

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenskski /Slovenian**
	Vaje / Tutorial:	**Slovenskski /Slovenian**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študijski program. Diplomanti biotehniških in naravoslovno matematičnih usmeritev.	Inscription to doctoral study program. Master degree in life sciences or master degree in natural sciences.

Vsebina:	**Content (Syllabus outline):**
Gozdni viri: pregled in značilnosti Spremembe gozdnih virov Lesni potencial Okoljske vloge gozdov: voda, varovanje, habitati, biodiverziteta Ogroženost gozdov Modeliranje in raziskave Upravljanje in načrtovanje Sestojna dinamika Primeri	Forest resources: an overview and characteristics Changes of forest resources Timber potential Environmental functions of forest ecosystems: water, protection, habitats, biodiversity Forest threats Modelling and research Management and planning Stand dynamics Case studies

Temeljni literatura in viri / Readings:

Izbrani članki / selected articles.
Frelich, L. E., 2002. Forest Dynamics and Disturbance Regimes. Studies from Temperate Evergreen-Deciduous Forests. Cambridge University Press.
Lindenmayer, D.B., Franklin, J.F. 2002. Conserving Forest Biodiversity. A Comprehensive Multiscaled Approach. Island Press. 351 str.

Cilji in kompetence:	**Objectives and competences:**
Študent dobi pregled nad gozdnimi viri, njihovimi potenciali in spremembami, seznani se z okoljskimi vlogami gozdov in osnovami upravljanja in načrtovanja.	The goals of the course are to get knowledge on forest resources, their potentials and changes, environmental services of forest ecosystems and basic principles of forest management and planning.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Znanje o gozdnih virih, razumevanje okoljskih funkcij gozda, njihovega pomena in posebnosti, razumevanje trajnostnega in večnamenskega upravljanja gozdnih virov. Razumevanje sestojne dinamike gozdov in ogroženosti gozdov.	Knowledge and understanding: Knowledge on forest resources, environmental services of forest ecosystems and their management, understanding of multi-objective and sustainable forest management. Understanding of stand dynamics, main disturbances and dangers for forest ecosystems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (20 ur) in voden seminar (30 ur) potekajo v učilnici, vaje (10 ur) v računalniškem laboratoriju.	Lectures (20 h), seminars (30 h) in the classroom, lab exercises in the computer cabinet.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- ustni ali pisni izpit	**70 %**	- Oral or written examination
- seminar	**30 %**	- Seminar

Reference nosilca / Lecturer's references:

prof. dr. Andrej Bončina:
1. **Bončina, A**. Conceptual approaches to integrate nature conservation into forest management : a Central European perspective Int. for. rev., 2011, vol. 13, no. 1, str. 13-22.
2. **Bončina, A.** Diaci, J., Gašperšič, F. Long-term changes in tree species composition in the Dinaric mountain forests of Slovenia. For. Chron., march/april 2003, vol. 79, no. 2, str. 227-232.
3. **Bončina, A**. Country report : Slovenia. V: LATHAM, J. (ur.). Protected forest areas in Europe : analysis and harmonisation (PROFOR) : reports of signatory states : COST action E27. Wienna: Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW), 2005, str. 325-337.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**HIBRIDNO MODELIRANJE OKOLJSKIH SISTEMOV**
Course title:	HYBRID MODELLING OF ENVIRONMENTAL SYSTEMS

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	Boris Kompare

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski in/ali angleški Slovenian and/or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje matematike, fizike ter drugih naravoslovnih in tehniških predmetov.	Enrolment to Ph.D. studies. Knowledge of mathematics, physics and other natural sciences and technology subjects

Vsebina:	**Content (Syllabus outline):**
osnovni okoljski modeli populacijske dinamike, nekataliziranih in encimatskih kemijskih reakcij, kompleksni bio-geo-kemijski modeli, hidrološki in hidravlični modeli konceptualni in eksperimentalni modeli modelna paradigma: konceptualni vs. empirični model hibridno modeliranje z uporabo obeh pristopov uvod v metode strojnega učenja iz podatkov uporaba programa WEKA priprava podatkov za dinamično modeliranje z nedinamičnimi orodji priprava podatkov za podatkovno in procesno intenzivne rutine	basic environmental and population dynamics models, noncatalytic and enzymatic chemical reactions, complex bio-geo-chemical models, hydrological and hydraulic models ... conceptual and experimental models modelling paradigm: conceptual vs. empirical models hybrid modelling using both modelling approaches introduction to machine learning from data, data mining use of the WEKA program data preparation for dynamic modelling with nondynamic tools

osnovni konceptualno pogojeni procesi knjižnice domenskega znanja hibridno modeliranje - uporaba modelov za izračun scenarijev in tolmačenje le-teh	data preparation for data and process intensive routines basic conceptually defined processes domain knowledge libraries hybrid modelling - Use of models for scenario evaluation and their interpretation

Temeljni literatura in viri / Readings:

Steven C. Chapra, 1996. Surface Water Quality Modeling
Jerald L. Schnoor, 1996. Environmental Modeling: Fate and Transport of Pollutants in Water, Air, and Soil. John Wiley & Sons, Inc.
Revija / Journal Ecological Modelling
Revija / Journal Ecological Engineering
Elektronski viri / Electronic (internet) sources:
WEKA 3: Data Mining Software in Java
spletne strani e-revij / web based journals
- svetovni splet vključujoč intranet FGG / web, including intranet of UL FGG

Cilji in kompetence:	**Objectives and competences:**
Cilji: seznanitev s temeljnimi bio-geo-kemijskimi procesi v okolju modelirna paradigma – eksperiment vs. teorija, induktivni vs. deduktivni modeli možnosti in metode združitve obeh modelirnih pristopov v hibridni pristop orodja za hibridno modeliranje in priprava podatkov ter interpretacija rezultatov **Kompetence**: zna uporabljati rezultate okoljskih monitoringov, uporablja in išče po bazah podatkov, razume osnovne principe (procese), ki opisujejo obravnavani okoljski sistem. zna izdelati, tolmačiti in uporabljati (1) empirične (statistične), (2) teoretične (konceptualne), predvsem pa (3) hibridne matematične modele, - zna pripraviti osnutek inženirskih okoljskih rešitev in jih zna vrednotiti in zagovarjati.	**Objectives:** basic bio-geo-chemical processes in the environment modelling paradigm – experiment vs. theory, inductive vs. deductive models possibilities and methods to combine both approaches into the hybrid approach tools for hybrid modelling, data preparation and interpretation of the results **Competences**: to use the results of the environmental monitorings, to use and to search data bases, to understand basic principles (processes) that describe the environmental system. to know how to elaborate, interpret and use (1) empirical (statistical), (2) theoretical (conceptual), and mostly (3) hybrid mathematical models, - know how to draft environmental engineering solutions and to defend them.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: študent zna optimalno izkoristiti tako teoretično znanje kot izvedene meritve zna zasnovati robusten, a uporaben model obravnavanega okoljskega sistema	Knowledge and understanding: the student can optimally use the theory as well as the experimental measured data can concept a robust, but useful model of the considered environmental system

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje za utrditev vsebine predavanj in s praktičnimi primeri dela, ter izdelava individualne seminarske naloge na izbrano temo.	Ex chatedra lectures, seminary work for building up the knowledge acquired by lectures and by practical hands-on work, elaboration of individual seminary work tailored to suit the student's background

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Študent izbira med: (1) Zagovor seminarske naloge na izbrano temo ali (2) Ustni ali pisni izpit (na željo študenta), ki obsega teoretični in praktični del (vsebino predavanj ter obvezne in priporočene literature)	**100%**	The student can make choice between: (1) Defence of the seminary work on the selected subject or (2) Oral or written exam (student decides) comprising theoretical and practical part (lectures, mandatory and recommended literature)

Reference nosilca / Lecturer's references:

(1) ATANASOVA, Nataša, TODOROVSKI, Ljupčo, DŽEROSKI, Sašo, **KOMPARE, Boris**. Application of automated model discovery from data and expert knowledge to a real-world domain: Lake Glumsø. *Ecol. model.*. [Print ed.], 2008, vol. 212, no. 1/2, str. 92-98.

(2) **KOMPARE, Boris**, LEVSTEK, Meta, ATANASOVA, Nataša. Dva pristopa k modeliranju čistilne naprave za odpadno vodo = Two approaches to wastewater treatment plant modelling. *Acta hydrotech. (Online)*. [Spletna izd.], 2006, letn. 24, št. 40, str. 45-64, ilustr. ftp://ksh.fgg.uni-lj.si/acta/a40bk.pdf.

(3) ATANASOVA, Nataša, TODOROVSKI, Ljupčo, DŽEROSKI, Sašo, **KOMPARE, Boris**. Constructing a library of domain knowledge for automated modelling of aquatic ecosystems. *Ecol. model.*. [Print ed.], 2006, vol. 194, no. 1-3, str. 14-36, graf. prikazi.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Informacijski pristopi v naravoslovju in tehniki**
Course title:	Information Approaches in Science and Technology

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	Bojana Boh

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski ali angleški Slovenian or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Poznavanje znanstvene terminologije na področju doktorske naloge.	Enrollment in the doctoral study programme. Familiarity with the scientific terminology in the field of doctoral thesis.

Vsebina:	**Content (Syllabus outline):**
Informacijski servisi, zbirni iskalniki in profesionalne bibliografske baze podatkov v naravoslovju in tehniki: struktura, lastnosti, primeri za področje stroke. Iskalna sintaksa, priprava profilov za iskanje: postavljanje ključnih besed, krajšanje, maskiranje, Boolovi in posebni operatorji, vključevanje dodatnih iskalnih polj. Iskanje z dodano vrednostjo za prepoznavanje in interpretacijo trendov. Faktografske baze podatkov za področje stroke: tipi, uporaba, dostopnost, iskalne strategije. Intelektualna lastnina: avtorske pravice, patenti, blagovne znamke, industrijsko	Information services, search engines and professional bibliographic database in science and technology: structure, properties, examples. Search syntax, preparation of search profiles: keywords, truncation, masking, Boolean and proximity operators, selection of additional search fields. Value-added searches for the identification and interpretation of trends. Factual databases in the field of study: types, uses, access, search strategies. Intellectual property: authors rights, patents, trademarks, industrial designs and models – applications, uses, availability of information. Analysis and

oblikovanje in zaščiteni modeli – pregled, pomen, dostopnost informacij. Analiza in strukturiranje podatkov iz patentne literature na izbranih primerih naravoslovja in tehnologije. Hevristične informacijske metode in tehnike za urejanje podatkov. Metoda strukturiranja podatkov: definicija problema, prepoznava kriterijev strukturiranja, potavitev hierarhije, gradnja drevesnih in modularnih struktur. Metoda prepoznavanja vzorcev. Uporaba informacijske gostote a) pri procesiranju podatkovnih baz z dodano vrednostjo, b) pri prepoznavi hrbtenic postopkov in načrtovanju eksperimentalnega laboratorijskega dela. Postavljanje, testiranje in evalvacija raziskovalnih hipotez. Vsebinska zasnova in časovno načrtovanje projektnega/doktorskega dela. Obdelava raziskovalnih rezultatov. Zgradba znanstvenega članka, patenta, doktorskega dela. Metodološki pristopi in računalniška programska orodja za kvalitetno predstavitev rezultatov lastnega raziskovalnega dela na področju disertacije.	structuring of information from patent literature in the selected fields of science and technology. Heuristic information methods and techniques for organisation of data. Method of data structuring: definition of the problem, identification of the criteria for data structuring, definition of the hierarchy of criteria, construction of tree and modular structures. Method of pattern recognition. Uses of information density: a) for added- value processing of databases, b) for the identification of process backbones and planning of experimental laboratory work. Design, testing and evaluation of research hypotheses. Scientific design, contents and scheduling of a project / dissertation. Processing of research results. Structure of scientific papers, patents, PhD thesis. Methodological approaches and software tools for presentation of the research results of the PhD thesis.

Temeljni literatura in viri / Readings:

Boh, B. Informacijski pristopi v naravoslovju in tehniki – spletna učilnica s študijskimi gradivi [online]. Ljubljana, Naravoslovnotehniška fakulteta. Dostopno na: http://www.kii3.ntf.uni-lj.si/pouk2/ = Information Approaches in Science and Technology - virtual classroom with study materials [online]. Ljubljana, Faculty of Natural Sciences and Engineering. Available at: http://www.kii3.ntf.uni-lj.si/pouk2/

Wong S., Li C.S. Life science data mining, London: World Scientific, 2007 (izbrana poglavja/selected chapters).

Chowdhury, G.G. Introduction to modern information retrieval. Third edition, London: Facet Publishing, 2010 (izbrana poglavja/selected chapters).

Cilji in kompetence:	**Objectives and competences:**
Predmet študente neposredno podpira v načrtovanju in izdelavi doktorskega dela. Informacijske vsebine spoznavajo in študirajo na primerih svojih doktorskih tem. **Splošne kompetence:** informacijska pismenost, obvladovanje zahtevnejših informacijskih strategij, sposobnost interdisciplinarnega povezovanja informacijskih, naravoslovnih in tehnoloških vsebin. **Predmetnospecifične kompetence**: poglabljanje informacijske pismenosti in sposobnosti naravoslovno-tehničnega mišljenja, usposobljenost za samostojno iskanje, zajemanje in obdelavo znanstvenih in tehničnih informacij s primeri za področje varstva okolja,	The course is directly supporting students in the design and preparation of the doctoral dissertation. Information contents are studied and learnt on the cases of their PhD themes. **General competences:** Information literacy, mastering of advanced information strategies, ability of interdisciplinary combining information, scientific and technological contents. **Subject-specific competencies:** enhancing information literacy skills and scientific-technical thinking, ability of autonomous data searching, acquisition and processing of scientific and technical information, on examples of environmental protection, sovereign application of heuristic information methods for data management and synthesis of

suverena uporaba hevrističnih informacijskih metod za urejanje in sintezo informacij v znanje, usposobljenost za informacijsko podprto načrtovanje raziskovalnega dela ter interpretacijo rezultatov.	information into knowledge, capacity for information-aided design of research, and interpretation of research results.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti se usposobijo za: iskanje podatkov v podatkovnih bazah na področju naravoslovja in tehnike, vključno s sintakso zahtevnejših iskalnih profilov in uporabo metod dodane vrednosti za zasledovanje trendov temeljnih in aplikativnih raziskav; analizo podatkov iz znanstvene in patentne literature z metodo strukturiranja podatkov v sisteme in z metodo informacijske gostote za sintezo razpršenih in fragmentiranih podatkov v znanje; prepoznavanje hrbtenic postopkov, načrtovanje raziskovalnih hipotez, prepoznavanje nezasedenih niš za razvoj novih izdelkov in postopkov; izdelavo informacijskih študij in zasnovo strukture doktorskega dela; vsebinsko in časovno načrtovanje doktorskega dela in drugih raziskovalnih projektov; urejanje, vizualizacijo in učinkovito predstavljanje rezultatov lastnih raziskav s pomočjo računalniške podpore z multimedijskimi orodji.	Knowledge and understanding: Students become able to: search data in the databases of science and technology, including advanced search syntax profiles, and usage of value-added methods for recognition of trends in basic and applied research; analyse data from the scientific and patent literature, with applications of methods of structuring data into systems, and the information density, for the synthesis of dispersed and fragmented information into knowledge; identify process backbones, design research hypotheses, identify unoccupied niches for the development of new products and processes; prepare information studies, and define the contents and structure of the doctoral dissertation, plan the scientific contents and timeframe of the doctoral dissertation and other research projects; edit, visualize, and effectively present the research results by computer supported multimedia tools.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja potekajo v računalniško opremljeni učilnici - podprta so z multimedijskimi predstavitvami in dopolnjena z individualnim interaktivnim delom študentov. Seminarske vaje potekajo v računalniški učilnici (delo v interakciji z učiteljem ter vodeno samostojno učenje), v povezavi s projektnim delom in razpravami. Zaključijo se z individualnim nastopom oz. zagovorom seminarskega dela podiplomskega študenta na študentski konferenci.	Lectures take place in a computer equipped classroom. They are supported by multimedia presentations and supplemented by interactive individual work of students. Seminar tutorials take place in the computer lab (students work in interaction with the teacher and by guided self-learning), and are linked with PhD project work and discussions. Seminar works are individually presented and discussed at the students' conference.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Aktivno sodelovanje pri predavanjih in seminarskih vajah, vključno z razpravami in sprotnim izpolnjevanjem delovnih listov.	**10%**	Active participation at lectures and tutorials, including discussions and completion of the study worksheets.
Izdelava in predstavitev projektne seminarske naloge.	**40%**	Preparation and presentation of the seminar project. Oral exam in theoretical contents.

Ustni izpit iz teoretičnih vsebin.	**50%**	

Reference nosilca / Lecturer's references:

STAREŠINIČ, Marica, **BOH, Bojana**. Patent informatics : the issue of relevance in full-text patent document searches. *Online inf. rev. (Print)*, 2009, vol. 33, no. 1, str. 157-172, ilustr.

JUVAN, Simona, BARTOL, Tomaž, **BOH, Bojana**. Data structuring and classification in newly-emerging scientific fields. *Online inf. rev. (Print)*, 2005, vol. 29, str. 483-498.

BOH, Bojana. Bioinformatics. V: *Encyclopedia of life support systems : EOLSS*. Eolls Publishers: Oxford, [2004-], 9 p.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**INDUSTRIJSKA EKOLOGIJA**
Course title:	INDUSTRIAL ECOLOGY

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
50	**10**				**190**	**10**

Nosilec predmeta / Lecturer:	**Andreja Žgajnar Gotvajn**

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski, angleški / Slovenian, English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Diplomanti študijskih programov tehniških in naravoslovnih smeri.	Finished second level of university study in technical or natural sciences

Vsebina:	**Content (Syllabus outline):**
– *Industrijska ekologija*: definicija, vzporednice med industrijskim procesom in biološkimi sistemi, povezava industrijskih sistemov z naravo in človekom, etika industrijske proizvodnje, etika in družbene posledice inženirskih odločitev, čistejša proizvodnja kot aplikacija industrijske ekologije v praksi za izboljšanje materialnih in energijskih izkoristkov. – *Orodja:* preprečevanje onesnaženja, eko-učinkovitost, čistejša proizvodnja, zelena topila, nadzor masnih in energijskih bilanc, matematično modeliranje procesov, multidisciplinaren pristop, koncept minimizacije, zamenjava surovin,	– *Industrial Ecology:* definitions, comparison of industrial and natural biological processes, connections of industrial systems with nature and humans, ethics of industrial production, ethics and social aspects and consequences of engineering decisions, cleaner production as application of concept of industrial ecology for better material and energy efficiency. – *Tools:* pollution prevention, eco-efficiency, cleaner production, green solvents, mass and energy balances, mathematical modelling of processes, multidisciplinary approach, minimization, new materials, optimization of processes, recycling, reuse,

optimizacija procesov, recikliranje, ponovna uporaba odpadkov in stranskih produktov, razgradnja, sekundarne surovine, ciklični procesi, koncept proizvodnje brez odpadkov, zakonodaja. – *Pristop k industrijski ekologiji:* integrirana strategija preventive, LCA (Life Cycle Assessment) in LCD (Life Cycle Design) s svojimi osnovnimi pristopi, ekooptimizacija proizvodnega procesa, ekooptimizacija produkta, učinkovit transport, učinkovita izraba energije, uporaba obnovljivih virov energije (sodobna hidro energija, biogoriva, solarna energija in energija vetra), uporaba obnovljivih surovin, učinkovita podpora industrijski proizvodnji (vodenje), ekonomska optimizacija, nenehen nadzor in izboljševanje sistema, eko parki, vključevanje lokalne in širše skupnosti pri sprejemanju odločitev, globalen pristop, koncept trajnosti. – *Uporaba koncepta industrijske ekologije na primeru:* primer industrije ali izdelka, relevanten času in slovenskemu prostoru.	resource usage, regeneration, recovery, remanufacturing, degradation, zero waste management, ethical investments, legislation. – *Industrial Ecology Approach:* Integrated pollution prevention, LCA (Life Cycle Assessment), LCD (Life Cycle Design) and their basic approaches and principles, eco-optimization of the production processes, eco-optimization of the products, efficient transport, efficient energy use, renewable energy sources (hydro energy, bio fuels, solar energy, wind energy), use of renewable raw materials, industrial production support and management, economic efficiency, monitoring and improvement of processes, eco parks, the meaning of local and global community in decision making, global approach, sustainability concept. – *The concept of industrial ecology: A case study, relevant to Slovenia.*

Temeljna literatura in viri / Readings:

- Greadel, T.E., Allenby, B.R. *Industrial Ecology*, 2nd Ed., Prentice Hall.
- Braden, A. R., Richards, D.J.: *The Greening of Industrial Ecosystems*, National Academy Press, 1994
- Revijalni članki s področja, tekoča periodika, učna gradiva.

Cilji in kompetence:	**Objectives and competences:**
Študent spozna pomen koncepta industrijske ekologije za čistejšo proizvodnjo, spozna njen pomen za ekosistem in ljudi, ter spozna orodja in metode za dosego in vpeljavo koncepta čistejše proizvodnje v industrijske in druge procese. Študent pridobi znanje za načrtovanje čistejše proizvodnje v obstoječi ali na novo načrtovani proizvodnji v različnih industrijskih branžah in drugih dejavnostih. Razvije zavedanje o etični odgovornosti in potrebi po nenehnem izpopolnjevanju že postavljenega sistema. Razvija sposobnost za kritično ovrednotenje možnih prednosti in slabosti uporabe različnih tehnologij in izboljšav v proizvodnih in drugih postopkih.	A concept of industrial ecology and cleaner production is being introduced. Its importance for ecosystem and humans is emphasised. Student meets tools and methods required for implementation of concept of cleaner production in industrial and other processes. Student acquires knowledge on design of cleaner production in existing or newly developed production processes in different types of industries or other social activities. He develops his ethical responsibility and need for permanent improvement of designed systems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: – Študent pridobi znanje za vrednotenje vpliva svojega dela na lokalni in globalni ravni ter zavedanje o družbenem vplivu svojih odločitev. – Študent razvije sposobnost za kritično uporabo osvojenih znanj pri reševanju znanstvenih in družbenih problemov.	Knowledge and understanding: – The ability for critical approach regarding different advantages and disadvantages after application of new or improved technology/concept. The knowledge for assessing impacts of his work at local and global level is being gained. Student develops awareness of importance of his decisions to broader society. – Student develops capability for critical application of gained knowledge during solving scientific, professional and other social problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, konzultacije, projektno delo, seminar	lectures, consultations, project work, seminar

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
– pisni in ustni izpit	**40%**	– examination, oral
– izdelava seminarja (projekt) z njegovo predstavitvijo in zagovorom	**40%**	– project with its presentation
– aktivna udeležba na predavanjih, seminarjih in pri drugih aktivnostih predmeta	**20%**	– active participation at lectures and other activities of the course

Reference nosilca / Lecturer's references:

1. **ŽGAJNAR GOTVAJN, Andreja**, KALČÍKOVÁ, Gabriela, ZUPANČIČ, Marija, ZAGORC-KONČAN, Jana. Determination of impact of landfill leachate to nitrification. *Fresenius environ. bull.*. [Print ed.], 2012, vol. 21, no. 8c, str. 2447-2452.
2. **ŽGAJNAR GOTVAJN, Andreja**, ZAGORC-KONČAN, Jana, COTMAN, Magda. Fenton's oxidative treatment of municipal landfill leachate as an alternative to biological process. *Desalination*. [Print ed.], 2011, vol. 275, no. 1/3, str. 269-275, doi: 10.1016/j.desal.2011.03.017.
3. **ŽGAJNAR GOTVAJN, Andreja**, ZAGORC-KONČAN, Jana. Bioremediation of highway stormwater runoff. *Desalination*. [Print ed.], 2009, vol. 248, no. 1/3, str. 794-802, doi: 10.1016/j.desal.2009.01.014.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Interdisciplinarni vidiki varovanja okolja na podeželju**
Course title:	The Interdisciplinary Aspects of Rural Areas Protection

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
15	15	15			205	10

Nosilec predmeta / Lecturer:	**Majda Černič Istenič**, Marina Pintar, Andrej Udovč

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski (možna angleščina) / Slovenian (possibly English)
	Vaje / Tutorial:	Slovenščina (možna angleščina) / Slovenian (possibly English)

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment in doctoral studies.

Vsebina:	**Content (Syllabus outline):**
• Presoja učinkov različnih kmetijskih praks, kmetijske politike in okoljevarstvenih direktiv EU ter mednarodnih konvencije na področju varovanja okolja v kmetijstvu/na podeželju na varovanje podeželskega okolja (zavarovanih območij). • Ekološke posledica delovanja transnacionalnih korporacij in globalizacije živilskega trga na podeželski prostor. • Sociološki vidiki učinkov biotehnologij v pridelovanju živeža na podeželsko okolje (prednosti in tveganja). • Vloga ekološkega kmetijstva v varovanju narave, ohranjanju biodiverzitete in	• Assessment of the effects of various agricultural practices, agricultural and environmental policies of the EU directives and international conventions in the field of environmental protection in agriculture / rural areas in rural environmental protection (protected areas). • Ecological consequences of transnational corporations and globalization of food market in the rural areas. • Sociological aspects of the effects of food biotechnology for the rural environment (benefits and risks). • The role of organic agriculture in nature

kulturne krajine. • Prednosti in slabosti slovenskega kmetijstva in podeželja z vidika varovanja okolja. Izkušnje konkretnih razvojnih projektov na slovenskem podeželju in njihova kritična presoja. • Nosilci/akterji varovanja okolja na podeželju v svetu in Slovenji – na državni in lokalni ravni - npr. podeželski prebivalci kot nosilci varovalnih funkcij ekosistemov, proizvajalci in distributerji fitofarmacevtskih sredstev, pridelovalci hrane in njeni potrošniki. Obveščenost, ozaveščenost, ravnanja in nadzor pri posegih v podeželski prostor. • Vzgoja pridelovalcev in potrošnikov hrane ter obiskovalcev podeželja (npr. turistov) za varovanje naravnih virov.	conservation, conservation of biodiversity and cultural landscape. • Advantages and disadvantages of Slovenian agriculture and rural in terms of environmental issues. Experience of concrete development projects in the Slovenian countryside and their critical assessment. • Holders /actors of environmental protection in rural areas on the global and Slovenian level- at the state and local level – e.g. rural people as holders of protective functions of ecosystems, producers and distributors of plant protection products, food producers and its consumers. Information, awareness, treatment and control in interventions in rural areas. • Raise the awareness of food producers and food consumers and rural visitors (e.g. tourists) for protection of natural resources.

Temeljni literatura in viri / Readings:

• Učbenik/Textbook:

Dunlap, R. E.,Michelson, W. (2002) Handbook of environmental sociology. Westport (Conn.): Greenwood Press. 602 str. ISBN: 0-313-26808-8

• Monografije/Monographs:

Seymour, S. Ward, N. (1997) Moralizing the environment: countryside change, farming and pollution. London, Bristol: UCL Press: University College London, 224 str. ISBN: 1-85728-839-4.

Hanley, N. (ed.) 1991. Farming and the Countryside: An Economic Analysis of External Costs and Benefits. CAB International, Wallingford, 328 str. ISBN: 0 85198 713 3

Huylenbroeck, G. Van, Whitby, M. (ed.) 1999. Countryside Stewardship: Farmers, Policies and Markets. Pergamon, Amsterdam, 232 str. ISBN: 0 08 043587 4

Helming, K., Wiggering, H., 2003. Sustainable Development of Multifunctional landscapes. Springer, Berlin, 286 s. ISBN 3-540-00008-9 (Izbrana poglavja).

Mander, Ü., Wiggering, H., Helming, K. 2007. Multifunctional Land Use. Meeting Future Demands for Landscape Goods and Services. Springer, Berlin, 421 s. ISBN 98-3-540-36762-8 (Izbrana poglavja).

Wiggering, H., Ende, H. P., Knierim, A., Pintar, M. I2010. Innovations in European rural landscapes. Heidelberg [etc.]: Springer, 161 str., ilustr. ISBN 978-3-642-04171-6. ISBN 978-3-642-04172-3 (zbrana poglavja).

• Revije/ Journals:

Shultis, J.D. Paul A. W. (2006) Changing Conceptions of Protected Areas and Conservation: Linking Conservation, Ecological Integrity and Tourism Management. Journal of Sustainable Tourism 14(3):223–237.

Ažururan seznam aktualnih člankov iz naslednjih revij: Sociologia Ruralis, Journal of Rural Studies, Agriculture and Human Values, Sociologija sela, Journal of Environemt and Development, Journal of Sustainable Tourism, Agriculture, Ecosystems and Environment, Journal of Environmental Management.

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je razviti interdisciplinarne vsebinske, upravljavske in raziskovalne sposobnosti študentov/tk. Omogočen jim je vpogled v delovanje različnih družbenih procesov, akterjev, vzvodov in kontekstov, ki oblikujejo različne družbene prakse rabe naravnih virov ter ohranjanja biodiverzitete in kulturne krajine v podeželskem prostoru.	The aim of the course is to develop interdisciplinary content, management and research skills of students. To enable them the insight into various social processes, actors, levers and contexts that shape different social practices of use of natural resources and conservation of biodiversity and cultural landscapes in rural areas.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti/tke se seznanijo tako s konceptualnimi vidiki kot s številnimi empiričnimi evidencami raznolikih posegov družbenih dejavnosti (kmetijstvo, gozdarstvo, turizem, ipd.) v podeželski (zavarovani) prostor ter z njihovimi sociološkimi, ekonomskimi in okoljskimi posledicami.	Knowledge and understanding: Students are introduced both with conceptual aspects and numerous empirical records of the interventions of diverse social activities (agriculture, forestry, tourism, etc...) within rural (protected) areas and their sociological, economic and environmental consequences.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, terenske delavnice	Lectures, seminars, field workshops

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelava seminarske naloge z njenim zagovorom. Ocenjevalna lestvica, ki velja za vse preizkuse znanja: 51-60 %-zadostno (6), 61-70 %-dobro (7), 71-80 %-prav dobro (8), 81-90 %-prav dobro (9), 91-100 %-odlično (10).	**100%**	Seminar work with its defense. Grading scale, which applies to all examinations: 51-60%-sufficient (6), 61-70%-good (7), 71-80%, very good (8), 81-90%, very good (9), 91-100%-perfect (10).

Reference nosilca / Lecturer's references:

Majda Černič Istenič:

ČERNIČ ISTENIČ, Majda. Medijska podoba kmetijstva in kmeta v Sloveniji. V: PETROVIĆ, Tanja (ur.), AVSENIK NABERGOJ, Irena, BANDELJ, David, ČERNIČ ISTENIČ, Majda, HOFMAN, Ana, HUBER, Ivanka, KIRN, Gal, KNEŽEVIĆ HOČEVAR, Duška, LUTHAR, Oto, MARUŠIČ, Franc, POGAČAR, Martin, PROMITZER, Christian, ŽAUCER, Rok, PETROVIĆ, Tanja. Politike reprezentacije v Jugovzhodni Evropi na prelomu stoletij, (Kulturni spomin). Ljubljana: Založba ZRC, 2011, str. 76-99

KNEŽEVIĆ HOČEVAR, Duška, **ČERNIČ ISTENIČ, Majda**. Dom in delo na kmetijah : raziskava odnosov med generacijami in spoloma. Ljubljana: Založba ZRC, ZRC SAZU, 2010. 158 str.

ČERNIČ ISTENIČ, Majda. Studying fertility behaviour of farm population as a contribution to understanding overall low fertility trends: the case of Slovenia. V: BONANNO, Alessandro (ur.), BAKKER, Hans (ur.), JUSSAUME, Raymond Adelard (ur.), KAWAMURA, Yoshio (ur.), SHUCKSMITH, Mark (ur.). From community to consumption : New and classical themes in rural sociological research, (Research in Rural Sociology and develiopment, Vol. 16). Bingley: Emerald Group Publishing Limited, cop. 2010, str. 77-91.

Andrej Udovč:
BARBIČ, Ana, **UDOVČ, Andrej**, MEDVED, Andrej. Protection of the environment and biodiversity for sustainable future of rural areas: the case of planned Regional park Trnovski gozd, Slovenia. Sociol. sela, srpanj-prosinac 2004, broj. 165/166 (3/4), god. 42, str. 277-307.

ELLIOTT, Craig, **UDOVČ, Andrej**. Nature conservation and spatial planning in Slovenia: continuity in transition. Land use policy. [Print ed.], 2005, vol. 22, str. 265-276, ilustr.

MILIČIĆ, Vesna, **UDOVČ, Andrej**. Uporabnost prostorskih podatkov kmetijskega sektorja za analize sprememb rabe kmetijskih zemljišč na primeru izbranega območja varovanja narave v Sloveniji. *Geod. vestn.*. [Tiskana izd.], 2012, letn. 56, št. 1, str. 83-104.

Marina Pintar:
PERPAR, Anton, MUBAREKA, Sarah, DERANJA, Davor, UDOVČ, Andrej, **PINTAR, Marina**. Projekcije prihodnje rabe tal v Mestni občini Koper na podlagi modela MOLAND = Projections of future land use in the Municipality of Koper based on the MOLAND model. *Geod. vestn.*. [Tiskana izd.], 2010, letn. 54, št. 4, str. 676-689, ilustr. http://www.geodetski-vestnik.com/54/4/gv54-4_676-690.pdf.

GLAVAN, Matjaž, **PINTAR, Marina**, VOLK, Martin. Land use change in a 200-year period and its effect on blue and green water flow in two Slovenian Mediterranean catchments-lessons for the future. *Hydrol. process.*, 2012, v tisku, ilustr., doi: 10.1002/hyp.9540.

PINTAR, Marina, UDOVČ, Andrej, ČERNIČ ISTENIČ, Majda, GLAVAN, Matjaž, POTOČNIK SLAVIČ, Irma. Goriška Brda (Slovenia) - sustainable natural resource management for the prosperity of a rural areas. V: WIGGERING, Hubert (ur.), ENDE, Hans Peter (ur.), KNIERIM, Andrea (ur.), PINTAR, Marina (ur.). *Innovations in European rural landscapes*. Heidelberg [etc.]: Springer, cop. 2010, str. [37]-52.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Inženirsko modeliranje ekoloških procesov v površinskih vodah**
Course title:	Engineering Modelling of Ecological Processes in Surface Waters

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**40**				**190**	**10**

Nosilec predmeta / Lecturer:	Matjaž Četina

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski in/ali angleški Slovenian and/or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski program.	Enrolment in Ph.D. programme.

Vsebina:	**Content (Syllabus outline):**
Pomen modeliranja kot orodja pri prognozi vplivov človekovih posegov na spremembo kvalitete površinskih voda. Principi matematičnega modeliranja: hidrodinamični, transportno-disperzijski in biogeokemični modul, povezava v kompleksne ekološke modele. Enodimenzijski, dvodimenzijski in trodimenzijski modeli. Osnovne enačbe: kontinuitetna, dinamična, konvekcijsko-difuzijska enačba za transport snovi, izvorni členi za opis biokemičnih procesov pri širjenju hraniv, kemičnih ali bioloških polutantov, naftnih derivatov in težkih kovin (npr. živo srebro). Analitične in numerične metode reševanja, vloga modelov turbulence, vpliv toplotne in	A role of modelling as a tool to predict the influence of human activities on the quality of surface waters. Principles of mathematical modelling: hydrodynamic, transport-dispersion and biogeochemical modules and their connection into complex ecological models. One-dimensional, two-dimensional and three-dimensional models. Basic equations: continuity, momentum and advection – diffusion equations, source terms for biogeochemical processes of different pollutants (nutrients, chemical or biological substances, oil spreading, heavy metals, mercury cycle). Analytical and numerical methods of solution,

gostotne stratifikacije, opis računalniških programov. Verifikacija, analiza občutljivosti, umerjanje in validacija modelov. Primeri praktične uporabe modelov za račun širjenja polutantov v rekah, jezerih in morju.	the role of turbulence models, the influence of temperature or density stratification, a description of computer codes. Verification, sensitivity analysis, calibration and validation of models. Examples of practical application of models to compute the spreading of pollutants in rivers, lakes and the sea.

Temeljni literatura in viri / Readings:

Wainwright, J., Mulligan, M. (2003). Environmental Modelling: Finding Simplicity in Complexity, John Wiley & Sons, Inc., 430 pp.
Jørgensen, S.E., Bendoricchio, G. (2001). Fundamentals of Ecological Modelling, 3rd Ed., Elsevier, 530 pp.
Članki v revijah/Articles in Journals: Ecological Modelling, Science of the total environment
Učna gradiva / Study materials
Internet:
Web pages of e-journals
- WWW, inclusive of intranet of Faculty of Civil and Geodetic Engineering (FGG)

Cilji in kompetence:	**Objectives and competences:**
Cilji: Uvajanje kandidatov v izrazito interdisciplinarno področje inženirskega modeliranja. Seznanitev s transportno-disperzijskimi procesi v površinskih vodah. Povezovanje znanj s področij tehnike in naravoslovja v kompleksnih ekoloških modelih. **Kompetence**: Odločanje o uporabi ustreznih modelnih orodij za simulacijo procesov v površinskih vodah. Na podlagi razumevanja osnovnih procesov sposobnost oceniti točnost in zanesljivost napovedi procesov v površinskih vodah, dobljenih s pomočjo modelnih simulacij. Poleg kvalitativnega poznavanja procesov tudi njihovo inženirsko kvantitativno ovrednotenje. Analiziranje in zagovarjanje predlaganih rešitev pred kritično strokovno javnostjo.	**Aims:** To introduce candidates into interdisciplinary work of engineering modelling. To understand transport-dispersion processes in surface waters. To join knowledge from technical and natural sciences in complex ecological models. **Competences**: Students can: Choose the most appropriate modelling tools to simulate processes in surface waters. Assess accuracy and realiability of modelling predictions because they understand processes in surface waters. Assess environmental processes qualitatively and quantitatively by engineering means. Analyse and defend proposed professional solutions in brain storming debates.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti znajo uporabljati kompleksne ekološke modele pri oceni vplivov na okolje. Zna načrtovati potrebne meritve okoljskih parametrov, potrebnih za umerjanje modelov.	Knowledge and understanding: Students are able to use complex ecological models in environmental studies. Students can make a plan of necessary measurements to calibrate ecological models.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, prikazi praktičnih primerov modeliranja ter izdelava individualne seminarske naloge.	Lectures, practical examples of modelling with case studies, elaboration and defence of seminar work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
pisni izpit	**25 %**	Examination
ustno izpraševanje	**25%**	Oral
naloge	**25%**	Coursework
projekt	**25%**	Project

Reference nosilca / Lecturer's references:

Žagar, D., Petkovšek, G., Rajar, R., Sirnik, N., Horvat, M., Voudouri, A., Kallos, G., **Četina, M.**, Modelling of mercury transport and transformations in the water compartment of the Mediterranean Sea, ***Marine Chemistry***, 2007, Vol.107, pp. 64-88.

Žagar, D., Knap, A., Warwick, J.J., Rajar, R., Horvat, M., **Četina, M.**, Modelling of mercury transport and transformation processes in the Idrijca and Soča river system, ***Science of the Total Environment***, 2006, Vol.368, pp. 149-163.

Rajar, R., Žagar, D., **Četina, M.**, Akagi, H., Yano, S., Tomiyasu, T., Horvat, M., Application of three-dimensional mercury cycling model to coastal seas, ***Ecological modelling***, 2004, Vol.171, pp. 139-155.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**KEMIJSKI PROCESI V OKOLJU**
Course title:	**CHEMICAL PROCESSES IN THE ENVIRONMENT**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**40**				**190**	**10**

Nosilec predmeta / Lecturer:	Helena Prosen

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski / Slovenian**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski program. Potrebno predznanje z enega od naštetih področij: kemije, kemijske tehnologije, fizike, metalurgije, hidrotehnike, medicine, biologije, agronomije in podobno. Potrebno je osnovno znanje kemije.	Enrolment in the doctoral study programme. Prerequisite knowledge of at least one of the following: chemistry, chemical technology, physics, metalurgy, hydrotechnics, medicine, biology, agronomy or similar. Basic knowledge of chemistry necessary.

Vsebina:	**Content (Syllabus outline):**
Atmosfera - nastanek in značilnosti atmosfere. Viri in mehanizmi nastanka glavnih onesnažil: žveplov(IV)oksid, NO_X, alifatski in poliaromatski ogljikovodiki, halometani, ozon.. Kemija troposfere in stratosfere, nastanek smoga in fotosmoga, vzroki za spremembe koncentracij troposferskega in stratosferskega ozona, toplogredni plini, vplivi na sevalno ravnotežje. Zmanjševanje emisij glavnih onesnažil atmosfere. Emisije, transport, akumulacija in razgradnja organskih snovi v okolju (biološko razgradljive	Atmosphere - evolution and properties. Sources and reaction mechanisms of principal pollutants: sulphourous oxide, NO_x, aliphatic and polyaromatic hydrocarbons, halomethans, ozone... Chemistry of troposphere and stratosphere, production of smog and photosmog, reasons for concentration fluctuations of tropospheric and stratospheric ozone, greenhouse gases, influences on the radiative balance. Ways to decrease emissions of principal atmospheric pollutants. Emissions, transport, accumulation and

snovi v vodah in v zemlji in spremljajoči problemi). Slabo razgradljive organske spojine kot klorirani pesticidi, klorirane aromatske spojine, višji ogljikovodiki; njihova stabilnost in akumulacija v okolju in kroženje stabilnih onesnažil. Kovine v okolju: viri, porazdeljevanje, kemijske reakcije, ki vplivajo na topnost kovin. Trdni odpadki, kemijski procesi, ki potekajo na odlagališčih in v sežigalnicah odpadkov.	degradation of organic substances in the environment (biodegradable substances in water bodies and soil with the associated problems). Persistent organic compounds, e.g. organochlorine pesticides, chlorinated aromatic compounds, higher hydrocarbons; their stability and accumulation in the environment, cycling of the persistent pollutants. Metals in the environment: sources, partitioning, chemical reactions influencing their solubility. Solid waste, chemical processes in landfills and in waste incinerators.

Temeljna literatura in viri / Readings:

G. Fellenberg: The Chemistry of Pollution, Chichester ,Wiley, ISBN 0-471-61391-6, 2000, 192 str./pages

Revije: izbrani članki / Journals: selected articles

Chemosphere , Elsevier, Nizozemska
Environ.Sci.Technol., American Chemical Society, ZDA
Environ. pollut. Elsevier, Nizozemska

Cilji in kompetence:	**Objectives and competences:**
Predstaviti študentom glavna onesnažila atmosfere, vod in zemlje in njihove kemijske spremembe pod vplivom okoljskih dejavnikov.	Present students with the knowledge of the principal pollutants of atmosphere, water bodies and soil, as well as of their chemical transformations influenced by the environmental factors.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje kemijskih reakcij in pretvorb glavnih okoljskih onesnažil in posledic teh onesnažil za okolje. Sposobnost predstavitve določenih okoljskih problemov ustno in v pismeni obliki; sposobnost razreševanja konkretnih okoljskih problemov.	Knowledge and understanding: Understanding of chemical reactions and transformations of principal environmental pollutants, as well as the effects of these pollutants on the environment. Ability to present certain environmental problems orally and in written form; ability to solve real-life environmental problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, seminarji in konzultacije	lectures, seminar coursework, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
ustno izpraševanje seminarska naloga	**60%** **40%**	oral exam seminar coursework

Reference nosilca / Lecturer's references:

Helena Prosen

PROSEN, Helena, ZUPANČIČ-KRALJ, Lucija. Evaluation of photolysis and hydrolysis of atrazine and its first degradation products in the presence of humic acids. *Environ. pollut. (1987)* 2005, vol. 133, no. 3, 517-529.

PROSEN, Helena, FINGLER, Sanja, ZUPANČIČ-KRALJ, Lucija, DREVENKAR, Vlasta. Partitioning of selected environmental pollutants into organic matter as determined by solid-phase microextraction. *Chemosphere (Oxford)*. 2007, vol. 66, no. 8, 1580-1589.

KRALJ CIGIĆ, Irena, **PROSEN, Helena**. An overview of conventional and emerging analytical methods for the determination of mycotoxins. *Int. J. Mol. Sci.* 2009, vol. 10, no. 1, 62-115.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**KOVINE V OKOLJU**
Course title:	METALS IN THE ENVIRONMENT

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40	**20**				**190**	**10**

Nosilec predmeta / Lecturer:	Marija Zupančič

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski ali angleški / Slovenian or English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje s področja naravoslovja ali tehnike.	Inscription to doctoral programme. University graduation of natural science or natural science technology study.

Vsebina:	**Content (Syllabus outline):**
Uvod (razporeditev kovin in kovinskih spojin v okolju, esencialni in toksični elementi, naravni in antropogeni izvori, pomen kovin za žive organizme). ***Reakcije kovin v okolju*** (topnost spojin, ligandi v okolju, nastanek koordinacijskih spojin, reakcije koordinacijskih spojin, stabilnost koordinacijskih spojin, obarjanje, adsorpcija, kemisorpcija, ionska izmenjava, redoks reakcije, frakcionacija kovin v tleh). ***Kemijska speciacija in frakcionacija kovin v okolju in njun pomen*** (principi nastanka kemijskih zvrsti, kemijska ravnotežja med kemijskimi zvrstmi v okolju, določevanje kemijskih zvrsti, razporeditev	***Introduction*** (distribution of metals and their compounds in the environment, essential and toxic metal compounds, geochemical and anthropogenic source of metals, importance of metals for living beings). ***Reactions of metals in environment*** (solubility of metal compounds; ligands for metals in the environment; origin, reactions and stability of coordination compounds; precipitation, adsorption, chemisorption, ionic exchange, redox reaction and fractionation of metals in ecosystems). ***Chemical speciation and fractionation of metals in environment and their significance*** (principles of the origin of chemical species, chemical equilibria

kemijskih zvrsti v okolju). ***Kroženje kovin in kovinskih spojin v okolju*** (transport kovinskih spojin v okolju, fizikalne in kemijske transformacije kovin, redoks reakcije, metiliranje kovin…). ***Obremenitev okolja s kovinskimi spojinami*** (toksičnost, mejne vrednosti, zakonodaja) ***Sanacija tal in vode, stabilizacija odpadkov*** (ocena stanja pri onesnaženju s kovinami, principi sanacije, izbira metode sanacije).	between chemical species in the environment, distribution and determination of chemical species in the environment). ***Cycling of metals and their compounds in the environment*** (transportation of metal compounds, physical and chemical transformations of metals, redox reactions, and methylation of metals …). ***Pollution of environment with metal compounds*** (toxicity, limit values, legislation) ***Remediation of soil and water, stabilisation of wastes*** (evaluation of state of contamination with metals, principles and suitable methods of rehabilitation).

Temeljni literatura in viri / Readings:

Učbeniki / Handbooks:

Hooda P.S., Trace elements in soils, Wiley, 2010.
Kabata-Pendias A., Trace elements in soils and plants, CRC Press, 2001.
Vernet J.P., Heavy metals in the environment, Elsevier Science, 1991.

Revije / Periodicals:

Environmental Science & Technology
Chemosphere
Waste Management
Environmental Pollution
Science of the Total Environment
Water Air and Soil Pollution
Journal of Environmental Monitoring
Journal of Environmental Management

Cilji in kompetence:	Objectives and competences:
Poznavanje pojavnosti kovin v okolju, njihove dinamike, problemov onesnaženja in osnovnih remediacijskih tehnik za kovine. Razumevanje povezav med dinamiko kovin, njihovo porazdelitev v okolju in biološko dostopnostjo. Samostojno iskanje literaturnih virov, samostojna obdelava in interpretacija podatkov, predstavitev seminarskih tem in rezultatov pred javnostjo. Uporaba znanj v nadaljnjem procesu študija, navezava problematike na druge predmete (Gospodarjenje z odpadki, Kemijski procesi v okolju, Tla in okolje...).	The knowledge about the appearance of metals in the environment, their dynamics, pollution problems and basic remediation techniques of metals. Comprehension of connection of metal dynamics, distribution in environment and biological accessibility. Self-dependence in investigation of literature sources, processing and interpretation of data, presentation of seminar topics and results in public. Use of knowledge in further study process.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje:Po končanem izpitu naj bi študent obvladoval in razumel zgoraj naštete vsebine. ***Uporaba***: Študent naj bi naučeno znanje znal uporabiti za razlago opazovanj in logično reševanje problemov povezanih z vsebinami predmeta. Sposoben naj bi bil uporabljati svoje znanje interdisciplinarno in na praktičnih primerih. ***Refleksija***: Študent razvija sposobnost za interpretacijo ter kritično analizo rezultatov. ***Prenosljive spretnosti***: Poznavanje vsebin iz predmeta pripomore k boljšemu razumevanje osnovnih procesov v naravi kot tudi k boljšemu razumevanje problematike drugih predmetov.	***Knowledge and understanding***: The student should understand and master the content listed above. ***Use***: The student should be able to use the acquired knowledge for observations and logical solving of problems. The student should be able to use his knowledge multidisciplinary. ***Reflections***: The student develops skills for critical interpretation and evaluation of results. ***Transferable skills***: Obtained knowledge enables better understanding of basic natural principles and could be beneficially used at many other subjects of doctoral programme.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predmet se izvaja v obliki predavanj in seminarskih nalog. V okviru predavanj se študentje seznanijo s teoretskimi osnovami. Velik poudarek je na aktualnih aplikacijah remediacije. Študentje pripravijo seminarje o izbranih temah in jih predstavijo pred svojimi kolegi.	Performance of the course includes lectures and seminars. At lectures students are informed with theoretical basics with emphasis on actual remediation applications. Students prepare seminars on particulate topics and represent them in front of their colleagues.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit, ocena pisnega dela seminarja in predstavitve seminarskega dela. Izpit: ocene od 6-10 (pozitivno) oz. 1-5 (negativno), ob upoštevanju Statuta UL.	**60%** **40%**	Written examination, mark of written presented part of the seminar. Examination criteria: marks from 6-10 (positive), marks from 1-5 (negative), with consideration of Statute of UL.

Reference nosilca / Lecturer's references:

ZUPANČIČ, Marija, LAVRIČ, Simona, BUKOVEC, Peter. Metal immobilization and phosphorus leaching after stabilization of pyrite ash contaminated soil by phosphate amendments. J. environ. monit., 2012, vol. 14, no. 2, p.p. 704-710, doi: 10.1039/c2em10798h.

LONCNAR, Mojca, **ZUPANČIČ, Marija**, BUKOVEC, Peter, ZUPANČIČ JUSTIN, Maja. Fate of saline ions in a planted landfill site with leachate recirculation. Waste manag., 2010, vol. 30, no. 1, p.p. 110-118, doi: 10.1016/j.wasman.2009.09.010.

ZUPANČIČ, Marija, ZUPANČIČ JUSTIN, Maja, BUKOVEC, Peter, ŠELIH, Vid Simon. Chromium in soil layers and plants on closed landfill site after landfill leachate application. Waste manag., 2009, vol. 29, no. 6, p.p. 1860-1869, doi: 10.1016/j.wasman.2008.11.013.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Kras in okolje**
Coursetitle:	Karst and Environment

Študijski program in stopnja Studyprogrammeandlevel	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
InterdisciplinaryDoctoralProgramme in EnvironmentalProtection	**/**	**1, 2**	**/**

Vrsta predmeta / Coursetype	Izbirni predmet / Elective course
Univerzitetna koda predmeta / Universitycoursecode:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**	**/**	**/**	**/**	**190**	**10**

Nosilec predmeta / Lecturer:	Mihael Brenčič

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski/ Angleški Slovenian/ English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment in the doctoral study programme.

Vsebina:	**Content (Syllabusoutline):**
Definicija krasa in zgodovinski pregled: Fizikalno- geološka in geografska definicija krasa. Drugi načini definiranja. Razvoj misli o krasu. Kras kot naravni pojav, matični Kras in klasični kras. Model čistega krasa. Kras kot življenjsko okolje. Kraške kamnine: karbonatne kamnine njihova struktura in tektura, minerali karbonatnih kamnin. Poroznost karbonatnih kamnin. Druge kraške kamnine. Vpliv strukture na razvoj krasa. Raztapljanje kraških kamnin: Raztapljanje karbonatnih kamnin. Kemijsko ravnotežje pri raztapljanju karbonatnih kamnin. Kinetika raztapljanja karbonatnih kamnin. Denudacija površine kraških kamnin: Globalna porazdelitev denudacije kraških kamnin.	Karst deffinition and historical overview: Geological, geographical and physical definition of karst. Other definitions. Ideas development in karst science. Karst as a natural phenomena, classical karst and Karst. Pure karst model. Karst as a human environment. Karstic rocks: carbonate rocks – their structure and texture, minerals in carbonate rocks. Porosity of carbonate rocks. Other karstic rocks. Geological structure influences on the karst development. Karstic rocks dissolution: Dissolution of karstic rocks. Chemical equilibrium in karstic rock dissolution. Kinetics of karstic rock dissolution. Karstic surface denudation: Global disstribution of karstic rock denudation. Measurements and calculations of karstic roc denudation

Meritve in izračunavanje denudacije kraških kamnin. Hidrogeologija krasa: Hidrogeološki pristop k razumevanju krasa. Hidrogeološka conacija krasa. Analiza hidrograma kraških vodotokov. Sledilni poizkusi. Speleogeneza: Hidrogeološka conacija krasa, karakteristične jamske oblike. Fizika nastajanja kraških kanalov, tipi kraških kanalov. Časovna dinamika speleogenetskega prostora. Enciklopedija podzemskih kraških oblik s posebnim poudarkom na povezavo s konkretnimi procesi. Sedimenti v krasu: Avtohtoni in alohtoni sedimenti v jamah. Površinska oblikovanost krasa: Kraške in navidezno kraške oblike. Pomen brezstropih jam. Enciklopedija površinskih kraških oblik. Pomembni kraški sistemi v Sloveniji in po svetu: Dinarski, alpski in osameli kras. Kras Kamniško-Savinjskih Alp. Kras v porečju Save nad Ljubljano. Kras v porečju zgornje Soče. Visoki kras. Kras v porečjih Reke, Ljubljanice, Kolpe in Krke. Osameli kras Posavja in Šavrinov. Pregled najpomembnejših kraških ozemelj in krasa v svetu. Uporabno krasoslovje: Kraška hidrogeologija. Samočistilnost krasa. Nastajanje in erozija tal na krasu.	processes. Karst hydrogeology: Hydrogeological understanding of karst. Hydrogeological conation of karst. Karst hydrograph analyses. Tracing experiments. Speleogenesis: Characteristic channel shapes of hydrogeological conation of karst. Physical processes in the development of karstic channels. Time component of speleogenesis processes. Encyclopaedia of karstic subsurface forms with the emphasise on the genetically processes. Sediments in karst: Autochthonous and alochthonous sediments in caves. Surface forms on karst: Karstic and virtually karstic features. Roofless caves and their meaning for karst development. Encyclopaedia of karstic surface forms. Important karstic systems in Slovenia and worldwide. Dinaric, Alpine and isolated karst. Karst of Kamnik Savinje Alps, karst in watershed of river Sava, High karst, Karst of rivers Soča, Ljubljanica, Kolpa and Krka. Posavje and Šavrinsko karst. Overview of most important karstic regions in the world. Applied karstology: Karst hydrogeology. Self-purification potential on karst. Development and erosion of soil on karst.

Temeljni literatura in viri / Readings:

1. Ford D. C. P.W., Williams. 2007. *Karst Hydrogeology and Geomorphology*. 562 str. John Wiley & Sons.
2. Gams, I. 2004. *Kras v Sloveniji v prostoru in času*. Založba ZRC, Ljubljana.
3. White, B.W. 1989. *Geomorphology and hydrology of karst terrains*. University Press, 464 str., New York.
4. Appelo, C. A. J., Postma, D. *Geochemistry, Groundwater and Pollution. 2nd ed*. Taylor and Francis, 2005. 649 str.
5. National Research Council, 1996: *Rock Fractures and Fluid Flow. Contemporary Understanding and Applications*. National Academy Press.
6. Periodika/Journals: Acta Carsologica, Naše jame, Karst and Cave Science, Water Resources Research, Hydrogeology Journal, Environmental Geology.

Cilji in kompetence:	**Objectives and competences:**
Podati slušatelju geološke osnove krasoslovja in ga seznaniti s tistimi fizikalno-kemičnimi procesi, ki delujejo v krasu. Zlasti bodo poudarjeni tisti kraški procesi in pojavi, zaradi katerih je kras ekološko posebej občutljiv.	Student will become acquainted with geological background of karstology and with physical and chemical processes responsible for karst development. Emphasise will be given on those processes that are responsible for karst ecological vulnerability.

Predvideni študijski rezultati:	**Intendedlearningoutcomes:**
Znanje in razumevanje: Slušatelji se teoretsko in praktično spoznajo z metodami krasoslovja s pomočjo katerih bodo znali izluščiti kritične parametre in jih prostorsko opredeliti.	Knowledge and understanding: Students will learn practical and theoretical methods of karstology that will help them understand important parameters and to determine them spatially and temporally.

Metode poučevanja in učenja:	**Learningandteachingmethods:**
Predavanja (v primeru zadostnega št. študentov) ali individualne konzultacije (v primeru nezadostnega št. študentov), terenske vaje.	Lectures (when number of students is adequate) or individual consultations (when number of students is less than required), seminar work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustno izpraševanje.	40%	Oral examination.
Seminarska naloga.	60%	Coursework.

Reference nosilca / Lecturer's references:

BRENČIČ, Mihael. Hydrogeological conditions of the Kroparica recharge area, Jelovica, Slovenia. *Geologija*, 2003/46, str. 281-306.
BRENČIČ, Mihael, POLTNIG, Walter, 2008: Podzemne vode Karavank = Grundwasser der Karawanken. 144 str., monografija.
PAVLIČ, Urša, **BRENČIČ, Mihael**. Application of sequential trend analysis for discharge characterisation of Vipava karstic springs, Slovenia. *Acta carsol.*, 2011, 40/2, 283-291

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Mikrobna ekologija**
Course title:	Microbial ecology

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
10	**50**				**190**	**10**

Nosilec predmeta / Lecturer:	**David Stopar**, Ines Mandić Mulec

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski/ opcijsko angleški Slovenian / optional English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študijski program.	Enrolment in the doctoral study program.

Vsebina:	**Content (Syllabus outline):**
Temeljna vsebinska področja pri predmetu so naslednja: 1. različnost mikrobnih habitatov in niš 2. ekstremna okolja mikroorganizmov 3. mikrobna ekofiziologija 4. mikrobne združbe in simbioze 5. značilnosti mikrobnega kroženja elementov 6. biofilmi 7. mikrobiologija odpadnih voda, 8. mikrobiologija tal, voda in sedimentov 9. biorazgradljivost in bioremediacija 10. proizvodnja mikrobne biomase in biogoriv.	The following themes will be discussed: 1. microbial habitats and niches 2. extreme environments and microorganisms 3. microbial ecophysiology 4. microbial communities and symbioses 5. biogeochemical cycling of elements 6. biofilms 7. wastewater treatment 8. soil, aquatic, and sediment microbiology 9. biodegradation and bioremediation 10. microbial fuel and biomass production.

Temeljni literatura in viri / Readings:

Stopar, D., Kompendij iz Mikrobne ekologije; za študente Mikrobiologije, 2005, Univerza v Ljubljani, Biotehniška fakulteta, Oddelke za živilstvo, str. 398
Atlas, R.M., Bartha, R., Microbial Ecology; Fundamentals and applications, 1998, četrta izdaja, Benjamin/Cummings Publishing, Menlo Park, str. 694
Maier, R.M., Pepper, I.L., Gerba, C.P. Environmental Microbiology., 2000, Academic Press, London, 585 str., ISBN: 0124975704

Cilji in kompetence:	**Objectives and competences:**
Predmet je predvsem namenjen študentom, ki niso diplomanti mikrobiologije, vendar bi radi pridobili znanje o razširjenosti, aktivnosti in pomenu mikroorganizmov v okolju. Študent bo na izbranem mikrobno ekološkem problemu pridobil ustrezne kompetence za reševanje okoljskih težav, ki jih povzročajo mikroorganizmi.	This course in Microbial ecology is mainly intended for students that are not masters of Microbiology, but would like to obtain basic knowleadge about the distribution, activity and the role of microbes in the environment. On a selected microbial ecology topic student will learn how to tackle and solve environmental problems related to microorganisms.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent spozna glavne interakcije med mikrobi. Pozna vplive fizikalno-kemijskih parametrov na rast in aktivnost mikrobne populacije v naravnem okolju. Pozna glavne mehanizme kroženja in transporta mikrobioloških hranil. Pozna osnovne koncepte pri razgradnji snovi. Pridobljeno znanje zna uporabiti za reševanje problemov v mikrobni ekologiji.	Knowledge and understanding: Student understands main interactions between microorganisms in the environment. Knows how different physicochemical parameters influence microbial growth, knows major mass and heat transport mechanisms in the environment, understands biogeochemical cycles. Student can apply knowledge to solve microbial ecology problem.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, konzultacije	lectures, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ocenjuje se seminarsko delo, ki študent zagovarja pred nosilcem predmeta Ocena ustnega izpita 6-10 (pozitivno), 1-5 (negativno).	**100%**	Oral seminar Grading scale: 6-10 (passed), 1-5 (failed)

Reference nosilca / Lecturer's references:

Prof. dr. David Stopar

1. ODIĆ, Duško, BUDIČ, Bojan, MANDIĆ-MULEC, Ines, **STOPAR, David**. Influence of bacterial lysate quality on growth of two bacterioplankton species. *Microb. ecol.*, 2010, issue 2, vol. 59, str. 246-252, doi: 10.1007/s00248-009-9557-1.

2. BORIĆ, Maja, DANEVČIČ, Tjaša, **STOPAR, David**. Prodigiosin from Vibrio sp. DSM 14379 : a new UV-protective pigment. *Microb. ecol.*, 2011, vol. 62, str. 528-536, doi: 10.1007/s00248-011-9857-0.

3. ABEDON, Stephen T., HERSCHLER, Troy D., **STOPAR, David**. Bacteriophage latent-period evolution as a response to resource availability. *Appl. environ. microbiol.*, 2001, vol. 67, no. 9, str.

4233-4241.

Prof. dr. Ines Mandić Mulec
PAL, Levin, KRAIGHER, Barbara, BRAJER HUMAR, Barbara, LEVSTEK, Marjetka, **MANDIĆ-MULEC, Ines**. Total bacterial and ammonia-oxidizer community structure in moving bed biofilm reactors treating municipal wastewater and inorganic synthetic wastewater. *Bioresour. technol.*. [Print ed.], apr. 2012, vol. 110, str. 135-143, doi: 10.1016/j.biortech.2012.01.130.
2. FILIPIČ, Jasmina, KRAIGHER, Barbara, TEPUŠ, Brigita, KOKOL, Vanja, **MANDIĆ-MULEC, Ines**. Effects of low-density static magnetic fields on the growth and activities of wastewater bacteria Escherichia coli and Pseudomonas putida. *Bioresour. technol.*. [Print ed.], Sep. 2012, vol. 120, str. 225-232, doi: 10.1016/j.biortech.2012.06.023.
3. ŠTEFANIČ, Polonca, DECOROSI, Francesca, VITI, Carlo, PETITO, Janine, COHAN, Frederick, **MANDIĆ-MULEC, Ines**. The quorum sensing diversity within and between ecotypes of Bacillus subtilis. *Environ. microbiol. (Print)*. [Print ed.], 2012, vol. 14, no. 6, str. 1378-1389, doi: 10.1111/j.1462-2920.2012.02717.X.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**MINERALNI MATERIALI V KULTURNI DEDIŠČINI**
Course title:	Mineral materials in cultural heritage

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**25**	**10**			**190**	**10**

Nosilec predmeta / Lecturer:	Breda Mirtič

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski, angleški / Slovenian, English**
	Vaje / Tutorial:	**Slovenski, angleški / Slovenian, English**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment to the doctoral study programme.

Vsebina:	**Content (Syllabus outline):**
Vrste mineralnih materialov kot element kulturne dediščine: naravni kamen, hidravlična veziva (naravna, umetna), ometi, malte, tlaki, agregati, keramični materiali (zidaki, strešniki) in steklo kot gradbeni element. Uporaba (mesto in namen uporabe v objektu), lastnosti, tehnologija priprave in uporabe mineralnih materialov skozi čas. Destruktivne in nedestruktivne metode preiskav mineralnih materialov po vgradnji, kvalitativna in kvantitativna kemična in mineralna sestava, fizikalne lastnosti. Izbira analitske tehnike glede na vrsto mineralnega materiala in dosegljivost vzorca. Propadanje (spremembe fizikalnih lastnosti, kemične in mineraloške	Mineral materials as the elements of cultural heritage: natural stone, hidraulic binders (natural and artificial), plasters, mortars, pavements, aggregats, ceramic materials (brick, tiles) and glass as the construction elements. Use, properties, manufacturing technology and use mineral materials in the past. Destructive and nondestructive investigation methods of mineral materials in situ. Qualitative and quantitative chemical and mineral composition, physical properties. Weathering (changes of physical properties, chemical and mineralogical changes, crystallization of secondary minerals), conservation and restoration of mineral materials, built in the objects of cultural heritage.

spremembe, nastanek sekundarnih mineralov), zaščita in restavriranje mineralnih materialov, ki so bili vgrajeni v objekte kulturne dediščine.	

Temeljni literatura in viri / Readings:

- E.M.Winkler: Stone in architecture, New York 1997, 313 str.
- J.in N.Ashurst: Practical building conservation, vol. 1 (100 str.), vol.3 (126 str.), Hants 1998
- P.Brimblecombe: The effects of air pollution on the built environment, London 2003, 428 str.
- B.Stuart: Analytical techniques in materials conservation, Chichester 2007, 424 str.
- Conservation of historic stone buildings and monuments, Washington 1982, 365 str. (NRCC report)
- C.Groot: Characterisation of old mortars with respect to their repair, Bagneux 2007, 177 str. (RILEM report)
- International RILEM Workshop on historic mortars, Paisley, Scotland 1999, 459 str. (RILEM proceedings, PRO 12)
- W.Vogel: Kemija stakla, Zagreb 1985, 379 str.
- mednarodni članki iz področja študija

Cilji in kompetence:	**Objectives and competences:**
Elementi kulturne dediščine, ki jo predstavljajo mineralne snovi, so naravni kamen, steklo, zračna in hidravlična veziva, keramični materiali. Njihova uporaba odraža odnos človeka do okolja in izraža stopnjo tehnološkega razvoja človeka v kulturni krajini. Obnašanje uporabljenih mineralnih snovi po vgradnji pa kaže na stanje okoljskih parametrov onesnaženosti zraka, vode in vpliv antropogenih dejavnikov. Študenti se spoznajo z mineralnimi snovmi, ki so uporabljeni v posameznem urbanem okolju (kamen, steklo, keramika, ..), s tehnologijo uporabe in se naučijo prepoznati posledice vplivov okoljskih dejavnikov na njihovo obstojnost.	Elements of cultural heritagewhere nonmetal mineral materials were used are natural stone, glass, air and hydraulic binders, ceramic materilas. Their use express the relation between the mankind and environment and determine the level of technological development in cultural region. The way of weathering and its rate are dependent on parameters of air pollutants, water and other anthropogene factors. Students acquire knowledge about mineral materials used in the particular geographic region (natural stone, glass and ceramic products), the technology of their use, the concequences of environmental factors on their durability.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti pridobijo znanja o mineralnih snoveh, ki jih potrebujejo za uspešno preprečevanje propadanja, zaščito in /ali obnovo objektov kulturne dediščine, za katere se bile uporabljene nekovinske mineralne snovi.	Knowledge and understanding: Knowledge about the nonmetal mineral materials, which the students need for successful prevention of weathering and protection or restoration the objects of cultural heritage

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in laboratorijske vaje, konzultacije, seminarska naloga	Lectures, tutorial (laboratory), seminar, consulting hours

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
seminar, ustni izpit	**50%** **50%**	seminar, oral examination

Reference nosilca / Lecturer's references:

KRAMAR, Sabina, LUX, Judita, MLADENOVIČ, Ana, PRISTACZ, Helmut, **MIRTIČ, Breda**, SAGADIN, Milan, ROGAN ŠMUC, Nastja. Mineralogical and geochemical characteristics of Roman pottery from an archaeological site near Mošnje (Slovenia). *Appl. clay sci.*. [Print ed.], 2012, vol. 57, str. 39-48, doi: 10.1016/j.clay.2011.12.00.

KRAMAR, Sabina, **MIRTIČ, Breda**, KNÖLLER, Kay, ROGAN ŠMUC, Nastja. Weathering of the black limestone of historical monuments (Ljubljana, Slovenia): Oxygen and sulfur isotope composition of sulfate salts. *Appl. geochem.*. [Print ed.], 2011, vol. 26, iss. 9-10, str. 1632-1638, doi: http://dx.doi.org/10.1016/j.apgeochem.2011.04.020.

KRAMAR, Sabina, ZALAR, Vesna, UROŠEVIČ, Maja, KÖRNER, Wilfried, MAUKO, Alenka, **MIRTIČ, Breda**, LUX, Judita, MLADENOVIČ, Ana. Mineralogical and microstructural study of mortars from the bath complex of the Roman villa rustica near Mošnje (Slovenia). *Mater. charact.*. [Print ed.], 2011, vol. 62, iss. 11, str. 1042-1057, doi: 10.1016/j.matchar.2011.07.019.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**NAČRTOVANJE OKOLJU PRIJAZNIH PROIZVODOV IN TEHNOLOGIJ**
Course title:	**DESIGNING ENVIRONMENTALLY-FRIENDLY PRODUCTS AND TECHNOLOGIES**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja	/	1, 2	/
Interdisciplinary Doctoral Programme in Environmental Protection	/	1, 2	/

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	30	30			170	10

Nosilec predmeta / Lecturer:	**Borut KOSEC**, Janez KOPAČ, Aleš NAGODE, Richard NOWOSIELSKI

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski (Angleški) / Slovenian (English)
	Vaje / Tutorial:	Slovenski (Angleški) / Slovenian (English)

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogoj za vključitev v delo oziroma za opravljanje študijskih obveznosti je vpis v 1. letnik doktorskega študija.	The condition to attend in the teaching course and to perform study obligations is an entry in the first year of doctoral study. Completed and successfully presented project work is required before taking the written and oral exam.

Vsebina:	**Content (Syllabus outline):**
Uvod. Načrtovanje okolju prijaznih proizvodov in tehnologij. Metode in orodja. Življenjski krog proizvoda in recikliranje. Življenjski krog proizvoda: proizvodnja in distribucija, uporaba. Po uporabi: recikliranje, odlaganje in sežiganje. Recikliranje materiala in recikliranje proizvoda. Analiza življenskega kroga proizvoda. Okoljsko, ekonomsko in tehnično vrednotenje. Orodja in tehnike. Metode načrtovanja proizvodov. LCA metoda. Predstavitev metode. Vrednotenje. MET metoda. Tehtanje pomembnosti posameznih vplivov na okolje. LiDS kolo okoljskega načrtovanja proizvoda. Predstavitev metode. Načrtovalne faze: (nov) koncept proizvoda, izbira materialov, zmanjšanje porabe materialov, optimiranje procesa, distribucijski sistem, vpliv proizvoda na okolje, optimiranje življenske dobe, scenarij po izrabi proizvoda. Vrednotenje. FMEA metoda (analiza možnih napak in posledic). Predstavitev metode in tipi. Analiza in optimiranje življenjskega kroga proizvoda z metodo FMEA. Analiza in optimiranje tehnologije in celotnega tehnološkega procesa z metodo FMEA. Čiste tehnologije. Analiza ekološko kritičnih mest v proizvodnih procesih. Monitoring. Modeliranje. Ekološko označevanje proizvodov, storitev, procesov. Študij praktičnih problemov. Projektno delo. Kompleksna analiza in optimiranje izbranega tehnološkega procesa, tehnologije oziroma proizvoda z vidika stroškov, časa in kakovosti z vključitvijo vidikov in zahtev varstva okolja.	Introduction. Designing environmentally-friendly products and technologies. Methods and tools. Product life cycle and recycling. Product life cycle: production and distribution, mode of application. After application: recycling, dumping and burning. Material recycling and product recycling. Product life cycle analyses: environmental, economic and technical assessment. Tools and techniques. Methods of product designing. Method LCA. Introduction of the method. Assessment. MET method. Weighing of importance of single influences to the environment. LiDS cycle of environmentally designing of the product. Introduction of the method. Designing phases: (new) product concept, materials selection, materials consume reduction, process optimization, distribution system, influence of the product to environment, life period optimization, scenario after exploitation of the product. Assessment. FMEA method (Failure Mode and Effects Analyses). Introduction of the method and types. Analyses and optimization of product life cycle with FMEA method FMEA. Analyses and optimization of the technology and whole technological process with FMEA method. Clean technologies. Analyses of ecological critical points in production processes. Monitoring. Modeling. Environmental labeling of products, services and processes. Case studies. Project work. Complex analyses and optimization of selected technological process, technology or product from the view of costs, time and quality with inclusion of aspects and demands of environmental protection.

Temeljni literatura in viri / Readings:

ABELE, E., ANDERL, R. in BIRKHOFER, H. *Environmentally – Friendly Product Development – Methods and Tools.* London: Springer Verlag, 2005.
BUDAK, I., KOSEC, B., HODOLIČ, J., KARPE, B., STEVIĆ, M. in VUKELIĆ, Đ. *Environmental labelling of products.* Novi Sad: Fakultet tehničkih nauka, 2009.
BURKE, G., SINGH, B. in THEODORE, L. *Handbook of Environmental Management and Technology*. New Yersey: John Wiley & Sons, 2005.
HODOLIČ, J., VUKELIĆ, Đ., HADŽISTEVIĆ, M., BUDAK, I., BADIDA, M., ŠOOŠ, L., KOSEC, B., in BOSAK, M. *Recycling and Recycling Technologies*. Novi Sad: Fakultet tehničkih nauka, 2011.
KUTZ, M. *Environmentally Conscious Manufacturing*. New Jersey: John Wiley & Sons, 2007.
KUTZ, M. *Environmentally Conscious Mechanical Design*. New Jersey: John Wiley & Sons, 2007.
LUND, H.F. *The McGraw – Hill Recycling Handbook.* New York: McGraw – Hill, 2001.

McDERMOT, E.R., MIKULAK, J.R. in BEAUERGARD R.M. *The Basics of FMEA.* New York: Productivity, 1996,
Acta Materialia, Elsevier, ISSN: 1359-6454
Basic and Applied Ecology, Elsevier, ISSN: 1439-1791
Environmental Modeling and Assessment, Springer, ISSN: 1420-2026
Journal of Environmental Management, Elsevier, ISSN: 0301-4797

Cilji in kompetence:

Študent pri predmetu Načrtovanje okolju prijaznih proizvodov in tehnologij spozna ekološko naravnanost posameznih materialov, proizvodov in tehnoloških procesov ter postopkov.
Nauči se metod in orodij za načrtovanje in analizo okolju prijaznih materialov, izdelkov in tehnologij.
Študent se navaja na samostojno in timsko raziskovalno ter projektno delo, uporabo strokovne literature in sodobnih virov informacij.

Objectives and competences:

In the teaching course Designing environmentally-friendly products and technologies the student acquires knowledge about the ecological orientation of individual products, technological processes and technologies.
Student learns the methods and tools methods and techniques of design and development of environmentally-friendly materials, products, and technologies.
Student gets accustomed to individual and team, project and research work, and expert literature and modern information source applications.

Predvideni študijski rezultati:

Znanje in razumevanje:
Pri predmetu Načrtovanje okolju prijaznih proizvodov in tehnologij pridobi študent znanja o ekološki naravnanosti posameznih proizvodov, tehnoloških procesov in tehnologij.
Spozna metode in tehnike načrtovanja in razvoja okolju prijaznih proizvodov, procesov in tehnologij.
Študent se navaja na samostojno sprejemanje odločitev, povezuje in vrednoti analitične, eksperimentalno in numerično dobljene rezultate.
Navaja se na samostojno in timsko delo, na projektno in raziskovalno delo, uporabo strokovne literature in sodobnih virov informacij.
Pridobi sposobnosti za samostojno znanstveno raziskovalno delo, razvoj, organizacijo in vodenje industrijskih in temeljnih raziskovalnih projektov.

Intended learning outcomes:

Knowledge and understanding:
In the course Designing environmentally-friendly products and technologies teaching course the student acquires knowledge about the ecological orientation of individual products, technological processes and technologies.
They learn methods and techniques of planning and development of environmentally-friendly products, processes and technologies.
Student will get accustomed to reach decision individually. Link and asses analytical, experimental and numerical acquired results. Students get used to individual and team, project and research work, and expert literature and modern information source applications.
Student will acquire knowledge for individual scientific work, development, organization and conduction of industrial and fundamental scientific activities and research projects.

Metode poučevanja in učenja:

Predavanja, računske vaje in simulacije, reševanje odprtih nalog (problemov), projektno delo.

Learning and teaching methods:

Lectures. Exercises solving and simulations. Solving case studies. Project work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način opravljanja izpita: • ustni /pisni izpit – teorija in naloge, reševanje odprtih nalog (problemov), izdelava in uspešen zagovor projektnega dela • predmet se zaključi z izpitom, ki ga sestavljata pisni in ustni del. Končno oceno predmeta sestavljajo: ocena projektnega dela (30 %) ocena pisnega dela izpita (30 %) ocena ustnega dela izpita (40 %) od 6-10 (pozitivno) oz. 1-5 (negativno) oz. opravil / ni opravil; ob upoštevanju Statuta UL in fakultetnih pravil. Opravljeno in uspešno predstavljeno projektno delo je pogoj za pristop k pisnemu in ustnemu izpitu.	30 % 30 % 40 %	Type of examination: • oral /written examination – theory and calculation tasks, solving case studies, successfully presented project work • the course ends with passing the examination which is composed of written and oral examination: The mark is composed of: the mark of project work (30%) the mark of written examination (30%) the mark of the oral examination (40%) from 6-10 (positive) and from 1-5 (negative) or; to pass / to fail; regard to Statute of UL faculty rules.

Reference nosilca / Lecturer's references:

prof. dr. Borut KOSEC:

1. **KOSEC, Borut**, SOKOVIĆ, Mirko, KOSEC, Ladislav, BIZJAK, Milan, PUŠAVEC, Franci, KAMPUŠ, Zlatko. Introduction of new ecologically safe material for fusible elements of low voltage fuses. Archives of materials science and engineering. 2007, Vol. 28, No. 4, pp. 211-216.
2. JEVREMOVIĆ, Danimir, PUŠKAR, Tatjana, **KOSEC, Borut**, VUKELIĆ, Djordje, BUDAK, Igor, ALEKSANDROVIĆ, Srbislav, EGBEER, David, WILLIAMS, Robert. The analysis of the mechanical properties of F75 Co-Cr alloy for use in selective laser melting (SLM) manufacturing of removable partial dentures (RPD). Metallurgy, 2012, Vol. 51, No. 2, pp. 171-174.
3. AGARSKI, Boris, BUDAK, Igor, **KOSEC, Borut**, HODOLIČ, Janko. An approach to multi-criteria environmental evaluation with multiple weight assignment. Environmental Modeling and Assessment, 2012, Vol. 17, No. 3, pp. 255-266.

red.prof.dr. Janez Kopač

1. DAVID, E., **KOPAČ, Janez**. Hydrolysis of aluminum dross material to achieve zero hazardous waste. *J. hazard. mater.*. [Print ed.], 2012, vol. 209/210, iss. [3], str. 501-509.
2. **KOPAČ, Janez**, ČUŠ, Franc, STOIĆ, Antun, ŽABKAR, Blaž. Some ideas about sustainable manufacturing concept. *Journal of production engineering*, 2012, vol. 15, no. 2, str. 19-22.
3. DAVID, E., **KOPAČ, Janez**. Development of palladium/ceramic membranes for hydrogen separation. *Int. j. hydrogen energy*. [Print ed.], 2011, vol. 36, iss. 7, str. 4498-4506.

doc.dr. Aleš Nagode:

1. **NAGODE, Aleš**, KLANČNIK, Grega, SCHWARCZOVA, Heidy, KOSEC, Borut, GOJIĆ, Mirko, KOSEC, Ladislav. Analyses of defects on the surface of hot plates for an electric stove. *Eng fail. anal.*. [Print ed.], 2012, vol. 23, str. 82-89.
2. **NAGODE, Aleš**, KOSEC, Ladislav, ULE, Boris. Uni-axial and multi-axial creep behavior of P91-type steel under constant load. *Eng fail. anal.*. [Print ed.], 2011, vol. 18, no. 1, str. 61-67.
3. **NAGODE, Aleš**, KOSEC, Ladislav, JENKO, Monika, ULE, Boris. An improved stress-dependent energy-barrier model for the creep of 9Cr-1Mo-0.2V steel under disc-bend loading. *Kovové mater.*, 2010, vol. 48, no. 4, str. 233-239.

prof. dr. Richard NOWOSIELSKI:

*1. **NOWOSIELSKI, Richard**, KANIA, Adam, SPILKA, Marczin.* Indicators of technological

processes environmental estimation, Journal of Achievements in Materials and Manufacturing Engineering, Vol. 22, No. 2, 99-102, 2007.
2. ***NOWOSIELSKI, Richard****, SPILKA, Marczin, KANIA, Adam*. Methodology and tools of ecodesign, Journal of Achievements in Materials and manufacturing Engineering, Vol. 23, No. 1, 91-94, 2007.
3. LESZ, S., BABILAS, R., NABIALEK, M., **NOWOSIELSKI, Richard**. The characterization of structure, thermal stability and magnetic properties of Fe-Co-B-Si-Nb bulk amorphous and nanocrystalline alloys. Journal of Alloys and Compounds, 2011, Vol. 509, Vol. 1, pp. S197-S201.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**NARAVNA TVEGANJA V GORSKEM OKOLJU**
Course title:	**NATURAL HAZARDS IN MOUNTAINOUS ENVIRONMENT**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	**40**	**-**	**-**	**-**	**190**	**10**

Nosilec predmeta / Lecturer:	**Matjaž Mikoš**, Marko Polič, Timotej Verbovšek, Johannes Hübl (BOKU, Dunaj)

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski /angleški/nemški** **Slovenian/ English/ German**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis na doktorski študij.	Enrollment to doctoral studies.

Vsebina:	**Content (Syllabus outline):**
Vsebina se deli na 4 enote (študent lahko glede na svoja predznanja in zasnovo doktorskega dela da poudarek le določenim vsebinskim sklopom): Ocenjevanje nevarnih procesov v gorskem okolju - delitev pobočnih masnih premikov; značilnosti hudourniških poplav, snežnih in zemeljskih plazov; metode določanja intenzitete in verjetnosti nastopa ter dosega delovanja omenjenih pojavov (osnove modeliranja posameznih vrst nevarnih procesov). Ukrepi za zmanjševanje tveganj ter urejanje hudourniških in nestabilnih območij - pregled metod ukrepanja za zmanjševanje tveganj, predvsem gradbeno-tehničnih in biotehničnih	The content is divided into 4 units (student may according to his own past experiences and the doctoral thesis give the accent to only selected parts): Assessment of dangerous processes in mountainous environment – classification of slope mass movements; characteristics of flash floods, avalanches and landslides; methods of determination of intensity, probability of occurrence, and reach-out areas of before mentioned processes (bases of modelling of single classes of dangerous processes). Measures for risk mitigation, torrent and landslide control – overview of risk mitigation methods, especially structural and bioengineering methods of mitigation in risk

metod urejanja ogroženih območij zaradi naštetih naravnih tveganj, metod dimenzioniranja posameznih varovalnih objektov ter načinov njihovega vzdrževanja. Upravljanje s tveganji in socio-ekonomski vidiki - analiza celotnega (integralnega) kroga upravljanja s tveganji od kriznega menedžmenta v primeru naravnih nesreč v gorskem svetu preko odprave posledic in sanacije (mitigacije) do preventive in priprave na prevzem novih tveganj (izobraževanje, obveščanje, zgodnje opozarjanje, alarmiranje) v luči modernega obvladovanja tveganj (risk governance). Zajemanje in priprava relevantnih podatkov o tveganjih in dogodkih - izdelava ustrezne dokumentacije o naravnih katastrofah v gorskem svetu za kasnejšo kakovostno analizo vzrokov in posledic, izvedeno na primerih dobre prakse v alpskem svetu.	areas due to before mentioned natural risks, designing methods of single protection structures, and ways of their maintenance. Risk management and socio-economic aspects – analysis of the integral risk management cycle from crisis management in the case of natural catastrophes in mountainous environment across removal of consequences and mitigation to prevention and preparations works to new risks (education, notification, early warning, alarming) in the light of modern risk governance. Gathering and preparation of relevant data on risks and events – preparation of adequate documentation on natural catastrophes in mountainous environment for later qualitative analysis of causes and consequences, done on the cases of good practice in the alpine environment.

Temeljni literatura in viri / Readings:

D. Alexander, 2002. Natural Disasters, Routledge.
F.G. Bell, 1999. Geological Hazards – Their Assessment, avoidance and mitigation, E & FN Spon, 648 str.
G.-R. Bezzola, C. Hegg (eds.), 2007. Ereignisanalyse Hochwasser 2005. Teil 1: Prozesse, Schäden und erste Einordnungen, BAFU, Bern & WSL, Birmensdorf, 215 str.
G.-R. Bezzola, C. Hegg (eds.), 2008. Ereignisanalyse Hochwasser 2005. Teil 2: Analyse von Prozessen, Massnahmen und Gefahrengrundlagen, BAFU, Bern & WSL, Birmensdorf, 426 str.
P. Blaikie, T. Cannon, I. Davis, B. Wisner, 2004. At Risk: Natural Hazards, People's Vulnerability and Disasters, 2nd ed., Routledge, 447 str.
E. Bryant, 2005. Natural Hazards, 2nd ed., Cambridge University Press, 312 str.
C. Embleton, C. Embleton-Hamann, 1997. Geomorphological Hazards of Europe, Elsevier, 524 str.
J. Hübl, H. Kienholz, A. Loipersberger (eds.), 2002. DOMODIS – Documentation of Mountain Disasters, INTERPRAEVENT, Handbuch 1, Klagenfurt, 40 str.
IRGC, 2005. Risk Governance – Towards an Integrative Approach, White Paper No1, IRGC, Geneva, 24 str.
E.M. Lee, D.K.C.Jones, 2004: Landslide Risk Assessment, Thomas Telford, 454 str.
J. Nott, 2006. Extreme Events – A Physical Reconstruction and Risk Assessment, Cambridge University Press, 297 str.
O. Renn, K. Walker (eds.), 2008. Global Risk Governance – Concept and Practice Using the IRGC Framework, Springer Verlag, 370 str.
K. Smith, 2000. Environmental Hazards: Assessing Risk and Reducing Disaster, 4th ed., Routledge, 432 str.

Revijalni članki s področja, spletne strani

Cilji in kompetence:	**Objectives and competences:**
Predmet seznanja študenta z nevarnimi naravnimi procesi, ki v gorskem svetu predstavljajo tveganje za človeka in njegovo infrastrukturo. Študent spozna vrste in zakonitosti teh procesov, načine določanja območij njihovega delovanja in pristope k načrtovanju, dimenzioniranju in izvajanju ustreznih varovalnih ukrepov (preventivnih in ob izrednih razmerah).	The course acquaints a student with dangerous natural processes that in mountainous environment represent risks for humans and their infrastructure. A student gets to know classes and characteristics of such processes, ways of determination of areas of their impacts, and approaches to planning, designing, and executing corresponding protection measures (preventive ones and those in emergency conditions).

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent spozna krog integralnega upravljanja s tveganji v gorskem svetu ter razume vlogo posameznih subjektov (država, lokalna skupnost, stroka, znanost, javnost) in dokumentiranja ekstremnih dogodkov pri integralnem upravljanju s tveganji. Študent zna s pridobljenim znanjem zasnovati analizo ekstremnega naravnega dogodka v gorskem okolju (predvsem hudourniških in rečnih poplav ter kamninskih podorov, padanja skal, drobirskih tokov in zemljinskih plazov), ali zasnovati eksperimentalno analizo delovanja izbranega varovalnega ukrepa, ali zasnovati raziskavo prostorske razširjenosti izbrane vrste tveganja ter nato tako zasnovo v okviru doktorskega dela tudi dokončati.	Knowledge and understanding: A student gets to know the risk management circle for risks in mountainous environment, and understands the role of single subjects (state, local community, professions, science, public), and the role of documenting extreme events in integral risk management. A student can with the gathered knowledge make a design of an analysis of a extreme natural event in mountainous environment (especially torrential (flash) and river floods, and rock falls, stone falls, debris flows, and landslides), or to make a design of an experimental analysis of the impacts of a selected protection measure, or to make a design of a research on spatial extent of a selected risk and furthermore to finalise such a design within the doctoral dissertation.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Študij izbrane literature s konzultacijami, zbiranje relevantnih podatkov, krajši raziskovalni projekt s pripravo poročila oziroma pisanje seminarske naloge na izbrano temo s področja naravnih tveganj v gorskem okolju s končnim poročilom v obliki raziskovalnega članka.	Studying of selected literature with consultations, collecting of relevant data, a short research project with a short report resp. seminar work on the selected theme from the field of natural risks in mountainous environment with a final report in the form of a research paper.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelava poročila o krajšem raziskovalnem projektu oz. predstavitev seminarske naloge ali objava raziskovalnega članka.	**100%**	Report on a short research project resp. presentation of a seminar work or publication of a research paper.

Reference nosilca / Lecturer's references:

Matjaž Mikoš:

1. **Mikoš, M.**, Fazarinc, R., Majes, B. 2007: Delineation of risk area in Log pod Mangartom due to debris flows from the Stože landslide, *Acta geographica Slovenica*, 47/2, 171-198.
2. Sodnik, J., **Mikoš, M.** 2006: Estimation of magnitudes of debris flows in selected torrential watersheds in Slovenia, *Acta geographica Slovenica*, 46/1, 93-123.
3. **Mikoš, M.** 2010: Public Perception and Involvement in Crisis Management of Sediment-

Related Disasters and Their Mitigation: The Case of Stoze Debris Flow in NW Slovenia, *Integrated Environmental Assessment and Management*, 7/2, 216-227.

Marko Polič:
1. Polič, M. 2002: Doumevanje okolja. V: Polič, M. (ur.), Repovš, G. (ur.). *Spoznavni zemljevid Slovenije*, (Razprave Filozofske fakultete). Ljubljana: Znanstveni inštitut Filozofske fakultete, 15-55.
2. **Polič, M.**, Repovš, G. 2004: Cognitive map of Slovenia: spatial representations and identity. *Psychol. Beitr. (Lengerich)*, 46, suppl. 1, 65-88.
3. Brilly, M., **Polič, M.** 2005: Public perception of flood risks, flood forecasting and mitigation. *Natural Hazards and Earth System Sciences*, 5/1, 5-11.

Timotej Verbovšek:
1. **Verbovšek, T.** 2009: BCFD - a Visual Basic program for calculation of the fractal dimension of digitized geological image data using a box-counting technique. *Geol. Q.*, 53/2, 241-248.
2. **Verbovšek, T.** 2009: Extrapolation of fractal dimensions of natural fracture networks from one to two dimensions in dolomites of Slovenia. *Geosci. J.*, 13/4, 343-351.
3. Žibret, G., **Verbovšek, T.** 2009: Quantitative analysis of randomness exhibited by river channels using chaos game technique: Mississippi, Amazon, Sava and Danube case studies. *Nonlinear process. geophys.*, 16/3, 419-429.

Johannes Hübl:
1. Mazzorana, B., **Hübl, J.**, Fuchs, S. 2009: Improving risk assessment by defining consistent and reliable system scenarios, Natural Hazards and Earth System Sciences, 9/1, 145-159.
2. Mayer, B., Stoffel, M., Bollschweiler, M., **Hübl, J.**, Rudolf-Miklau, F. 2010: Frequency and spread of debris floods on fans: A dendrogeomorphic case study from a dolomite catchment in the Austrian Alps, *Geomorphology*, 118/1-2, 199-206.
3. Kogelnig-Mayer, B., Stoffel, M., Schneuwly-Bollschweiler, M., **Hübl, J.**, Rudolf-Miklau, F. 2011: Possibilities and Limitations of Dendrogeomorphic Time-Series Reconstructions on Sites Influenced by Debris Flows and Frequent Snow Avalanche Activity, *Arctic, Antarctic and Alpine Research*, 43/4, 649-658.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**NEVARNE SNOVI V TEKSTILIJAH**
Course title:	HAZARDOUS SUBSTANCES IN TEXTILES

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	**Petra Forte-Tavčer**, Barbara Simončič

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski, angleški/ Slovenian, English**
	Vaje / Tutorial:	**/**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij	Enrolment in the programme

Vsebina:	**Content (Syllabus outline):**
Vsebina predmeta se prilagaja študijskemu načrtu in raziskovalnemu delu doktoranda. Poglobljeno se predelajo vsebine izbrane izmed naslednjih poglavij: Vrste tekstilnih vlaken in ploskih tekstilj. Vpliv procesov proizvodnje in izdelave vlaken, tekstilij in oblačil na ljudi in okolje. Okolju prijazni postopki pridobivanja naravnih, regeneriranih celuloznih in sintetičnih vlaken. Humana tekstilna ekologija. Vpliv tekstilij in oblačil na počutje in zdravje ljudi. Oporečne substance (formaldehid, težke kovine, pesticidi, biocidi, alergeni…). Toksičnost tekstilij in tekstilnih pomožnih sredstev. Toksičnost barvil in pigmentov. Analitika oporečnih substanc. Ekološke oznake tekstilij	The content of the course conform to the study plan and research work of particular student. Selected contents out of the following chapters will be studied: Types of fibers and textiles Influence of fiber and fabric production on environment and population Environmetaly friendly production of natural and synthetic fibers Human textile ecology Influence of textiles and apparels on well-being and health Prohibited, hazardous, toxic substances in textiles Eco-labels and certification Environmental legislation

(npr. Eko-Tex standard 100). Pridobivanje certifikatov. Okoljska zakonodaja. Tekstilni odpadki; odlaganje in recikliranje.	Textile waste, disposal and recycling

Temeljni literatura in viri / Readings:

- Mirafab M. and Horrocks A.R. Ecotextiles, (Woodhead publishing in textiles). [Manchester]: Textile Institute; Boca Raton [etc.]: CRC Press; Cambridge: Woodhead Publishing, 2007.
- Christie, R. M. Environmental aspects of textile dyeing, (Woodhead publishing in textiles). [Manchester]: Textile Institute; Boca Raton [etc.]: CRC Press; Cambridge: Woodhead Publishing, 2007.
- Wang, Y., Recycling in textiles, (Woodhead publishing in textiles). [Manchester]: Textile Institute; Boca Raton [etc.]: CRC Press; Cambridge: Woodhead Publishing, 2006.
- Slater, K. Environmental impact of textiles, Production, processes and protection, Woodhed Publishing Ltd., Cambridge, 2003.
- Blackburn, R.S. Biodegradable and sustainable fibres, (Woodhead publishing in textiles). [Manchester]: Textile Institute; Boca Raton [etc.]: CRC Press; Cambridge: Woodhead Publishing, 2005.
- Skelly, J. K. Water Recycling in Textile Wet Processing, SDC, Bradford, 2003.
- Cooper, P. Colour in Dyehouse Effluent, SDC, Nottingham, 1995.
- revijalni članki s področja, tekoča periodika, učna gradiva.

Cilji in kompetence:	**Objectives and competences:**
Študenti se pri predmetu seznanijo z osnovami tekstilne tehnologije in vplivom procesov proizvodnje tekstilij na okolje. Spoznajo prednosti in pomanjkljivosti naravnih in sintetičnih vlaken. Spoznajo se z okoljsko zakonodajo in standardi na področju tekstilstva. Spoznajo kemijsko strukturo vlaken ter kemikalije, ki se uporabljajo za plemenitenje tekstilij. Seznanijo se z dovoljenimi in prepovedanimi spojinami pri obdelavi tekstilij. Spoznajo vpliv tekstilij na zdravje ljudi. Seznanijo se z najpomembnejšimi ekološkimi oznakami tekstilij.	Students get information of fundamentals of textile technology and the influence of fiber and textile production on the envirnomnet. They recognize benefits and drawbacks of natural and synthetic fibers. They get information on environmental legislation and standardization in the field of textiles. They acquired knowledge about chemical structure of fibers and chemicals used in the production of textiles. They get information on forbbiden and permitted chemicals for textile processing. They recognize the influence of textiles and apparels on human health. They get to know different environmental labels and their meaning in general and especially for textiles.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Poznavanje in razumevanje: − vpliva tekstilne industrije na okolje, − okolju prijaznejših tekstilnih surovin, sredstev in postopkov, − vpliva tekstilij na zdravje ljudi, − različnih okoljskih znakov in njihovega pomena, − problemov odlaganja tekstilnih odpadkov in izdelkov, − postopkov predelave in recikliranja tekstilnih odpadkov in tekstilnih izdelkov, − pravilnikov (zakonodaje) in standardov s področja varovanja okolja, − osnov okoljske analitike.	Knowledge and understanding: Influence of textile industry on environment Environmentaly friendly resources, chemicals and processes Influence of textiles on human health Different environmental labels and their influence Problematic of waste textile disposal Processes of recycling of textile waste Regulation and standardisation of environment protection Fundamentals of environmental analysis

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, konzultacije, seminar, študij po literaturnih virih	Lecturing, consulting, seminar, individual study,

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- Izdelava seminarja z zagovorom ali objavo - ustno spraševanje	**60%** **40%**	Project performance or publication Oral exam

Reference nosilca / Lecturer's references:

Petra Forte-Tavčer

1. FORTE-TAVČER, Petra. Low-temperature bleaching of cotton induced by glucose oxidase enzymes and hydrogen peroxide activators. *Biocatal. biotransform. (Print)*, 2012, vol. 30, no. 1, str. 20-26, doi: 10.3109/10242422.2012.644437.

2. GOLJA, Barbara, BOH, Bojana, ŠUMIGA, Boštjan, FORTE-TAVČER, Petra. Printing of antimicrobial microcapsules on textiles. *Color. technol.*, 2012, vol. 128, no. , 8 str. [online, 23 Jan. 2012]. http://onlinelibrary.wiley.com/doi/10.1111/j.1478-4408.2011.00349.x/pdf, doi: 10.1111/j.1478-4408.2011.00349.x.

3. FORTE-TAVČER, Petra. Biotechnology in textiles - an opportunity of saving water. V: EINSCHLAG, Fernando S. García (ur.). *Waste water - treatment and reutilization*. Rijeka: Intech, 2011, str. [387]-404. http://www.intechopen.com/articles/show/title/biotechnology-in-textiles-an-opportunity-of-saving-water.

Simončič Barbara

1. KLEMENČIČ, Danijela, TOMŠIČ, Brigita, KOVAČ, Franci, SIMONČIČ, Barbara. Antimicrobial cotton fibres prepared by in situ synthesis of AgCl into a silica matrix. *Cellulose (Lond.)*, 2012, vol. 19, no. 5, str. 1715-1729, doi: 10.1007/s10570-012-9735-z.

2. SIMONČIČ, Barbara, TOMŠIČ, Brigita, ČERNE, Lidija, OREL, Boris, JERMAN, Ivan, KOVAČ, Janez, ŽERJAV, Metka, SIMONČIČ, Andrej. Multifunctional water and oil repellent and antimicrobial properties of finished cotton: influence of sol-gel finishing procedure. *J. sol-gel sci. technol.*, 2012, vol. 61, no. 2, str. 340-354, ilustr., doi: 10.1007/s10971-011-2633-2.

3. KLEMENČIČ, Danijela, SIMONČIČ, Barbara, TOMŠIČ, Brigita, OREL, Boris. Biodegradation of silver functionalised cellulose fibres. *Carbohydr. polym.*. [Print ed.], Apr. 2010, vol. 80, iss. 2, str. 426-435, ilustr., doi: 10.1016/j.carbpol.2009.11.049.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Obnovljivi viri energije**
Course title:	Renewable energy sources

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/Elective Course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**	**60**			**130**	**10**

Nosilec predmeta / Lecturer:	**Sašo Medved**, Brane Širok, Marko Topič

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski, angleški / Slovenian, English
	Vaje / Tutorial:	Slovenski, angleški / Slovenian, English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v doktorski študij	Admission to the doctoral programme

Vsebina:	**Content (Syllabus outline):**
<u>Splošni modul</u> - energija in sodobne družbe (človek); - procesi v okoljskih sferah na katere vplivamo s pretvarjanjem energij; - uravnoteženje med dobavo in porabo energij, pomen oskrbe in varčevanja z energijami; - potencial OVE; metode za vrednotenje potenciala; - - naravni in tehnološki procesi pretvarjanja OVE in njihovo modeliranje, teoretične omejitve učinkovitosti pretvarjanja; - - modeliranje sistemov in naprav za pretvarjanje OVE v toploto, električno energijo in goriva; - - okoljski pritiski tehnologij za pretvarjanje OVE; - - ekonomičnost tehnologij pretvarjanja OVE in	<u>General module</u> - Energy and modern society; - Processes in environmental spheres, influenced by the energy conversion; - Balance between supply and consumption of energy, the importance of power supply and energy saving; - The potential of renewable energy sources, methods for evaluating the potential; - Natural and technological processes for converting renewable energy sources and their modelling, theoretical limits of conversion efficiency; - Modelling of technologies and systems for utilization of renewable energy sources for heat, electricity and fuel production; - Environmental footprint of technologies for

študije izvedljivosti; - - vloga OVE v energetskih politikah držav EU; - perspektive oskrbe z energijo v prihodnosti. <u>Modul sončne energija</u> modeliranje sončnega sevanja na poljubno orientirano ploskev; naravno ogrevanje in hlajenje stavb; naravna osvetlitev stavb; prenos toplote in modeliranje toplotnega odziva stavb; aktivni solarni sistemi za ogrevanje in hlajenje; modeliranje sistemov za pretvarjanje sončne energije v toploto in električno energijo. <u>Modul fotovoltaike:</u> - pregled tehnologij za pridobivanje elektrike iz sonca, ekološki in ekonomski vidiki - *sončne celice:* principi delovanja, materiali in tehnologije ter značilnosti in napredni trendi celic iz kristalnega silicija, tankoplastnih celic (silicijevih, halkopiritnih in kadmijteluridnih), elektrokemijskih in organskih sončnih celic, tandemskih in večspojnih celic ter celic termofotovoltaike; analiza optičnih in električnih izgub, modeliranje, simulacije in karakterizacija. Sončne celice tretje generacije. - *fotonapetostni moduli:* značilnosti, tehnološki trendi in standardi kristalnosilicijevih, tankoplastnih in koncentratorskih PV modulov. Vrednotenje zmogljivosti, analiza izgub in energijskega izplena. Modeliranje, simulacije in karakterizacija. - *Fotonapetostni sistemi:* omrežni in samostojni PV sistemi, načrtovanje, gradnja in vzdrževanje; močnostni regulatorji in razsmerniki, zaščitni elementi; priključevanje na omrežje, ekonomika PV sistemov. <u>Modul izkoriščanje energije vode in vetra</u> - osnove turbinskih strojev in metode modeliranja vodnih in vetrnih turbin - energijske pretvorbe v vodnih in vetrnih turbinah ter predstavitev specifičnih pojavov, - hidroenergetski potencial in metode vrednotenja potencialov - snovanje in modeliranje hidroenergetskih sistemov - izkoriščanja energije vetra in metode vrednotenja smotrne izrabe energije vetra - osnove eksperimentalnih metod - modelna preskušanja turbinskih strojev v laboratorijskih in obratovalnih razmerah - funkcionalni nadzor in vzdrževanje na hidroenergetskih objektih in vetrnih turbinah	utilization of RES; - Efficiency of technologies and feasibility studies; - The role of RES in the EU energy policies; - Perspective of energy supply in the future. <u>Solar energy module</u> - Modelling of the solar radiation on an arbitrary oriented surface; - Natural heating and cooling of buildings; - Natural lighting of buildings; - Modelling of heat transfer and thermal response of buildings; - Active solar systems for heating and cooling; - Modelling of systems for converting solar energy into heat and electricity. <u>PV module:</u> - An overview of technologies for electricity generation from the solar energy, ecological and economical aspects; - Solar cells: operating principles, materials and technologies and advanced features and trends of (mono/poly)crystalline, thin-film (Si, CIGS, CdTe), dye sentitized and organic solar cells, tandem and multi-junction cells; analysis of optical and electrical losses, modelling, simulations and characterization. Third generation solar cells; - Photovoltaic modules: types and technological trends, standards of crystalline silicon, thin-film and concentrator PV modules. Evaluation of performance, analysis of losses and energy yield. Modelling, simulation and characterization; - Photovoltaic systems: grid-connected and autonomous PV systems, design, realization and maintenance; power regulators and inverters, protection devices; connection to the grids, economy of PV systems; <u>Water energy and wind power utilisation module</u> - Fundamentals of turboengine and modelling of water and wind turbines; - Energy conversion in wind and water turbines and presentation of specific phenomena; - Hydropower potential and methods for potential evaluation; - Design and modelling of hydropower systems; - Wind-energy exploitation and evaluation methods of efficient utilization of wind energy; - Fundamentals of experimental methods - model turboengine testing in the laboratory and operating conditions; - Functional control and maintenance of the hydropower facilities and wind turbines.

Temeljni literatura in viri / Readings:

- S. Medved; P. Novak (2000), Varstvo okolja in obnovljivi viri energije; Univerza v Ljubljani, Fakulteta za strojništvo
- Širok B., Dular M., Stoffel B. Kavitacija. 1. natis. Ljubljana: i2, 2006. 164 str., ilustr., graf. prikazi.
- H. Scheer (2004); Renewable energy for a sustainable global future, EARHTSCAN, UK
- J. Gordon; Solar Energy The State of the Art (2001); James&James, UK Raabe J., Hydro power, VDI Verlag, Dusseldorf, 1985, ISBN 3-18-400616-6
- J.A.Duffie, W. A. Beckman; Solar Engineering of Thermal Processes (1991); John Wilex&Sons, Inc. USA
- Ursula Eicker (2003): Solar technologies for buildings, John Wiley & Sons, England, Germany Davies M.G.; Building Heat Transfer (2004); John Wiley & Sons, Ltd
- Harvey D.L.D; A Handbook on Low-energy Buildings and District-Energy Systems (2006); Earthscan (UK)
- T.B. Johansson, H. Kelly, A.K.N. Reddy (1993). Renewable Energy Sources for Fuels and Electricity, Island Press, Califirniy, USA
- Freris L.L; Wind Energy Conservation Systems (1990); Prentice Hall International (UK) Ltd Gipe P; Wind Energy Comes of Age (1995); John Wiley&Sons, Inc.
-J.Raabe, Hydro power (1985); VDI Verlag, Dusseldorf.
- Sun&Wind Energy; BVA Bielfelder Verlag GmbH & Co. KG
- Renewable Energy Focus; Elsevier Ltd, UK
- Solar Energy, ISBN 0038-092X, http://www.elsevier.com/locate/solener
- Energy and Buildings, ISSN 0378-7788, http://ees.elsevier.com/enb
- Renewable energy, ISSN: 0960-1481, http://www.elsevier.com/
- Luque A., Fonash S.: Handbook of Photovoltaic Science and Engineering, Wiley, 2003.
- Roth W., Brecl K., Krč J., Likovič A., Nemac F., Opara Krašovec U., Smole F., Škarja G., Vukadinović M, Topič M.: Soltrain: Izkoriščanje sončne energije za proizvodnjo električne energije s pomočjo fotonapetostnih sistemov, slovenski priročnik, Ljubljana, Fakulteta za elektrotehniko, 2004.
- Green M.A.: Third Generation Photovoltaics: Advanced Solar Energy Conversion, Springer, 2005.
- BALLIF C., Topič M.. A strategic research agenda for photovoltaic solar energy technology. [Brussels]: European Communities, 2007.

Cilji in kompetence:

Namen predmeta je kandidata seznaniti z lastnostmi obnovljivih virov energije (OVE) in procesi pretvarjanja teh virov v oblike energij, ki jih potrebujemo v sodobnih družbah. Uvodoma kandidat spozna elemente okolja in procese, ki se v njih dogajajo zaradi antropogenih virov onesnaževanja, ki so posledica oskrbe z energijami. Za posamezni OVE so predstavljene metode za oceno potenciala ter teoretične omejitve pri izkoriščanju. Predstavljeni so fizikalni, kemijski in biološki procesi pretvarjanja OVE v obsegu, ki jih kandidat potrebuje za razumevanje potenciala OVE oziroma pretvarjanja v toploto, električno energijo in goriva. Kandidat spozna metode za modeliranje delovanja sistemov in njihovo optimizacijo in ekonomsko presojo. Posamezne skupine tehnologij za pretvarjanje OVE so analizirane tudi s stališča vplivov na okolje in tveganja. Spozna kako so OVE v

Objectives and competences:

The purpose of the course is to educate the candidate with the characteristics of renewable energy sources (RES) and the process of converting these resources into forms of energy that are needed in modern societies. The candidate is introduced to the elements of the environment and processes that occur in them due to anthropogenic sources of pollution as a result of the energy supply. For each RES methods for assessment of the potential and theoretical limits of exploitation are presented. The physical, chemical and biological processes for conversion of RES are presented in such an extent, that the candidate is able to understand the potential of RES and conversion into heat, electricity and fuel. The candidate learns methods for modelling operation of systems and their optimization and economic assessment. Individual groups of technologies for conversion of RES are also analyzed in terms of impact on

različnih državah umeščeni v energetsko politiko in kako se uporaba OVE s strani držav spodbuja. Predstavljeni so potencialni nosilci energij, ki izvirajo iz OVE, ki se napovedujejo v prihodnosti. Kandidati bodo spoznali tudi temeljne raziskovalne segmente fotovoltaike od materialov preko sončnih celic in fotonapetostnih modulov do fotonapetostnih sistemov ter sodobne razvojne trende pridobivanja elektrike iz sonca. V obliki modulov bodo kandidatom posredovane dodatne vsebine o pretvarjanju sončne energije, energije vetra in vodne energije.	the environment and environmental risks. They learn how RES are settled in the energy policy in different countries and how these countries promote the use of RES. Potential energy carriers anticipated in the future, derived from RES, are presented. Candidates will also learn about basic research segments of the photovoltaic, covering materials, solar cells, PV modules, PV systems and modern development trends of solar electricity generation. The additional content on converting solar energy, wind energy and hydropower will be forwarded to candidates in the form of modules.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razume pomen trajnostne oskrbe in rabe energije, pozna značilnosti neobnovljivih in obnovljivih naravnih virov, spozna povezavo med energetsko in okoljsko politiko, razume fizikalne, kemične in biološke procese, ki se uporabljajo pri pretvarjanju obnovljivih virov energije, spozna in zna uporabiti metode za modeliranje procesov pretvarjanja obnovljivih virov energij, zna uporabiti metode za LCA in LCC presojo energetskih tehnologij.	Knowledge and understanding: The candidate understands the importance of sustainable energy supply and use, is familiar with features of non-renewable and renewable energy resources, learns about the connection between energy and environmental policy, understands the physical, chemical and biological processes that are used in the conversion of RES, recognizes and knows how to use methods for modelling processes of RES conversion, is able to use methods for LCA and LCC assessment of energy technologies.

Metode poučevanja in učenja:	**Learning and teaching methods:**
avditorna predavanja, laboratorijske vaje, individualni raziskovalni seminar, osebna komunikacija	Auditorial lectures, lab experiments, individual research seminar , personal communication

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit, ustni zagovor, javna predstavitev seminarske naloge s področja teme doktorske disertacije	60% 25% 15%	Examine: written and oral, public presentation of project report

Reference nosilca / Lecturer's references:

prof. dr. Sašo Medved:

1. MEDVED, Sašo, ARKAR, Ciril. Correlation between the local climate and the free-cooling potential of latent heat storage. *Energy build.*. [Print ed.], 2008, letn. 40, št. 4, str. 429-437.

2. DOVRTEL, Klemen, **MEDVED, Sašo.** Weather-predicted control of building free cooling system. *Appl. energy*. [Print ed.], Sep. 2011, vol. 88, iss. 9, str. 3088-3096

3. FINK, Rok, **MEDVED, Sašo**. Health impact assessment of liquid biofuel production. *Int. j. environ. health res. (Print)*, 2012, vol. , no. , str. 1-10,

prof. dr. Brane Širok

ŠIROK, Brane, BLAGOJEVIĆ, Bogdan, BULLEN, Peter Ronald. *Mineral wool : production and properties*. Cambridge: Woodhead; Boca Raton [etc.]: CRC Press, cop. 2008. X, 185 str., ilustr. ISBN 978-1-84569-406-7. ISBN 1-84569-406-6. ISBN 978-1-4200-7045-3. ISBN 1-4200-7045-2.

ŠIROK, Brane, HOČEVAR, Marko, BAJCAR, Tom, KLASINC, Roman. Measuring void fraction :

the visualization method. *Int. water power dam constr.*, 2008, letn. 60, št. 11, str. 36-40.
BAJCAR, Tom, MALAČIČ, Vlado, MALEJ, Alenka, ŠIROK, Brane. Kinematic properties of the jellyfish Aurelia sp. *Hydrobiologia (Den Haag)*, 2009, let. 616, št. 1, str. 279-289.

prof. dr. Marko Topič
1. KURNIK, Jurij, JANKOVEC, Marko, BRECL, Kristijan, **TOPIČ, Marko**. Outdoor testing of PV module temperature and performance under different mounting and operational conditions. *Solar Energy Materials and Solar Cells*. [Print ed.], 2011, vol. 95, no. 1, str. 373-376, JCR IF(2011)= 4.542
2. ANDREJAŠIČ, Tine, JANKOVEC, Marko, **TOPIČ, Marko**. Comparison of direct maximum power point tracking algorithms using EN 50530 dynamic test procedure. *IET renewable power generation*. [Print ed.], 2011, vol. 5, no. 4, str. 281-286.
3. BOKALIČ, Matevž, OPARA KRAŠOVEC, Urša, **TOPIČ, Marko**. Electroluminescence as a spatial characterisation technique for dye-sensitised solar cells. *Progress in Photovoltaics*, 2012, vol., no. , str. 1-5.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Ohranitveno gozdarstvo**
Course title:	Conservation Forestry

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	/	1, 2	/
Interdisciplinary Doctoral Programme in Environmental Protection	/	1, 2	/

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	35	/	/	5	190	10

Nosilec predmeta / Lecturer:	Jurij Diaci

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment in doctoral studies.

Vsebina:	**Content (Syllabus outline):**
Naravna izhodišča: Spreminjanje rabe tal v svetovnem merilu in ekološke posledice; Gozdovi sveta: razvoj, raba in ohranjanje; Referenčne krajine za sonaravno, ohranitveno gospodarjenje; Pragozdovi in zavarovani gozdovi; Naravne motnje in obnovitveni cikli gozdnih ekosistemov; Umetni gozdni ekosistemi in primerjava z naravnimi ekosistemi; Vplivi človeka na gozdne ekosisteme; Gozdovi in podnebne spremembe. Nega gozdnih ekosistemov: Izhodišča in razvoj sonaravnega gospodarjenja z gozdnimi ekosistemi; Nega gozdnega roba, obvodnih gozdnih ekosistemov, gozdnate krajine, primestnih gozdov; Certifikacijske sheme – ekosistemsko gospodarjenje – trajnostno	Natural traits: Global change in the land use patterns and ecological consequences; Worlds' forests: trends, use and conservation; Reference landscapes for close-to-nature, conservative management; Old-growth and protected forests; Natural disturbances and regeneration dynamics of forest ecosystems; Man-made forest ecosystems and comparison with natural ecosystems; Influence of man on forest ecosystems; Forests and climate change. Tending and use of forest ecosystems: Origins of close-to-nature forest management; Tending of forest edge, riparian forests, forested landscapes and urban forests; Forest certification – ecosystem management – sustainable management; Conservation of

gospodarjenje; Ohranjanje biotske pestrosti pri upravljanju z gozdnimi ekosistemi; Načrtovanje in praktična izpeljava ukrepov nege; Revitalizacija spremenjenih gozdnih ekosistemov; Agrogozdarstvo; Smeri razvoja upravljanja gozdnih ekosistemov.	biodiversity and forest management; Planning and practical implementation of forest tending; Gradual conversion and restoration of artificial, man-made forest ecosystems; Agroforestry; Future development of forest ecosystem management.

Temeljni literatura in viri / Readings:

Knjige in učbeniki / Textbooks:

Diaci, J. (ur.) 2006. Nature based forestry in Central Europe: alternatives to industrial forestry and strict preservation. Univerza v Ljubljani, 178 s.

FAO - Global forest resources assessment 2010 / http://www.fao.org/forestry/site/fra2010/en/

Kaufmann, M. R. / Graham, R. T. / Boyce, Jr, .A. D. / Moir, W. H. / Perry, L. / Reynolds, R. T. / Bassett, R. L. / Mehlhop, P. / Edminster, C. B. / Block, W. M. / Corn, P.S., 1994. An ecological basis for ecosystem management. - Fort Collins, CO, Gen. Tech. Rep. RM 246, USDA For. Serv., 24 s.

Kimmins, J. P., 1997. Forest Ecology: A Foundation for Sustainable Management.- Prentice Hall, Upper Saddle River, New Jersey, 596 s.

Kimmins, J. P.: Forest Ecosystem Management: An environmental necessity, but is it a practical reality or simply an ecotopian ideal? http://www.fao.org/DOCREP/ARTICLE/WFC/XII/MS18-E.HTM#P10_151

Peterken, G. F. 1996. Natural woodland: ecology and conservation in northern temperate regions.- Cambridge University Press, Cambridge, 522 s.

Smith, D. M., Larson, B. C., Kelthy, M. J., Ashton, P. M. S., 1997. The practice of silviculture: applied forest ecology.- John Wiley & Sons, inc., New York, 537 s.

Vera, F. W. M. 2000. Grazing Ecology and Forest History", CABI Publishing, Waltingford, 528 s, ISBN 0-85199-442-3.

Vsi viri so študentu dosegljivi v gozdarski knjižnici ali jih posredujemo na elektronskih medijih. Dodatni viri za izdelavo seminarskih nalog so na voljo na svetovnem spletu.

All sources are accessible to students in the forestry library or they will be distributed as the electronic media. Additional resources for seminar papers are available on the World Wide Web.

Cilji in kompetence:	**Objectives and competences:**
Slušatelj osvoji temeljna znanja o teoretičnih izhodiščih, razvoju in razlikah modelov ohranitvenega gozdarstva v evropskem in svetovnem merilu (npr. sonaravno, trajnostno, ekosistemsko, večnamensko gozdarstvo) ter spoznava in razume razvojne ovire za ohranitveno gospodarjenje.	Students attain basic knowledge on theoretical background, development and differences among diverse approaches to conservation forestry on a global and European level (e.g. close-to-nature, sustainable, ecosystem, multipurpose forestry). They understand developmental constraints for conservation forestry.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Slušatelj je sposoben samostojne presoje in ocene različnih standardov upravljanja gozdnih ekosistemov. Osvoji praktične primere dobrih praks povezovanja ekoloških, varovalnih, ekonomskih ter socialnih vlog in funkcij gozdov. Preko seminarja in terenskega pouka razvije spretnosti samostojnega in skupinskega dela v naravi ter možnosti predstavitve rezultatov javnosti.	Knowledge and understanding: Students learn to judge and evaluate different standards of forest ecosystem management. They gain knowledge on practical examples of successful combination of ecological, protection, economic and social forest functions and services. Within a seminar and field work they develop skills of individual and group work in nature, as well as possibilities of public presentation of their work.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja s sodelovalnim, refleksivnim učenjem / poučevanjem in diskusijo. Vodeno seminarsko delo v kabinetu in na terenu. Poudarek je na sprotnem učenju in sodelovanju. Končni izpit se opravlja neposredno po opravljenih kontaktnih urah. Sprotno ocenjevanje dosežkov stimulira študenta k rednem delu. Slušatelj aktivno sodeluje na predavanjih in diskusijah (vsakokratna priprava na tematiko), pripravi seminarsko nalogo s terenskega pouka, izdela obsežnejšo seminarsko nalogo in jo predstavi pred podiplomskimi študenti oz. na dodiplomskem študiju (okvirno 20 min in 10 min diskusije). Možna je predstavitev na terenu. Naloga lahko vključuje gozdno-ekološke ali gozdno-upravljavske vidike doktorske naloge.	Formal lectures with reflexive learning / teaching and discussion. Guided seminar work in classroom, lab and in the field. Stress is on continuous learning and cooperation. Final exam is to be taken directly after accomplished contact hours. Permanent evaluation of study success stimulates students for continuous learning. Student actively participates in lectures and discussions (obligatory preparing for every lecture and theme), he/she prepares seminar from the field exercises, accomplishes comprehensive seminar, which is presented in front of undergraduate or graduate students (ca. 20 min and 10 min of discussion). Presentation can take place in the field. The seminar may include forest ecological or managerial parts of students' doctoral dissertation.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Končna ocena izpita je sestavljena iz:		Final grade will be comprised of:
(1) ocene sodelovanja na predavanjih	20%	(1) grade for lecture participation
(2) ocene seminarskih nalog s terena	20%	(2) grade for field seminar reports
(3) ocene vsebine in predstavitve obsežnejše seminarske naloge	20%	(3) grade for the comprehensive final seminar
(4) pisnega izpita.	40%	(4) final written exam

Reference nosilca / Lecturer's references:

Diaci, J., Adamic, T., Rozman, A., 2012. Gap recruitment and partitioning in an old-growth beech forest of the Dinaric Mountains: Influences of light regime, herb competition and browsing. Forest Ecology and Management 285, 20-28.
Diaci, J., Firm, D., 2011. Long-term dynamics of a mixed conifer stand in Slovenia managed with a farmer selection system. Forest Ecology and Management 262, 931–939.
Diaci, J., Rozenbergar, D., Anic, I., Mikac, S., Saniga, M., Kucbel, S., Visnjic, C., Ballian, D., 2011. Structural dynamics and synchronous silver fir decline in mixed old-growth mountain forests in Eastern and Southeastern Europe. Forestry, 479-491.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Okolje, biovarnost in živalska produkcija**
Course title:	Environment, Biosecurity and Animal Production

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective Course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**40**	**/**			**190**	**10**

Nosilec predmeta / Lecturer:	Martin Dobeic

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski, angleški/ Slovenian, English
	Vaje / Tutorial:	**/**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študijski program.	Enrollment in the Interdiciplinary Doctoral Programme.

Vsebina:	**Content (Syllabus outline):**
definicija biovarnosti kot strateški in integrirani pristop k analizi in ukrepom glede zdravstvenih in okoljskih tveganj razvoj, vsebina in posebnosti ukrepov biovarnosti. posebnosti sistema biovarnosti kot harmoniziranega in integriranega medsektorskega sistema v okviru vzdrževanja javnega zdravja, varne hrane, veterinarstva, kmetijstva, gozdarstva, ribištva in zaščite okolja. management in preventivnost ukrepov biovarnosti na nivoju mednarodnih političnih in administrativnih teles v zvezi s komplementarnimi ukrepi. obvladovanje sistema biovarnosti kot politike in	- definition of biosecurity as a strategic and integrated approach to the analysis and evaluation of health and environmental risks - the development, content and special issues of biosecurity measures. - special issues of biosecurity as a harmonized and integrated cross-sectoral system in the maintenance of public health, food safety, veterinary medicine, agriculture, forestry, fishery and in environmental protection. - biosecurity management and its preventive on international policy and administrative level, based on complementary measures. - Management of biosecurity as a policy and regulatory mechanisms in the areas of food safety, zoonoses, animal and plant diseases,

regulatornih mehanizmov na področjih varne hrane, zoonoz, bolezni živali in rastlin, tujerodnih organizmov, gensko spremenjenih organizmov in njihovih proizvodov. interdisciplinaren pristop k urejanju mikro- in makroambienta, s stališča manipulacije, higienizacije in distribucije odpadkov in živalskih stranskih proizvodov. zaščita zraka v smislu zniževanja razvoja emisij in imisij toplogrednih plinov, neugodnih vonjav in NH3 specialna mikrobiologija in higiena živinorejskih objektov in objektov za predelavo živalskih surovin in živalskih stranskih proizvodov	non-native organisms, genetically modified organisms and their products. - interdisciplinary approach to regulation of micro- and macroambient, in terms of handling, sanitation and distribution of wastes and animal by-products. - protection of air in terms of greenhouse gases, odours and NH_3 emission and imission reducing. - special microbiology and hygiene of livestock facilities, facilities for animal products processing and the processing of animal by-products

Temeljni literatura in viri / Readings:

Glavni učbeniki

OIE. Animal Production Food Safety Challenges in Global markets. OIE Vol. 25 (2), 2006

OIE.Animal Welfare: Global Issues, Trends and Challenges. OIE Vol. 25 (2), 2006

Kelley J. D., Thelin A. Agricultural medicine – Ocucupational and Environmental Health for the Health Professions. Ames, Iowa: Blackwell Publishing, 2006.

Axford, I Fayez M. Marai, H Omed. Pollution in Livestock Production Systems, Edit. I. Ap Dewi, R.F.E, AB International, 1994

FAO. FAO Biosecurity toolkit. Food and Agric.Org.UN, Rome, 2007.

Tekoča periodika

DEFRA. Biosecurity guidance.
http://www.defra.gov.uk/animalh/diseases/control/biosecurity/index.htm. 2008

Cilji in kompetence:	**Objectives and competences:**
Cilji in kompetence izobraževanja so, da udeleženci: dosežejo poglobljeno razumevanje glede ciljev biovarnosti v ohranjanju človekovega zdravja, zdravja živali, rastlin in zaščite okolja. razumejo principe za zmanjševanje tveganja dejavnikov rizika, učinkov in za oblikovanje profila skladnosti sistema biovarnosti razvijejo sposobnost za harmoniziran ter integriran pristop k analizi tveganja, pridobijo poglobljena znanja s področja zdravstvenih pravil za različne stranske proizvode	Goals and specific competencies of training base on the objectives that participants have to: - achieve the profound understanding of the biosecurity objectives in maintaining of the human and animal health, plant and environment protection. - understand the principles of the risk factors diminishing and to create a profile of biosecurity compliance - the ability to develop a harmonized and integrated approach to risk analysis, - acquire knowledge in the field of health rules concerning different by-products

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Udeleženci bodo: pridobili znanja glede strateških in integriranih pristopov k analizi, presojam ter ukrepom glede tveganj na področjih zaščite okolja, javnega zdravja in zdravja živali razumeli načine in postopke presoje glede ocene kapacitet za uvajanje sistema biovarnosti razumeli problematiko živalske reje v odnosu do okolja in javnega zdravja	Knowledge and understanding: Participants will: - gain knowledge of strategic and integrated approaches to the analysis, assessments and measures of risk on the areas of environmental protection, public and animal health - understand the different ways of procedures on estimation of the capacity for the bio-security system implementation - understand the problematics on the issue of animal husbandry in relation to the environment and public health

Metode poučevanja in učenja:	**Learning and teaching methods:**
Učenje se izvede s predavanji, skupinskimi (diskusijske ure) in individualnimi konzultacijami, seminarskimi nalogami in praktičnimi vajami	Teaching is conducted through lectures, small-group (discussion hours) and individual consultations, seminar papers, and practical exercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit. Seminarska naloga Ocenjevalna lestvica: 6-10 pozitivno, 1-5 negativno, skladno z določili statuta UL.	 50% 50%	Oral examination. Seminar exercise. Marking scale: 6-10 positive, 1-5 negative, harmoniously with UL statute regulation.

Reference nosilca / Lecturer's references:

DOBEIC, Martin, PINTARIČ, Štefan. Laying hen and pig livestock contribution to aerial pollutin of Slovenia. Acta vet. (Beogr.), 2011, vol. 61, no. 2/3, str. 283-293.

DOBEIC, Martin, KENDA, Edvard, MIĆUNOVIĆ, Jasna, ZDOVC, Irena. Airborne Listeria spp. in the red meat processing industry. Czech J. Food Sci., 2011, vol. 29, no. 4, str. 441-447.

KRAPEŽ, Uroš, SLAVEC, Brigita, FRATNIK STEYER, Adela, PINTARIČ, Štefan, DOBEIC, Martin, ZORMAN-ROJS, Olga, DOVČ, Alenka. Prevalence of pigeon circovirus infections in feral pigeons in Ljubljana, Slovenia. Avian dis., 2012, vol. 56, no. 2, str. 432-435.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**OKOLJSKA EPIDEMIOLOGIJA**
Course title:	ENVIRONMETAL EPIDEMIOLOGY

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**	**15**			**175**	**10**

Nosilec predmeta / Lecturer:	**Ivan Eržen**, Borut Poljšak

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Študenti doktorskega študija.	PhD students.

Vsebina:	**Content (Syllabus outline):**
Predstavitev dejavnikov okolja ter njihovega pomena za zdravje Razvoj pristopov v okoljski epidemiologiji Predmet proučevanja – odkrivanje in proučevanje posledic delovanja okolja na zdravje- metodološki pristopi za opredelitev škodljivosti Oblikovanje osnovnih kriterijev za oceno nevarnosti dejavnikov okolja Pregled glavnih metod dela ter tipov posameznih študij – opis metod. Predstavitev prednosti in slabosti posameznih tipov študij Napake in prostranosti v epidemiologiji okolja ter tehnik za njihovo zmanjševanje Obravnava posameznih primerov okoljskih	Introduction to environmental factors and their importance for health Approach development in environmental epidemiology Object of study - discovering and studying environment impact on health-methodological approaches for hazard identification Design of basic criteria for risk assessment of environmental factors Overview of the main working methods and the types of individual studies. Description of methods. Presentation of the advantages and disadvantages of each type of the study Errors and bias in environmental epidemiology and techniques to reduce

škodljivosti ter analiza pristopov, ki so bili uporabljeni v okviru proučevanja razmer Načrtovanje okoljskih raziskav ter priprava metode dela	Presentation of particular cases of environmental harm and analysis of approaches that were used in the study Planning of environmental research and preparation methods

Temeljni literatura in viri / Readings:

Eržen in sod. Zdravje in okolje. Medicinska fakulteta Maribor 2010, 1-208
Lijana Zaletel-Kragelj, Ivan Eržen. Ecological Studies: Basic Principles
http://www.snz.unizg.hr/ph-see/Documents/Publications/PH-SEE_Book6_Full_MethodsAndToolsInPH.pdf,
stran 289 do 309
R. Beaglehole, R. Bonita, T. Kjelldstrom Basic Epidemiology. World Health Organisation (WHO). 1994
Lilienfeld AM, Lilienfeld ED. Foundations of Epidemiogy, Oxford, New York: Oxford University Press, 1980.http://themes.eea.eu.int/

Cilji in kompetence:	**Objectives and competences:**
Cilj izobraževanja je, da udeleženci: dosežejo poglobljeno razumevanje metodoloških pristopov pri proučevanju vpliva okoljskih dejavnikov na zdravje razumejo možnosti ter prednosti in slabost metodoloških pristopov v okoljski epidemiologiji poznajo praktično uporabo metod v okviru okoljske epidemiologije ter njihove omejitve razvijejo kritičen odnos do možnosti, ki jih imamo na področju okoljskega raziskovanja v sodobnem času	The goal of training is that students: achieve in-depth understanding of methodological approaches for studying the impact of environmental factors on health understand the options and the pros and cons of methodological approaches in environmental epidemiology know the practical application of methods in environmental epidemiology, and their limitations develop a critical attitude towards the opportunities that we have in the field of environmental research at present

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentke in študenti bodo: poznali definicije, vlogo in značilnosti epidemiologije okolja ter razvoj tega področja, poznali osnovne interakcije med okoljem (socialno in biološko) in človekom ter njihov vpliv na zdravje, poznali pomen proučevanja populacije kot prispevek k zdravju posameznika, razumeli in obvladali pristope, probleme in rešitve na področju epidemiologije okolja, poznali pravne in etične okvire na področju epidemiologije okolja, s pridobljenim znanjem razumeli principe na dokazih temelječega ukrepanja na področju zmanjševanja škodljivih vplivov okolja na zdravje.	Knowledge and Understanding: On the completition of this course the student will: be acquainted with the definitions, role and characteristic of environmental epidemiology and its development, be familiar with the importance of interdependency of health determinants in social and physical environment for health status of the population, understand the importance of measurement of health and diseases, be able to recognize and understand approaches, problems and soulutions in environmental epidemiology, will know legal and ethical frames in public health, will understand the principles of evidence based environmental epidemiology.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah, reševanje konkretnih problemov, individualne naloge.	Lectures, seminars, case study, student's presentations, small group work, consultations, team work, individual work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit	100%	Oral examination

Reference nosilca / Lecturer's references:

Ivan Eržen

ERŽEN, Ivan. Ocena izpostavljenosti otrok svincu v celjskih vrtcih = An assessment of lead exposure among children attending kindergartens in Celje. Zdravstveno varstvo. [Tiskana izd.], 2011, letn. 50, št. 2, str. 113-120

ERŽEN, Ivan, KUKEC, Andreja, ZALETEL-KRAGELJ, Lijana. Air pollution as a potential risk factor for chronic respiratory diseases in children: a prevalence study in Koper municipality. HealthMed, 2010, vol. 4, no. 4, suppl. 1, str. 945-954

ŠTUPAR, Janez, DOLINŠEK, Franci, ERŽEN, Ivan. Hair-Pb longitudinal profiles and blood-Pb in the population of young Slovenian males. Ecotoxicol. environ. saf., 2007, letn. 68, št. 1, str. 134-143

Borut Poljšak

MILISAV, Irina, POLJŠAK, Borut, ŠUPUT, Dušan. Adaptive response, evidence of cross-resistance and its potential clinical use. Int. j. mol. sci. (Online), 2012, vol. 13, str. 10771-10806

POLJŠAK, Borut, MILISAV, Irina. The neglected significance of "antioxidative stress". Oxid. med. cell. longev., 2012, vol. 2012, 1-12

POLJŠAK, Borut. Strategies for reducing or preventing the generation of oxidative stress. Oxid. med. cell. longev. , 2011, vol. 2011, 1-15

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**OKOLJSKE POLITIKE MED MORALNIM UPRAVIČENJEM, EKONOMSKO ANALIZO IN POLITIČNO URESNIČLJIVOSTJO**
Course title:	ENVIRONMENTAL POLICIES BETWEEN MORAL JUSTIFICATION, ECONOMIC ANALYSIS AND POLITICAL FEASABILITY

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	Igor Pribac

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski, angleški/ Slovenian, English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrolment in the doctoral study.

Vsebina:	**Content (Syllabus outline):**
Predmet bo po uvodnem delu, posvečenem seznanjanju z temeljnimi pojmi in problemi odnosa med moralno in ekonomsko teorijo (instrumentalna racionalnost, interes, moralna norma, analiza stroškov in koristi itd.) ter relevantnimi koncepti in stališči najpomembnejših tokov sodobne praktične etike in normativne politične filozofije, s pomočjo pridobljenega znanja problematiziral razmerja med moralnimi normami, pravom, političnim odločanjem in ekonomskim delovanjem v zvezi z okoljem. Temu se bo posvečal prek analize argumentacij v zvezi s posameznimi okoljskimi izzivi (globalno segrevanje, ohranitev divjine, genski	After an introduction, dedicated to basic concepts and problems concerning the relation between moral and economic theory (instrumental rationality, interest, moral norm, cost benefit analysis) and the relevant concepts and positions of the most important strains in contemporary practical ethics and normative political philosophy, the subject will focus on the relationships between moral norms, law, political decisions and profitability based acting concerning the environment. The topic will be dealt with analyzing the argumentations proposed concerning peculiar environmental challenges (global warming, preserving the wilderness, genetic engineering, moral status of

inženiring, moralni status nečloveških živali, biotska raznovrstnost itd.) ter – realnih in možnih – okoljskih ukrepov in politik, (emisijska, energetska, demografska, davčna politika, trajnostni razvoj). V ospredju bo preučevanje njihove upravičenosti (npr. individualna in kolektoivna odgovornost; bogati in revni; lokalno in globalno; mesto in podeželje; medgeneracijska pravičnost; okoljski aktivizem; poslovna etika in korporativna odgovornost; okoljska civilna neposlušnost), pozornosti pa bo deležna tudi njihova politična uresničljivost.	non-human animals, biodiversity etc.) and real or potential environmental measures and politics (regarding pollution, energy, demography, tax policy, sustainable development). In the forefront there will be the study of their justification (for example: individual and collective responsibility; rich and poor; local and global; city and countryside; intergenerational justice; environmental activism; business ethics and corporate responsibility; environmental citizens' disobedience), some attention will be paid also to their political feasibility.

Temeljni literatura in viri / Readings:

Donald VanDeVeer, Christine Pierce (2003): The Environmental Ethics & Policy Book, Wadsworth, 2003.
Daniel M. Hausman, Michael S. McPherson: Economic analysis and moral philosophy, Cambridge University Press,
Paola Cavalieri: Živalsko vprašanje, Krtina, 2006
Andrew Dobson: Green Political Thought, Routledge, 2003.
Jeremy Rifkin: Stoletje biotehnologije, Krtina, 2001.
George Monbiot: Vroče, Krtina, 2010

Cilji in kompetence:	**Objectives and competences:**
Študentje bodo pridobili temeljna znanja o prepletu moralnih, pravnih, političnih in ekonomskih argumentacij, ki se v sodobnih družbah pojavljajo v zvezi z okoljem. Cilj predmeta je usposobiti študente za samostojno analizo in presojo moralne upravičenosti praks, institucij, ukrepov in politik, ki zadevajo okolje, ter za samostojno oblikovanje argumentov za ali proti uvedbi posameznih ukrepov na področju okoljskih politik. Predmetnospecifične kompetence, ki jih bodo pridobili študetje so: - sposobnost smotrne uporabe osnovnega instrumentarija normativne moralne, politične in ekonomske filozofije, - sposoblnost odkrivanja, prepoznavanja, analize in presoje moralnih stališč ter argumentacij v javnih diskurzih, ki zadevajo status okolja, - sposobnost oblikovanja in zagovarjanja lastnih moralnih in političnih stališč o upravičljivosti okoljskih praks, ukrepov in politik.	Students will gain basic knowledge on the interconnectedness of moral, legal, political and economic argumentations, which appears in contemporary societies regarding the environment. The aim of the subject is to enable the student to undertake independent analysis and form judgments about moral justifications of praxis regarding the environment, as well as for an independent formulation of arguments for or against the implementation of proposed measures of environmental policies. The competences specific to the subject that the students will gain, are: The competence to make sensible use of the basic tools pertinent to normative moral and political philosophy and economy. The competence to discover, recognize, analyse and judge moral standpoints as well as argumentation which appears in public discurse, related to the status of the environment. The competence to form and argue for her own moral and political standpoints about the justifications of environmental praxis, measures and policies.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti bodo spoznali in razumeli oblikovanje okoljskih politik kot iskanje ravnovesja med moralnim upravičenjem ekonomsko učinkovitostjo in politično uresničljivostjo.	Knowledge and understanding: Students will get the knowledge and understanding of environmental policies as a trade- off between moral justification, economic profitability and political feasibility.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Uvodni, konceptualni del bo podan prek predavanj, aplikativni del pa pretežno v seminarski obliki, ki bo vključevala tudi individualne konzultacije	The introductory conceptual part will be delivered through lessons; the applied part will take mainly in seminar form, including individual consultations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustno izpraševanje, seminarska naloga.	**50%** **50%**	Oral examination, seminar work

Reference nosilca / Lecturer's references:

doc. dr. Igor Pribac:

1. **Igor Pribac**: Konsenz kot kriterij legitimnosti političnih odločitev, v: »Revija 2000«, št. 189-191, 2007, str. 45 – 54.
2. **Igor Pribac:** Javna etika, v: Javna etika in integriteta, (ur. Bečir Kečanović), Komisija za preprečevanje korupcije, Ljubljana 2012, str. 141-150.
3. **Igor Pribac**: O delničarskem in deležniškem modelu v poslovni etiki, v: "Teorija in praksa", Filozofska fakulteta, Ljubljana 4/2012, str. 1017-1028.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Podzemne vode**
Coursetitle:	Ground Water

Študijski program in stopnja Studyprogrammeandlevel	**Študijska smer Studyfield**	**Letnik Academicyear**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
InterdisciplinaryDoctoralProgramme in EnvironmentalProtection	**/**	**1, 2**	**/**

Vrsta predmeta / Coursetype	Izbirni predmet / Elective course
Univerzitetna koda predmeta / Universitycoursecode:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**	**/**	**/**	**/**	**190**	**10**

Nosilec predmeta / Lecturer:	Mihael Brenčič

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski/ Angleški Slovenian/ English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Zaključen študijski program druge stopnje s področja naravoslovno matematičnih ali tehničnih usmeritev.	Master degree in mathematics, natural or technical sciences.

Vsebina:	**Content (Syllabusoutline):**
Študent se seznani s pojavljenjem podzemne vode v prostoru, njenim nastopanjem v tleh, sedimentih in kamninah, konceptom poroznega medija in pojavljanjem poroznosti v različnih geoloških okoljih, vlogo podzemne vode in njenim vplivom na ostale podsisteme v hidrološkem krogu ter njenimi bilančnimi parametri (na globalni in na regionalni ravni), vplivom podzemne vode na ekosisteme, osnovami dinamike toka podzemne vode skozi sedimente, definicijo vodonosnika in različnimi hidrodinamskimi modeli vodonosnikov, osnovnimi tehnikami raziskav podzemnih vod (hidrogeološko kartiranje, meritve gladin podzemne vode, črpalni in nalivalni poizkusi, sledilni poizkusi, geofizikalne metode, izhodišči	Students will learn basic concepts of groundwater appearance in space, its appearance in soil, sediments and rocks, porous media concept in different geological environments. They will learn about the role of groundwater in relation to other hydrological subsystems and their balance characteristics on local, regional and global scale, influences of groundwater on ecological systems. It is intended to present also basic knowledge of groundwater dynamics through sediments, aquifer definition and various conceptual hydrodynamic models of aquifer types. Basic groundwater investigation techniques (hydrogeological mapping, groundwater level measurements, pumping test, inflow tests,

za modeliranje toka podzemne vode), vplivi točkovnih in ploskovnih onesnaževanj in onesnaževanja na kemijsko stanje podzemne vode in osnovami širjenja in transporta onesnaževal skozi vodonosnike, osnovami razvoja podzemnih vodnih virov (izvedba zajetij na izvirih, izvedba vodnjakov in opazovalnih vrtin), osnovami zaščite podzemne vode na medzrnskih in kraških vodonosnikih in osnovami varstva pred podzemnimi vodami (pri globokih gradbenih jamah, pri gradnji avtocest in železnic). Podane bodo tudi osnovne informacije o pojavljanju mineralnih, in termalnih vod.	tracing tests, geophysical methods, basics of groundwater numerical modelling) will be presented. Basics of contaminant hydrogeology will be presented in relation to point and spatial pollution sources and basic knowledge about mass transport in porous media will be given. In the frame of applied hydrogeology construction of wells and water capture facilities will be presented as well as groundwater protection in intergranular and karstic aquifers. Protection from groundwater influences in larger infrastructural projects (railway and highway construction) will be also illustrated.

Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig in člankov iz revij (v okviru izbranega št. kreditov)/ Selected chapters from books and papers in journals (in the frame of ECTS):
Brenčič, M. Splošna hidrogeologija (general hydrogeology) – študijsko gradivo / lecture materials
Hiscock, K., 2005: Hydrogeology - principles and practice. Blackwell Publishing, 389 pp.
Todt, D.K. & Mays, L.W, 2005: Groundwater Hydrology. John Wiley & Sons., Inc., 636 pp.
Younger, P.L., 2007: Groundwater in the Environment. Blackwell Publishing, 318 pp.
Periodika/Journals: Water Resources Research, Journal of Hydrology, Ground Water, Hydrogeology Journal

Cilji in kompetence:	**Objectives and competences:**
Študent bo osvojil osnovno znanje o pojavljanju podzemne vode v sedimentih in kamninah ter osnovno znanje o pomenu podzemne vode za oskrbo prebivalstva s pitno vodo, pomenu podzemne vode v hidrološkem krogu in njenem vplivu na ekosisteme ter vlogi podzemne vode pri širjenju antropogenih onesnaževal v prostoru.	Student will learn basic knowledge about groundwater appearance in sediments and rocks. They will gain basic understanding of groundwater hydrology needed for drinking water supply form aquifers and about the role of groundwater in hydrological systems and their influence on the ecosystems. They will learn also about anthropogenic influences on the aquifer pollutant transport.

Predvideni študijski rezultati:	**Intendedlearningoutcomes:**
Znanje in razumevanje: Predvideni študijski rezultati: usposobljenost študenta za opredelitev pojavljanja podzemne vode v kamninah in sedimentih, usposobljenost za sodelovanje pri zajemih podzemne vode za potrebe vodooskrbe in pri zaščiti virov pitne vode v vodonosnikih.	Knowledgeandunderstanding: Capacity for determination of groundwater in rocks and sediment and skills for cooperation in groundwater drinking water supply projects and safe guard protection zones determination in aquifers.

Metode poučevanja in učenja:	**Learningandteachingmethods:**
Predavanja (v primeru zadostnega št. študentov) ali individualne konzultacije (v primeru nezadostnega št. študentov), terenske vaje.	Lectures (when number of students is adequate) or individual consultations (when number of students is less than required), seminar work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustno izpraševanje.	40%	Oral examination.
Seminarska naloga.	60%	Coursework.

Reference nosilca / Lecturer's references:

BRENČIČ, Mihael, VREČA, Polona. Identification of sources and production processes of bottled waters by stable hydrogen and oxygen isotope ratios. *Rapid commun. mass spectrom.*, 2006, vol. 20, vol. 20, iss. 21, str. 3205-3212.
VREČA, Polona, **BRENČIČ, Mihael,** LEIS, Albrecht. Comparison of monthly and daily isotopic composition of precipitation in the coastal area of Slovenia. *Isot. environ. health stud.*, 2007, vol. 43, no. 4, str. 307-321.
BRENČIČ, Mihael. Groundwater and highways interaction: past and present experiences of highway construction in Slovenia. *Environ. geol.* 2006, vol. 49

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Politična ekologija**
Course title:	**Political Ecology**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	**Izbirni predmet/elective course**
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**35**				**190**	**10**

Nosilec predmeta / Lecturer:	**Andrej A. Lukšič**

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski/ Slovenian**
	Vaje / Tutorial:	**/**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študijski program.	Doctoral programme enrolment

Vsebina:	**Content (Syllabus outline):**
- Osnovni koncepti države (predstavitev osnovnih konceptov liberalne, socialne, korporativne, policijske, totalitarne, ekološke države, itd.) - Osnovni koncepti politik za področje narave in okolja (običajno poslovanje, ekološko ugajanje, ekološka modernizacija, ekološki razvoj, ekološka pravičnost, ekološka družba, politike in subpolitike, redefiniranje političnega in nepolitičnega) - Koncepti policy aren (vrste, značilnosti, tipologije, zakonitosti, politični akterji in odločevalci, načini oblikovanja politik) - Komunikacijske in odločevalne forme (zgodovina, vloga in pomen, participativne	- Basic concepts of state (introduction to the basic concepts of liberal, welfare, corporate, police, totalitarian, ecological state, etc.). - Basic concepts of policies in the field of nature and environment (business as usual, pleasing organic, ecological modernization, environmental development, environmental justice, ecological society, politics and subpolitike, redefining the political and non-political) - Concepts of policy arenas (the nature, characteristics, typology, legality, political actors and decision-makers, policy-making methods) - Communication and the decision-making forms (history, role and importance of

ideje, zakonitosti delovanja in vzpostavljanje, nacionalna in internacionalna raven) - Komunikacijski in odločevalni procesi (struktura akterjev, pravila komuniciranja, sistemska in strukturna moč, lobiranje, moč javnega pritiska, vloga javnih medijev, nove tehnološke možnosti za povezovanje akterjev) - Koncept "konfliktnih" interesov (percepcija problemov, artikulacija, viri konfliktov, vodenje konfliktnega procesa) - Koncept dekonflikcije (načini razumevanja, argumentativni način mišljenja, lateralno mišljenje, dizajn mišljenje) - Koncept komunikacije v trikotniku stroka – politika – javnost (decizionistični, tehnokratski, pragmatični model, odpiranje političnega, nezmožnost komuniciranja, kolektivne identitete in pripadnosti).	participatory ideas, and the legality of the establishment, national and international level) -- Communication and decision-making processes (structure of actors, rules of communication, systemic and structural power, lobbying power of public pressure, the role of public media, new technological options for connecting players) - The concept of "conflict" of interest (perception problems, articulation, sources of conflict, conflict management process) -The concept of »deconfliction« (ways of understanding, argumentative way of thinking, lateral thinking, design thinking) - The concept of communication in the triangle science - politics - public (decisional, technocratic, pragmatic model, opening of political, inability to communicate, collective identity and belonging).

Temeljni literatura in viri / Readings:

Beck Ulrich (2001): Družba tveganja. Na poti v neko novo moderno. Krtina, Ljubljana.
Lukšic A. Andrej (1998): Rizična tehnologija: izziv demokraciji (k politicni ekologiji), CKZ, ŠOU, Študentska založba, Ljubljana.
Dobson Andrew (2003): Green Political Thought (Third Edition), Routledge, London, New York.
Forsyth Tim (2003): Critical Political Ecology. The Politics of Environmental Science. Routlage. London, New York.
Lukšic A. Andrej, M. Bahor (2008): eZbornik znanstvenih člankov s področja politične ekologije, Center za kritično politologijo, FDV, Ljubljana.

Cilji in kompetence:	**Objectives and competences:**
Študent/-ka bo s predmetom osvojil temeljne in posodobljene poglede politične ekologije, s katerimi bo sposoben umestiti sebe v komunikacijski in odločevalski sistem kot okoljskega strokovnjaka s specifičnim znanjem, (zavest o omejenosti lastnega strokovnega znanja po eni strani in po drugi o pomembnosti vključevanja svojega znanja, kar nujno vodi k interdisciplinarnemu sodelovanju);	Students will acquire basic and updated views of political ecology, which will be able to place yourself in communication and decision-making system as an environmental expert with specific knowledge; awareness of the limitations of our own knowledge on the one hand and the other on the importance of integrating their knowledge, which necessarily leads to interdisciplinary collaboration;

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - poznavanje osnovnih razmerij med stroko politiko in javnostjo/civilnodružbenimi akterji - razumeti potrebo po vključevanju javnosti in civilnodružbenih akterjev v presojanje alternativnih strokovnih rešitev; - razumeti odnos javnih oblasti do znanja - razumeti komunikacijskih in odločevalskih form, v katere bo kot strokovnjak vključen.	Knowledge and understanding: -Knowledge of the basic relationships between science, policy and public / civil society actors, -Understand the need to involve the public and civil society actors to analyze alternative technical solutions; - Understand the attitude of the public authorities to knowledge - Understand communication and decision-making form, in which will be included as an expert.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja z aktivno komunikacijo s študenti	lectures with active communication with students

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Naloga v obsegu 30.000 znakov in zagovor	100%	Text to the extent of 30,000 characters and defense

Reference nosilca / Lecturer's references:

1. LUKŠIČ, Andrej. *Rizična tehnologija: izziv demokraciji : k politični ekologiji*, (Časopis za kritiko znanosti, Let. 27, št. 193). Ljubljana: Študentska organizacija Univerze v Ljubljani: Inštitut za ekologijo, 1999. 335 str.
2. **LUKŠIČ, Andrej,** BAHOR, Maja. Koncepti demokracije u Europskoj uniji. *Anali Hrvat. politol. društva*, 2006, god. 3, str. 149-176, ilustr.
3. **LUKŠIČ, Andrej,** BAHOR, Maja. Trajnostni razvoj v luči Lizbonske strategije in njene revizije. V: LUKŠIČ, Andrej (ur.), PLUT, Dušan (ur.). *Zbornik Okoljske akademske mreže, številka 1, letnik 2007 : zbornik člankov in prispevkov prvega srečanja Okoljske akademske mreže*. Ljubljana: Fakulteta za družbene vede, 2007, str. 27-42.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**POŽARI IN VPLIV NA OKOLJE**
Course title:	Fires and Their Environmental Impacts

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective Course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**60**	**60**	**0**	**0**	**110**	**10**

Nosilec predmeta / Lecturer:	Stojan Petelin

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v doktorski študij.	Enrollment in doctoral studies.

Vsebina:	**Content (Syllabus outline):**
Požarna znanost in zgorevanje, požarna varnost, prenos toplote, razvoj plamena, gorljivost, difuzija plamena in ognjeni oblak, stacionarno gorenje tekočih in trdnih snovi, vžig, razširjanje plamena, tvorba in gibanje dima. Modeli požara: empirični, področni in CFD. Probabilistične in deterministične analize požarov. Puščanja, razlitja, odpovedi posod v povezavi s požari. Ocene posledic požarov in eksplozij.	Fire Science and combustion, fire safety, heat transfer, development of flame, burning, diffusion flames and fiery cloud, stationary combustion of liquid and solid materials, ignition, flame spread, smoke formation and movement. Fire models: empirical, area and CFD. Probabilistic and deterministic analyzes of fires. Leaks, spills, failure of vessels in connection with the fires. Assessment of the consequences of fires and explosions.

Temeljni literatura in viri / Readings:

Dougal Drysdale: An Introduction to Fire Dynamics, John Wiley&Sons, 1999.
G.Cox: Combustion Fundamentals of Fire, Academic Press, 1996.
Karlsson B.: Quintiere J.G., Enclosure Fire Dynamics, CRC Press LLC, 2000.
Baulak C.E.: Heat transfer in Industrial combustion, CRC Press LCC, 2000.
Cowley J.: Fire Safety at Sea, Institute of Marine Science and Technology, 2002.
Di Nenno, P.J., et al.: SEPE Handbook of Fire Protection Engineering, Society of Fire Protection Engineering, Boston, 1995.
Cote A.E. ed.: NFPA Handbook, National Fire Protection Association, Quiney, MA,1997.
Schrol R.C.: Industrial Fire Protection Handbook, CRC Press LLC, 2002.
Guidelines for Chemical Process Quantitative Risk Analysis, Second Ed., Center for Chemical Process Safety, American Institute of Chemical Engineers, 2000.
Melhem G.A.: Advanced Consequence Analysis: Fluid Flow, Emergency Relief Systems Design, Thermal Hazards Assessment, Emission, Dispersion, Fire, and Explosion Dynamics, ioMosaic Corporation, Copyright ioMosaic Corporation 2006, 878 pages.
James G. Quintiere, Fundamentals of Fire Phenomena, University of Maryland, USA, 2006 John Wiley & Sons, Ltd ISBN: 0-470-09113-4.
Andrew Furness, Martin Muckett, Introduction to Fire Safety Management, 2007, Elsevier Ltd., ISBN: 978 0 7506 8068 4.
J. Wang, V. Trbojevic, Design for Safety of Marine and Offshore Systems, IMAREST, 2007, 403 pages.
J. Reason, Managing the Risks of Organizational Accidents, ASGATE, 2011, 252 pages.
Turns S.R., An Introduction to Combustion Concepts and Application, Third Edition, McGrawHill 2012, ISBN 978-007-108687-5, 732 pages.

Cilji in kompetence:

Požarno inženirstvo in požarna znanost sta kompleksni področji, ki obsegata obravnavo širokega spektra fizikalnih pojavov kot so: hidrodinamika, prenos toplote s prevodom, konvekcijo in sevanjem, prenos snovi, kemija zgorevanja, toksičnost, odziv konstrukcij pri visokih temperaturah itd.
Obstajajo predvsem tri računske tehnike za modeliranje širjenja požara:
empirični modeli so v bistvu najenostavnejši. So dobro zasnovani, ker slonijo na eksperimentalnih podatkih in so zanesljivi za tisto, kar so namenjeni.
področni modeli slonijo na čistem fizikalnem popisu dogodkov, kot so zgorevanje, prenos toplote in snovi itd.
"Computational Fluid Dynamics" CFD modeli so računalniško bistveno bolj zahtevni, vendar omogočajo veliko bolj nazorne rezultate.
Na primer modeliranje gašenja požara, ali iskanje novih metod gašenja lahko predstavlja izjemno zahtevno nalogo, ker je povezano z obravnavo kompliciranih večfaznih tokov z istočasnim prenosom toplote in snovi, ki niti v svetu še niso ustrezno rešeni.

Objectives and competences:

Fire engineering and fire science are complex areas that cover the treatment of a wide spectrum of physical phenomena such as fluid dynamics, heat transfer by conduction, convection and radiation, mass transfer, combustion chemistry, toxicity, response structures to high temperatures, etc.
There are mainly three computational techniques for modeling fire spread:
Empirical models are basically the simplest. They are well designed, because are based on experimental data and are reliable for what they are intended.
Zone models are based on physical description of events such as combustion, heat and mass transfer, etc.
"Computational Fluid Dynamics" CFD computer models are much more complex, but are capable of much more vivid results.
For example, modeling of fire-fighting, or search for new methods of extinguish can be an extremely challenging task, as it is linked to the treatment of complicated multiphase flows with simultaneous heat and mass transfer, which even in the world have not yet been adequately resolved.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Analize posledic namernih ali slučajnih izrednih dogodkov na okolje. Vpliv požarov oz. eksplozij na okolje. Vpliv posredovanja in gašenja na okolje. Identifikacija izvorov onesnaževanja v primeru požara z namenom minimiziranja posledic.	Knowledge and understanding: Analyses of the consequences of deliberate or accidental incidents on the environment. The effect of fires or. explosions on the environment. The impact of intervention and extinguish a fire on the environment. Identification of sources of pollution in the event of a fire in order to minimize the consequences.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Na predavanjih pridobi študent temeljna teoretična znanja. S seminarsko nalogo samostojno pod mentorstvom visokošolskega učitelja rešuje problematiko požarov v obliki projektne oz. laboratorijske naloge.	In the lectures the student gains the basic theoretical knowledge. The seminar work independently under the guidance of a university teacher solves the problem of fires in the form of project or laboratory tasks.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ocena seminarske-projektne naloge, ustnega znanja in vseh vaj se oceni ločeno od pisnega dela izpita. Pogoj za pristop k ustnemu izpitu so opravljene vaje, seminarska-projektna naloga in pozitivna ocena pisnega dela izpita. Znanje se vrednoti s sistemom; od 6-10 (pozitivno) oz. 1-5 (negativno).		Rating seminar, project work, oral skills and all work is assessed separately from the written part of the exam. The condition for the oral examination is carried out exercises, seminar, project work and a positive evaluation of the written part of the exam. Knowledge is valued from the system; 6-10 (positive) or. 1-5 (negative).
Pisni izpit	50%	Written exam
Ustni zagovor	30 %	Oral exam
Seminar - projekt	20 %	Seminar - project

Reference nosilca / Lecturer's references:

1. JUG, Aleš, PETELIN, Stojan, BUKOVEC, Peter. Designing an underground car park fire scenarios on a probabilistic basis. *Acta chim. slov.*. [Tiskana izd.], 2010, vol. 57, no. 1, str. 136-143. http://acta.chem-soc.si/57/57-1-136.pdf.
2. PETELIN, Stojan, LUIN, Blaž, VIDMAR, Peter. Risk analysis methodology for road tunnels and alternative routes. *Stroj. vestn.*, 2010, vol. 56, no. 1, str. 41-51. http://www.sv-jme.eu/current-volume/sv-jme-56-1-2010/.
3. PETELIN, Stojan, MAVKO, Borut, KONČAR, Boštjan, HASSAN, Yassin A. Scaling of small-scale thermal-hydraulic transient to the real nuclear power plant. *Nucl. technol.*, 2007, vol. 158, no. 1, str. 56-68.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**PRESOJE OKOLJSKIH POSEGOV IN POKRAJINSKA RANLJIVOST**
Course title:	ASSESSING ENVIRONMENTAL IMPACTS AND LANDSCAPE VULNERABILITY

Študijski program in stopnja Study programme and level	**Študijska smer Field of study**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorials**	**Klinične vaje Clinical work**	**Druge oblike študija Other forms of study**	**Samost. delo Individ. work**	**ECTS**
30	**15**				**205**	**10**

Nosilec predmeta / Lecturer:	Metka Špes

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Izpolnjeni pogoji za vpis v doktorski študij.	The student must meet the criteria for enrolment in the Ph.D. programme

Vsebina:	**Content (Syllabus outline):**
• vzdrževanje dinamičnega ravnovesja kot temeljna zahteva pri pokrajinskoekološki presoji posegov; • možnosti in oblike prenosa ekosistemskih mehanizmov ravnovesja v pokrajinskoekološke presoje; • občutljivost posameznih pokrajinotvornih sestavin na antropogeno obremenjevanje in posege; • kvantitativni in kvalitativni kazalci za njihovo vrednotenje; • pomen različne ranljivosti okolja v specifičnih mikrogeografskih okoljih in prepoznavanje vzrokov za zmanjšan naravni	• maintaining a dynamic equilibrium as the primary requirement in assessing the landscape ecological effect of impacts; • possibilities and forms for the transfer of ecosystem equilibrium mechanisms to landscape ecological assessments; • sensitivity of particular landscape-forming components to anthropogenic pressure and impacts; • quantitative and qualitative indicators for their evaluation; • the significance of different environmental vulnerabilities in specific microgeographic environments and

potencial posameznih sestavin okolja; • nabor kazalcev raznovrstnih okoljskih vplivov, ki izvirajo iz različnih človekovih dejavnosti tako tistih, ki sodijo v skupino okoljsko bolj agresivnih (poselitev gradnja infrastrukture, industrija, proizvodna obrt….), kot pasivnih (kmetijstvo, nekatere oblike turizma in rekreacije, gozdarstvo, uslužnostne dejavnosti…); • vzroki za ranljivost pokrajinotvornih sestavin in pokrajinskoekoloških enot in njen pomen za načrtovanje trajnostnega razvoja; • trajnostno gospodarjenje z občutljivimi ekosistemi.	identification of causes for the reduction of the natural potential of particular environmental components; • set of indicators of diverse types of environmental impacts originating from various human activities, including those ranked among the environmentally most aggressive (settlement, construction of infrastructure, industry, manufacturing, etc.) as well as more passive forms (agriculture, certain forms of tourism and recreation, forestry, services, etc.); • causes of the vulnerability of landscape-forming components and landscape ecological units and significance in planning sustainable development; • sustainable management of sensitive ecosystems.

Temeljni literatura in viri / Readings:

- Plut, 1998, Varstvo geografskega okolja-učbenik, Filozofska fakulteta, Ljubljana
- Park, 1997, The Environment: Principles and Application. Routledge, London
- Goudie 1987, The Nature of the Environment, Basil Blackwell, Oxford
- A.P.A. Vink, Landscape Ecology and Land Use, Longman, London 1983
- M. G. Turner, R.H. Gardner, R. V. O´Neal, 2001, Landscape Ecology in Theory and Practice, Pattern and Process, Springer,London
- A.R.W.Jackson, J.M. Jackson, 1996, Environmental Science. The natural environment and human impact, Longman, London
- Z. Naveh, A. S. Lieberman, Landscape Ecology, Springer-Verlag, New York 1994
- M.Špes, D.Cigale, B. Lampič, K.Natek, D. Plut, A. Smrekar, Študija ranljivosti okolja (Metodologija in aplikacija)-Environmental Vulnerability Study (Methodology and Application), Geographica Slovenica 35/1-2, Založba ZRC, Ljubljana 2002
- Pokrajinsko ranljiva območja v Sloveniji (The Landscape Vulnerable Areas in Slovenia), Geographica Slovenica33/I, Inštitut za geografijo, Ljubljana 2000
- Plut, 2002, Okoljevarstveni vidiki prostorskega razvoja Slovenije, Razprave Filozofske fakultet, Ljubljana
- M. Špes, 1998, Degradacija okolja kot dejavnik diferenciacije urbane pokrajine, Geographica Slovenica 30, Ljubljana
- F. Vester, 1991, Kriza prenaseljenih območij, DZS, Ljubljana
- R. G. Bailey, 1996, Geosystem Geography, Springer, New York
- C.J.Barrow, 1995, Developing the Environment Problems & Management, Longman Scientific & Technical, London
- F. Sandbach, 1982, Principles of Pollution Control, Longman, London

Spletna učilnica

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je poglobiti znanje za razumevanje, spremljanje in vrednotenje raznovrstnih okoljskih posegov, ki se odražajo v paleti negativnih in ponekod tudi pozitivnih sprememb v posameznih pokrajinotvornih sestavinah oziroma različnih ekosistemih. Gre predvsem za prepoznavanje in posledično preprečevanje onesnaževanja okolja v območjih s specifičnimi pokrajinskimi značilnostmi. Z razumevanjem mrežne	The objective of the subject is to deepen knowledge for the understanding, monitoring, and evaluation of different types of environmental impacts reflected in a range of negative and in some cases also positive changes in particular landscape-forming components or ecosystems. It is concerned primarily with the identification and consequent prevention of environmental pollution in areas with specific landscape characteristics. Through

povezanosti vseh sestavin okolja t.im. vertikalni pogled na pokrajino jo razumemo kot rezultat součinkovanja vseh sestavin, ne pa zgolj kot seštevek njihovih individualnih značilnosti. Tovrstno celostno- ekosistemsko razumevanje pokrajine se prenaša v izdelavo metodoloških izhodišč za presojo načrtovanih posegov. Pokrajinskoekološke presoje zahtevajo poznavanje in razumevanje naravnih in družbenih dejavnikov, predvsem pa pokrajinskim značilnostim prilagojene metodološke pristope, kar je temeljni cilj predmetno specifične kompetence.	an understanding of the web of interconnections among all environmental components, the landscape is understood as the result of the interaction of all its components, not just as the sum of its individual characteristics. This kind of holistic ecosystemic understanding of the landscape is transferred to the development of methodological bases for assessing planned impacts. Landscape-ecological assessments require a knowledge and understanding of natural and social factors, and especially methodological approaches which are adapted to landscape properties, which is the fundamental objective of subject-specific competences.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: pomena presoj posegov v luči preventivnega varovanja okolja in trajnostnega razvoja, pri čemer je ključno prepoznavanje vloge pokrajinske ranljivosti (pokrajine kot ekosistema in njegovih sestavin) oziroma odzivnost na posege, ki se razlikujejo po intenzivnosti in obsegu.	Knowledge and understanding: importance of evaluating impacts in light of preventive environmental protection and sustainable development, in which the recognition of the role of landscape vulnerability (landscapes as ecosystems and their components) and reaction to impacts of differing intensity and extent is crucial.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanje, projektno delo, individualne seminarske naloge, sodelovanje v raziskovalnih projektih	Lectures, project work, individual seminar papers, participation in research projects

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
preizkusi znanja ob reševanju konkretnih raziskovalnih problemov, pozitivno ocenjena poročila o opravljenih seminarskih delih in raziskovalnih projektih	**40%** **60%**	testing of knowledge through solving of specific research problems, reports with passing grades for seminar work and research projects

Reference nosilca / Lecturer's references:

1. ŠPES, Metka, 1998. Degradacija okolja kot dejavnik diferenciacije urbane pokrajine (Geographica Slovenica, 30). Ljubljana:. 199 str

2. ŠPES, Metka, 2007.Pomen vzdrževanja dinamičnega ravnovesja za sonaravni razvoj , Dela 28, Oddelek za geografijo, Filozofska fakulteta

3. Špes, Metka in sodelavci, 2012: Sonaravna sanacija okoljskih bremen kot trajnostno razvojna priložnost Slovenije, Degradirana območja : [Ciljni raziskovalni program (CRP) "Konkurenčnost Slovenije 2006-2013"] : zaključno poročilo. Ljubljana: Oddelek za geografijo Filozofske fakultete Univerze v Ljubljani.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Prostor in okolje**
Course title:	Spatial planning and environment

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**25**	**10**		**50**	**140**	**10**

Nosilec predmeta / Lecturer:	Andrej Pogačnik

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski/ angleški po potrebi Slovenian / English, if necessary**
	Vaje / Tutorial:	**slovenski/ angleški po potrebi Slovenian / English, if necessary**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Temeljna znanja iz prostorskih ved, ki jih na 2. bolonjski ali univerzitetni ravni nudijo študijske smeri geografije, geodezije, gradbeništva, arhitekture, krajinske arhitekture, varstva okolja, geoinformatike in sorodnih ved.	Basic knowledge in the fields of spatial sciences, which are offered by curricula on the master level or universitv degree level of following sudies: geography, surveying, civil engineering, architecture, landscape planning, environmental protection, geoinformatics and others.

Vsebina:	**Content (Syllabus outline):**
Raziskovalno delo na področju trajnostnega prostorskega razvoja. Metode usklajevanja razvojnega in varstvenega načrtovanja. Ublažitveni ukrepi. Usklajevanje interesov med urbanizacijo, kmetijstvom, gozdarstvom, prometom, vodnim gospodarstvom, energetiko, rudarstvom, turizmom. Metode raziskovanja ranljivosti, okoljske nosilnosti in privlačnosti prostora. Sistemi zgodnjega opozarjanja. Zakonodaja na področjih urejanja prostora in varstva okolja. Upravna in sodna praksa. Trajnostni razvoj na ravneh lokalne skupnosti, regije, države, EU in sveta. Oblikovanje in vrednotenje alternativ. Primeri dobrih praks. Seminar z obdelavo konkretne prostorske naloge in prezentacija.	Research in the field of sustainable spatial development. Coordination between development and protective approach. Mitigating as a method of environmental problem solving. Synthesis of urbanisation, agriculture, forestry, producion of energy, traffic, water management, mining, turism and other land uses. Vulnerability and attraciveness; early warning systems. Legal foundations of planning and environmental protection. Sustainable spatial development on the levels of local community, region, state, EU and world- wide. Planning the alternatives and its evaluation. Cases of good practice. In seminar a planning task is worked out and presented.

Temeljni literatura in viri / Readings:

European Spatial Development Perspecives (1999/2000), European Commission, Potsdam
Federal Office for Building and Regional Planning (2007), ESPON Atlas, EU Interreg III., Bonn
European Environmental Agency (2006), Urban Sprawl in Europe. EEA Report no. 10, Kopenhagen
Land Accounts in Europe, Ibid. Report no. 11
Pogačnik, A. (2006) , Kako izdelamo prostorske načrte, Založba Obzorja, Maribor
Prosen, A. (1993) Sonaravno urejanje podeželjskega prostora. UL, FGG, Ljubljana

Cilji in kompetence:	**Objectives and competences:**
Spoznati metode raziskovanja v prostorskih vedah. Razumevati konfliktnost ciljev razvojnega in varovalnega načrtovanja in pridobiti znanja za usklajevanje obeh vidikov. Usposobiti se za timsko in interdisciplinarno delo na področju varstva okolja.	Knowledge of the research methods in spatial sciences. Understanding the conflicts of development and protecitve approach. Obtain the capability to balance and coordinate various interests in space. Capabilities for Team and Interdisciplinary work in the fields of environmental protection.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Samostojno vodenje raziskav na področjih umeščanja dejavnosti v prostor. Sposobnost za vodilne funkcije v raziskovalnih institucijah, upravi ali v gospodarstvu na področjih varstva okolja. Komuniciranje z javnostjo.	Knowledge and understanding: Leading the research teams in the fields of spatial planning and protection. Ability for top jobs in public or private sector . Knowledges for communication with different publics.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in individualne konzultacije. Terensko delo ob spoznavanju konkretne naloge. Individualna izdelava seminarske naloge z obveznimi konzultacijami in končno prezentacijo	Lectures and individual consultations. Field work related to practical seminary task. Individual seminary work with obligatory consultations. Final presentation is compulsory.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit Izdelava in zagovor seminarske naloge	**50%** **50%**	Written examination Written seminary work with final presentation

Reference nosilca / Lecturer's references:

Pogačnik, A. (2007) Sustainable Land Use as a Global Commitment. Geodtaski vestnik, št.2, letnik 51, Ljubljana
Pogačnik, A. (2004), Metoda sinteze občinskega in regionalnega prostorskega plana v stroki danes, v: Prosen A. (ur.), Prostorske znanosti za 21. stoletje, UL FGG, Ljubljana
Pogačnik, A. (2006) Kako izdelamo prostorske načrte, Založba Obzorja, Maribor.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	RECIKLIRANJE KOVINSKIH MATERIALOV
Course title:	RECYCLING OF METAL MATERIALS

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja	/	1, 2	/
Interdisciplinary Doctoral Programme in Environmental Protection	/	1, 2	/

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	30	20			170	10

Nosilec predmeta / Lecturer:	Boštjan MARKOLI, Jožef MEDVED, Igor BUDAK, Borut KOSEC, Primož MRVAR,

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski (Angleški) / Slovene (English)
	Vaje / Tutorial:	Slovenski (Angleški) / Slovene (English)

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogoj za vključitev v delo oziroma za opravljanje študijskih obveznosti je vpis v 1. letnik doktorskega študija. Opravljeno in uspešno predstavljeno projektno delo je pogoj za pristop k pisnemu in ustnemu izpitu.	The condition to attend in the teaching course and to perform study obligations is an entry in the first year of doctoral study. Completed and successfully presented project work is required before taking the written and oral exam.

Vsebina:	**Content (Syllabus outline):**
Uvod. Osnove recikliranja kovinskih materialov. Pregled področja recikliranja in naraščanje njegovega pomena ter obsega. Zakonodaja s področja reciklaže, razvrščanje, določanje in vrednotenje odpadnih snovi. Karakterizacija ali opredelitev odpadnih snovi. Postavljanje ciljev in prednostnih nalog in ciljev recikliranja. Sistemi za zbiranje in postopki ločevanja odpadnih snovi. Obrati in procesi za predelavo sekundarnih surovin. Demontaža večjih odpadnih industrijskih kompleksov. Recikliranje glavnih kovinskih materialov, kot so: jeklo, aluminij, baker, nikelj, titan, magnezij, zlato, svinec, težke kovine, redke zemlje ter njihove zlitine. Primeri: aluminijske pločevinke, odpadna elektronska in električna oprema, avtomobili in avtomobilski deli, letala in letalski deli, odpadne avtomobilske baterije oz. akumulatorji. Sistemi in standardi za zagotavljanje kakovosti sekundarnih surovin. Analiza življenskega kroga proizvoda. Načrtovanje življenjskega kroga izdelka in njegovo recikliranje. Načrtovanje programov recikliranja in uvajanje v prozvodnjo. Pregled postopkov in zakonodaje sosednjih sdržav s področja recikliranja odpadnih snovi. Študij praktičnih problemov. Projektno delo.	Introduction. Basics of recycling of metallic materials. Overview of the field of recycling and increase of its importance and scope. Legislation in the field of recycling, sorting, identification and evaluation of waste materials. Characterization and identification of waste. Setting goals and priorities and recycling targets. Systems for the collection and separation processes waste materials. Installations and processes for the recovery of secondary raw materials. Disassembly of the major waste industrial complexes. Recycling main metallic materials, such as steel, aluminum, copper, nickel, titanium, magnesium, gold, lead, heavy metals, rare earths, and alloys thereof. Examples: aluminum cans, waste electronic and electrical equipment, automobiles and automotive parts, aircraft and aircraft parts, waste automotive batteries. Systems and standards for quality assurance of secondary raw materials. Analysis of the life cycle of the product. Planning life cycle of the product and its recycling. Planning and implementation of recycling programs in production. Review of procedures and the laws of neighboring countries in the field of recycling waste materials. Study of practical problems. Project work.

Temeljni literatura in viri / Readings:

LUND, H.F. *The McGraw – Hill Recycling Handbook.* New York: McGraw – Hill, 2001.
SCHMITZ, C. *Handbook of Aluminium Recycling*. Essen: Vulkan Verlag, 2006.
HODOLIČ, J., VUKELIĆ, Đ., HADŽISTEVIĆ, M., BUDAK, I., BADIDA, M., ŠOOŠ, L., KOSEC, B., in BOSAK, M. *Recycling and Recycling Technologies*. Novi Sad: Faculty of Technical Sciences, 2011.
ČOSIĆ, I., LAZAREVIĆ, M., ŠOOŠ, L., ONDEROVA, I., in KRIŽAN, P. *End-of-Life Products, Disassembly and Recycling*. Novi Sad: Faculty of Technical Sciences, 2009.
RAMACHANDRA RAO, S .Resource Recovery and Recycling From Metallurgical Wastes, Waste Management Seriec Vol. 7. New York: Elsevier, 2006.
Ecological Engineering, ISSN: 0925-8574
Acta Materialia, Elsevier, ISSN: 1359-6454
Ecological Modelling, ISSN: 0304-3800
Environmental Modeling and Assessment, Springer, ISSN: 1420-2026

Cilji in kompetence:	**Objectives and competences:**
Študent pri predmetu Načrtovanje okolju prijaznih proizvodov in tehnologij najprej spozna potencialno obremenitev okolja, ki ga predstavljajo posamezne skupine sodobnih materialov ter smernice in težnje industrije k ekološki naravnanosti posameznih materialov, proizvodov in tehnoloških procesov ter postopkov. Spozna se z metodami in orodji potrebnimi za zanesljivo, moderno načrtovanje in analizo okolju prijaznih materialov, izdelkov in tehnologij. Pri tem se naslanja na tradicionalno poznavanje značilnosti kovinskih materialov, njihovega vpliva na okolje in sodobnih proizvodnih procesov kovinskih materialov v Sloveniji in svetu. Študent se navaja tako na samostojno kot na skupinsko raziskovalno ter projektno delo, uporabo ažurne strokovne literature in sodobnih virov informacij.	Students are during the subject Design of environmentally friendly products and technologies firstly acquainted with the potential environmental burden posed by certain groups of modern materials and guidelines or industry trends to the ecological orientation of individual materials, products and technological processes and procedures. Student is familiarized with the methods and tools necessary for a reliable, modern design and analysis of environmentally friendly materials, products and technologies. In doing so, relying on traditional knowledge of the characteristics of metallic materials, and their impact on the environment and modern manufacturing processes of metallic materials in Slovenia and around the world. The student states both independently and in team research and project work, the use of up to date literature and contemporary sources of information.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pri predmetu Načrtovanje okolju prijaznih proizvodov in tehnologij pridobi študent znanja o škodljivosti posameznih kemijskih elementov in skupin materialov ter v zvezi s tem ekološko naravnanost posameznih proizvodov, tehnoloških procesov in tehnologij. Spozna metode in tehnike načrtovanja ter modernega razvoja okolju prijaznih proizvodov, procesov in tehnologij. Študent se navaja na samostojno sprejemanje odločitev, povezuje in vrednoti analitične, eksperimentalno in numerično dobljene rezultate. Navaja se na samostojno in skupinsko delo, na projektno in raziskovalno delo, uporabo strokovne literature in sodobnih virov informacij. Pridobi sposobnosti za samostojno znanstveno raziskovalno delo, razvoj, organizacijo in vodenje industrijskih in temeljnih raziskovalnih projektov.	Knowledge and understanding: In the course Designing environmentally-friendly products and technologies teaching course the student acquires knowledge about the ecological burden of individual chemical elements and groups of materials and in relation with that the orientation of individual products, technological processes and technologies. They learn methods and techniques of planning and modern development of environmentally-friendly products, processes and technologies. Student will get accustomed to reach decision individually and link and asses analytical, experimental and numerical acquired results. Students get used to individual and team, project and research work, and expert literature and modern information source applications. Student will acquire knowledge for individual scientific work, development, organization and conduction of industrial and fundamental scientific activities and research projects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, računske vaje in simulacije, reševanje odprtih nalog (problemov), projektno delo.	Lectures. Exercises solving and simulations. Solving case studies. Project work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način opravljanja izpita: • ustni /pisni izpit – teorija in naloge, reševanje odprtih nalog (problemov), izdelava in uspešen zagovor projektnega dela • predmet se zaključi z izpitom, ki ga sestavljata pisni in ustni del. Končno oceno predmeta sestavljajo: ocena projektnega dela (30 %) ocena pisnega dela izpita (30 %) ocena ustnega dela izpita (40 %) od 6-10 (pozitivno) oz. 1-5 (negativno) oz. opravil / ni opravil; ob upoštevanju Statuta UL in fakultetnih pravil.	35 % 30 % 35 %	Type of examination: • oral /written examination – theory and calculation tasks, solving case studies, successfully presented project work • the course ends with passing the examination which is composed of written and oral examination: The mark is composed of: the mark of project work (30%) the mark of written examination (30%) the mark of the oral examination (40%) from 6-10 (positive) and from 1-5 (negative) or; to pass / to fail; regard to Statute of UL faculty rules.

Reference nosilca / Lecturer's references:

prof. dr. Boštjan MARKOLI:

1. ZUPANIČ, Franc, **MARKOLI, Boštjan**, NAGLIČ, Iztok, BONČINA, Tonica. The experimental investigation of phase equilibria in the Al-rich corner within the ternary Al-Mn-Be system. J. alloys compd.., 2013, vol. 570, pp. 125-132
2. **MARKOLI, Boštjan**, BONČINA, Tonica, ZUPANIČ, Franc. Behaviour of a quasicrystalline strengthened Al-alloy during compression testing. Mater.wiss. Werkst.tech., Apr. 2012, vol. 43, no. 4, pp. 340-344.
3. PODMILJŠAK, Benjamin, ŠKULJ, Iztok, **MARKOLI, Boštjan**, ŽUŽEK ROŽMAN, Kristina, MCGUINESS, Paul J., KOBE, Spomenka. Microstructural changes in Fe-doped Gd[sub]5Si[sub]2G[sub]2. J. magn. magn. mater., 2009, vol. 321, no. 4, pp. 300-304.

izr. prof. dr. Jožef MEDVED:

1. KLANČNIK, Grega, **MEDVED, Jože.** Ternary invariant point at 403 and 455 oC in the Al-Sb-Zn system : a DTA and DSC studies. J. therm. anal. calorim., 2012, vol. 110, no 1, pp. 243-248.
2. KLANČNIK, Grega, STEINER PETROVIČ, Darja, **MEDVED, Jože.** Thermodynamic calculation of phase equilibria in stainless steels. J. min. metall., B Metall., 2012, vol. 48 B, no. 3, pp. 383-390.
3. **MEDVED, Jože,** MRVAR, Primož, VONČINA, Maja. Oxidation resistance of cast magnesium alloys. Oxid. met., 2009, vol. 71, no. 5/6, pp. 257-270.

doc. dr. Igor BUDAK:

1. AGARSKI, Boris, KLJAJIN, Milan, **BUDAK, Igor**. Application of Multi-criteria Assessment in Evaluation of Motor Vehicles Environmental Performances.Technical Gazette, 2013, Vol. 19, No. 2, pp. 221-226.
2. AGARSKI, Boris, **BUDAK, Igor**, KOSEC, Borut, HODOLIČ, Janko. An approach to multi-criteria environmental evaluation with multiple weight assignment. Environmental Modeling and Assessment, 2012, Vol. 17, No. 3, pp. 255-266.
3. **BUDAK, Igor**, SOKOVIĆ, Mirko, BARIŠIĆ, Branimir. Accuracy improvement of point data reduction with sampling-based methods by Fuzzy logic-based decision-making. Measurement, 2011, Vol. 44, No. 6, pp. 1188-1200.

prof. dr. Borut KOSEC:
1. KARPE, Blaž, **KOSEC, Borut**, NAGODE, Aleš, BIZJAK, Milan. The influence of Si and V on the kinetics of phase transformation and microstructure of rapidly solidified Al-Fe-Zr alloys. *J. min. metall., B Metall.*, 2013, Vol. 49 B, No. 1, pp. 83-89.
2. AGARSKI, Boris, BUDAK, Igor, **KOSEC, Borut**, HODOLIČ, Janko. An approach to multi-criteria environmental evaluation with multiple weight assignment. Environmental Modeling and Assessment, 2012, Vol. 17, No. 3, pp. 255-266.
3. ŠKRABA, Polona, KOSEC, Ladislav, BIZJAK, Milan, RUDOLF, Rebeka, ROMČEVIĆ, Nebojša, KOSEC, Gorazd, **KOSEC, Borut**, LAZAREVIĆ, Zorica, ROTH, Jože, ANŽEL, Ivan. Internal oxidation of Ag-VC composites. Corrosion Science, 2011, Vol. 53, No. 1, pp. 127-134.

izr. prof. dr. Primož MRVAR:
1. ZOVKO BRODARAC, Zdenka, UNKIĆ, Faruk, MEDVED, Jože, **MRVAR, Primož**. Determination of solidification sequence of the AlMg9 alloy. Kovové mater., 2012, vol. 50, no. 1, pp. 209-214.
2. VONČINA, Maja, KORES, Stanislav, **MRVAR, Primož**, MEDVED, Jože. Effect of Ce on solidification and mechanical properties of A360 alloy. J. alloys compd.., 2011, vol. 509, no. 27, pp. 7349-7355.
3. PETRIČ, Mitja, MEDVED, Jože, **MRVAR, Primož**. Effect of grain refinement and modification of eutectic phase on shrinkage of AlSi9Cu3 alloy. Metallurgy, 2011, vol. 50, no. 2, pp. 127-131.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Remediacija tal**
Course title:	Soil Remediation

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**35**				**190**	**10**

Nosilec predmeta / Lecturer:	Domen Lestan

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Študent mora biti vpisan na doktorski študij. Za razumevanje in spremljanje vsebin predmeta so nujna osnovna znanja iz matematike, kemije, (mikro)biologije, in biokemije. Obvezna udeležba pri seminarjih.	Student has to be enrolled in the doctoral study. Basic knowledge of mathematics, chemistry, (micro)biology and biochemistry. Mandatory presence at seminars.

Vsebina:	**Content (Syllabus outline):**
Kemizacija tal in podtalnice: organska in anorganska onesnažila, usoda in transport onesnažil v tleh, bio-dostopnost/ dosegljivost onesnažil. Ocena tveganja onesnaženja in upravljanje z onesnaženimi zemljišči. Izbor metode remediacije tal/ podtalnice. Naravno zmanjševanje onesnaženja. Termične metode in situ in ex situ: sežig tal, piroliza, vitrifikacija. Fizikalno-kemijske metode in situ in ex situ: pranje tal, separacijske metode, termična desorpcija, vakuumska ekstrakcija, solidifikacija/ stabilizacija, elektroremediacija, oksidacija/ redukcija onesnažil. Bioremediacija in situ in ex situ: bio-prezračevanje, biostimulacija, fitoremediacija, bioaugmentacija, obdelovanje tal, nadzorovana bioremediacija, kompostiranje tal, bioremediacija v pol-trdi fazi. bio-izpiranje tal. Remediacija podtalnice: "pump and treat" metode, razprševanje zraka, in situ izpiranje, odstranjevanje hlapov v vrtini, pasivne in reaktivne pregrade. Metode spremljanja učinkovitosti remediacije, postopki po remediaciji tal in vpliv remediacije na kakovost in funkcioniranje tal.	Pollution in soil and vandose zone: organic and inorganic pollutants, fate and transport of pollutants, bio-accessibility / availability of pollutants. Risk assessment and risk management of soil pollution. Factors in selection of soil/groundwater remediation technology. Natural attenuation of pollution. Thermal methods in situ and ex situ: soil combustion, pyrolysis and vitrification. Physical-chemical method in situ and ex situ: soil washing, separation of soil fractions, thermal desorption, vacuum desorption, solidification/stabilization, electro-remediation, oxidation / reduction of pollutants. Bioremediation in situ and ex situ: bio-venting, bio-stimulation, phyto-remediation, bio-augmentation, soil-farming, enhanced bioremediation, soil composting, slurry-phase remediation, bio-leaching. Groundwater remediation: pump and treat methods, air sparging, in situ flushing, well vapor extraction, passive and reactive barriers. Methods of remediation efficiency evaluation, post-remedial measures, quality and functioning of remediated soils.

Temeljni literatura in viri / Readings:

Pichtel, J. 2000. Fundamentals of Site Remediation. Governoment Institutes, Rockville, Maryland. ISBN 0-86587-689-4 (izbrana poglavja/ selected chapters)
Nathanial, C.P., Bardos, R.P. 2004. Reclamation of Contaminated Land. Wiley, Chichester. ISBN 0-471-98560-0 (izbrana poglavja / selected chapters)
Suthersan, S.S. 2002. Natural and Enhanced Remediation Systems.Lewis Publishers, Boca Raton. ISBN 1-56670-282-8 (izbrana poglavja / selected chapters)
Revije / Journals:

- Environmental Science and Technology, ACS
- Chemosphere, Elsevier
- Environmental Pollution, Elsevier
- Journal of Hazardous Materials, Elsevier
- Water, Soil and Air Pollution, Springer
- Plant and soil, Kluwer
- Journal of Environmental Engineering, ASCE
- Soil and Sediment Contamination, AEHS
- Journal of Environmental Quality, ASA

Cilji in kompetence:	**Objectives and competences:**
Cilji: Poznavanje postopkov, procesov in tehnologij remediacije tal za sonaravno ohranjanje okolja, odpravljanje onesnaženosti tal ter trajnostno rabo tal kot ne-obnovljivega naravnega vira. **Predmetno specifične kompetence:** Slušatelji se seznanjajo z fizikalno-kemijskimi, mikrobiološkimi, biološkimi in biokemijskimi procesi, ki so temeljni za tehnologije sanacije in remedicaije tal. Spoznajo metode določevanja komcentracije in (bio)dostopnosti / dosegljivosti onesnažil v tleh, metode ocenjevanja tveganja onesnaženja ter metode obvladovanja tveganja onesnaženja.	**Aims:** Student gains the information on processes and technologies of soil remediation for sustainable environment and use of soil as a non-renewable natural resource. **Specific competences:** Understanding of physical-chemical, microbiological, biological and biochemical processes that are essential for development of soil remediation /reclamation technologies. Knowledge of methods of assessment of pollutant concentration and (bio)availability / accessibility, risk assessment and risk management of pollution.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent osvoji osnovne fizikalno-kemijske in biološke koncepte tehnologij remediacije tal, obvladuje obstoječe in lahko sodeluje pri razvoju novih tehnologij, pridobi znanje, da najde in razume informacije vezane na tehnologije remediacije tal.	**Knowledge and understanding:** Understanding of basic physico-chemical and biological concepts and principles of soil remediation technologies, knowledge and skills to actively participate in the development of novel technologies, skill to find and comprehend information related to remediation technologies.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, skupinsko ali individualno delo.	Lectures, seminars, team or individual work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ocena izpita:		Lectures assessment:
aktivna udeležba	10%	active participation
pisni izpit	60%	written exam
ocena projekta/seminarja	30%	seminar

Reference nosilca / Lecturer's references:

VOGLAR, David, **LEŠTAN, Domen**. Pilot-scale washing of Pb, Zn and Cd contaminated soil using EDTA and process water recycling. Chemosphere (Oxford). [Print ed.], 2013, vol. 91, str. 76-82.

JELUŠIČ, Maša, GRČMAN, Helena, VODNIK, Dominik, SUHADOLC, Marjetka, **LEŠTAN, Domen**. Functioning of metal contaminated garden soil after remediation. Environ. pollut. [Print ed.], 2013, vol. 174, str. 63-70.

VOGLAR, Grega E**., LEŠTAN, Domen**. Equilibrium leaching of toxic elements from cement stabilized soil. J. hazard. mater.. [Print ed.], 2013, vol. 246-247, str. 246-247

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**SPREMEMBE OKOLJA IN RASTLINE**
Course title:	Environmental Changes and Plants

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**20**	**10**		**10**	**190**	**10**

Nosilec predmeta / Lecturer:	**Alenka Gaberščik**, Mateja Germ

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski/angleški Slovenian/ English**
	Vaje / Tutorial:	**slovenski/angleški Slovenian/ English**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij Varstvo okolja.	Enrolment in the doctoral study Environment protection.

Vsebina:	**Content (Syllabus outline):**
Pogled v zgodovino (spremembe okolja in rastline v preteklosti). Rastline in njihova vloga pri oblikovanju okolja (vplivi na atmosfero, hidrosfero, tla, energijsko bilanco pokrajine). Zaščitna vloga rastlin (vloga vegetacije kot zaščite vodnega ekosistema, pomen gozdnega roba). Rastline kot nosilci ekosistemskih storitev. Rastline kot indikatorji sprememb v okolju (indikatorji in monitoring organizmi, indikatorji klimatskih sprememb). Rastline vezane na posebna rastišča (kisla ali bazična tla, tla revna z minerali, apnenčasta tla, tla z veliko vsebnostjo težkih kovin, slana tla). Vpliv globalnih sprememb na rastline (ekosistemski sindromi, tanjšanje ozonske plasti, topla	View into history (environmental changes in the past). Plants and their role in development of environment (influences on atmosphere, hydrosphere, soil, energy balance in landscape). Protection role of plants (the role of vegetation in protection of aquatic ecosystems, the importance of forest edge). Plants and ecosystem services. Plants as indicators of changes (bioindicators and monitors, indicators of climate changes). Plants of special habitats (acid and alkaline soil, oligotrophic habitats, limestone, soil with increased amounts of toxic metals, saline soil). The influence of global changes on plants (ecosystem syndromes,

greda). Zračni polutanti in rastline (vpliv na rastline in mehanizmi odpornosti). Pesticidi, težke kovine, radionukleidi (vplivi na rastline in mehanizmi odpornosti). Tujerodne in gensko spremenjene rastline ter biološka varnost.	ozone layer, greenhouse effect). Air pollutants and plants (influence on plants and mechanisms of resistance). Pesticides, toxic metals, radionuclides (influence on plants and mechanisms of resistance). Alien and genetically modified plants and biological safety.

Temeljni literatura in viri / Readings:

Schulze, D.E., Beck, E., Hohenstein, K. M. Plant Ecology, 702 pages, Springer Verlag, 2002.
Gurevitch J., Scheiner S.M., Fox G..The Ecology of Plants. 523 pages, Sinauer Associates, 2002
Larcher, W. Physiological Plant Ecology. 513 pages, Springer, 4 edition, 2003

Monografije/Monographs

Pritchard, S.G:, Amthor, J.S. Crops and environmental change, 411 pages, Food Product Press, An Impriit of the Haworth Pres, Inc.2005.

Izbrani članki iz revij na primer/ Selected articles

Costanza, R., Fisher, B., Mulder, K., Liu, S., Christopher, T. Biodiversity and ecosystem services: A multi-scale empirical study of the relationship between species richness and net primary production, Ecological Economics, Volume 61, Issues 2-3, 1 March 2007, Pages 478-49.
Nagler, P.L., Glenn, E.P., Hinojosa-Huerta O., Zamora, F., Howard, K. Riparian vegetation dynamics and evapotranspiration in the riparian corridor in the delta of the Colorado River, Mexico, Journal of Environmental Management, In Press, Corrected Proof, Available online 27 June 2007
Rozema J., Bjorn, L.O., Borman, F. J.t, Gaberščik, A., Haeder, D., P., Trošt Sedej, T., Germ, M., Klisch, M., Groninger, A., Sinha, R.P., Lebert, M., He, Y.Y., Buffoni-Hall, R., de Bakker, N. V. J., de Staaij, J., Meikamp, B.B. The role of UV-B radiation in aquatic and terrestrial ecosystems - an experimental and functional analysis of the evolution of UV-absorbing compounds. J. photochem. photobiol., B Biol., 2002, vol. 66, no. 1, str. 2-12.
Jansen, M. A.K Hectors, K., O'Brien, N. M., Guisez, Y., Potters, G. (2008). Plant stress and human health: Do human consumers benefit from UV-B acclimated crops? Plant Science, In Press.
Kruijt, B., Witte, J.-P. M., Jacobs, C. M.J., Kroon, T. (2008). Effects of rising atmospheric CO2 on evapotranspiration and soil moisture: A practical approach for the Netherlands Journal of Hydrology, Volume 349, Issues 3-4, 1, Pages 257-267.
Winter, C., Lehmann, S., Diekmann M. (2008). Determinants of reproductive success: A comparative study of five endangered river corridor plants in fragmented habitats. Biological Conservation, Volume 141, Issue 4, Pages 1095-1104.

R**evije / Journals**

Plant Ecology,
Photosynthetica,
Plant, Cell and Environment

Cilji in kompetence:	**Objectives and competences:**
Razumevanje delovanja abiotskih in biotskih dejavnikov na rastline in vloge rastlin pri preoblikovanju okolja ter ekosistemskih storitvah. Razumevanje antropogenih vplivov in globalnih sprememb na rastline.	Objectives: The understanding of the relation between plants and their biotic and abiotic environment, the role of plants in environment development and ecosystem services. The understanding of anthropogenic influences and global changes on plants.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje. Študenti spoznajo osnovne vlogo rastlin pri oblikovanju atmosfere, pedosferein biosphere, ter grožnje rastlinam zaradi sprememb ter ohranitvene in omilitvene ukrepe ter načine izboljšanja stanja. Uporaba. Razumevanje pomena rastlin za vzdrževanje ugodnih razmer ter njihovo priilagojenost na dane razmere. Refleksija. Aplikacija znanj pri delovanju in odločanju o naravi. Prenosljive spretnosti. Uporaba domače in tuje literature in drugih virov, zbiranje in razlaga podatkov, kritična analiza podatkov pridobljenih z meritvami, njihova sinteza in pisanje poročil, delo v skupini.	Knowledge and understanding: Students get acquainted with role of plants in development of atmosphere, pedosphere and biosphere as well as threats to plants due to changes and conservation and mitigation measures. Application: The understanding of the importance of plants in maintenance of favourable conditions and their adaptation to different conditions. Reflection: The applications of the knowledge in decision-making. Transferable skills: The use of literature and other scientific and professional sources, gathering the results, critical analysis of data, writing and presenting results, work in a group.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, laboratorijske vaje, projektna naloga in terensko delo	Lectures, seminar, coursework, laboratory exercises, field work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelava in zagovor seminarja	35 %	Seminar
laboratorijske vaje	15 %	Coursework
projektna naloga in/ali poročilo o terenskem delu	15 %	Project /report on field work
in pisni izpit	35 %	written exam
od 6-10 (pozitivno), 1-5 (negativno)		

Reference nosilca / Lecturer's references:

prof. dr. Alenka Gaberščik:

1. KRŽIČ, Nina, PONGRAC, Paula, KLEMENC, Maja, KLADNIK, Aleš, REGVAR, Marjana, **GABERŠČIK, Alenka**. Mycorrhizal colonisation in plants from intermittent aquatic habitats. *Aquat. bot.*. [Print ed.], 2006, vol. 85, str. 331-336.
2. **GERM, Mateja**, MAZEJ, Zdenka, **GABERŠČIK, Alenka**, TROŠT SEDEJ, Tadeja. The response of Ceratophyllum demersum L. and Myriophyllum spicatum L. to reduced, ambient, and enhanced ultraviolet-B radiation. *Hydrobiologia (Den Haag)*, 2006, no. 1, vol. 570, str. 47-51.
3. TROŠT SEDEJ, Tadeja, **GABERŠČIK, Alenka**. The effects of enhanced UV-B radiation on physiological activity and growth of Norway spruce planted outdoors over 5 years. *Trees (Berl. West)*, Online first, 2008, 13 str., [in press]. http://www.springerlink.de/content/v46101r704125163/fulltext.pdf.

doc. dr. Mateja Germ:

1. BREZNIK, Barbara, **GERM, Mateja**, **GABERŠČIK, Alenka**, KREFT, Ivan. Combined effects of elevated UV-B radiation and the addition of selenium on common (Fagopyrum esculentum Moench) and tartary (Fagopyrum tataricum (L.) Gaertn.) buckwheat. *Photosyntetica*, 2005, letn. 43, št. 4, str. 583-589.

2. SMRKOLJ, Polona, **GERM, Mateja**, KREFT, Ivan, STIBILJ, Vekoslava. Respiratory potential and
Se compounds in pea (Pisum sativum L.) plants grown from Se-enriched seeds. *J. Exp. Bot.*, 2006,
vol. 57, no. 1, str. 3595-3600.
3. KRŽIČ, Nina, **GERM, Mateja**, URBANC-BERČIČ, Olga, KUHAR, Urška, JANAUER, G.A., **GABERŠČIK, Alenka**. The quality of the aquatic environment and macrophytes of karstic watercourses. *Plant ecol. (Dordr.)*, 2007, vol. 192, str. 107-118.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Toksikokinetika zdravil za uporabo v veterinarski medicini v živalskem organizmu in okolju**
Course title:	**Toxicokinetics of Medicinal Products for Use in Veterinary Medicine in an Animal's Organism and the Environment**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	**Izbirni predmet/** elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40		**20**			**190**	**10**

Nosilec predmeta / Lecturer:	**Silvestra Kobal**

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Splošni pogoji za vpis na doktorski študij. Predznanje temeljev kemije, farmakologije, mikrobiologije, biologije in geologije.	General requirements for admission to PhD study with knowledge of the foundations of chemistry, pharmacology, microbiology, biology and geology.

Vsebina:	**Content (Syllabus outline):**
Splošno o problemu onesnaževanja okolja z zdravili za uporabo v veterinarski medicini, pesticidi (insekticidi in rodenticidi) ter nekaterimi drugimi pomembnimi onesnaževalci okolja (PCB, P in dr.), njihovi mobilnosti in porazdelitvi v okolju. Načini vnosa navedenih onasneževalcev v živalski organizem ter biološki mehanizmi, ki so vključeni v toksikokinetiko le teh v živalskem organizmu in v okolju. Predstavitev problema onesnaženosti okolja s ostanki neuporabljenih zdravil za uporabo v	General of the problem of environmental pollution by drugs for use in veterinary medicine, pesticides (insecticides and rodenticides), and some other important environmental pollutants (PCBs, P et al.), Their distribution and mobility in the environment. Input methods listed contaminants in animal organism and biological mechanisms involved in the toxicokinetics of these in the animal body and in the environment. Introduction to the problem of environmental pollution remains unused medicines for use in

veterinarski medicini, zlasti iz skupine protiparazitarnih, protimikrobnih in hormonskih zdravil ter onesnaženosti okolja s preostanki le teh, ki se v nespemenjeni obliki ali v obliki njihovih metabolitov z različnimi živalskimi izločki vračajo v naravo, po njihovi uporabi pri živalih. Možnosti pretvorbe bolj toksičnih v manj toksične učinkovine, njihove popolne detoksikacije, uporabe specifičnih antidotov in doktrina zdravljenja zastrupitev živali.	veterinary medicine, and in particular from the group antiparasitic, antimicrobial drugs, and hormonal and environmental contamination with residues of these, which are unchanged form or in the form of its metabolites with various animal secretions back into the wild after their use in animals. Conversion Options more toxic to less toxic substances, their full detoxification, the use of specific antidotes and treatment doctrine poisoning animals.

Temeljni literatura in viri / Readings:

Plumlee K. *Clinical Veterinary Toxicology*. Mosby, 2004. (izbrana poglavja)
Chapman M. *Veterinary Toxicology*. Blackwell Publishing, 2006. (izbrana poglavja)
Walker CH, Hopkin SP, Sibly RM, Peakall DB. 2001. *Principles of Ecotoxicology*. Taylor & Francis, New York, New York. (izbrana poglavja)
Rang HP, Dale MM, Ritter JM. Pharmacology. 4th international student edition, Churchill, Livingstone, Edinburgh, 2003. (izbrana poglavja)
Oberdisse E, Hackenthal E, Kuschinsky K. Pharmakologie und Toxikologie. Springer, Berlin, 1997. (izbrana poglavja)
Gilman AG, Nies AS, Rall TW, Taylor P. Goodman & Gilman's The pharmacological basis of therapeutics. Mc Millan, New York, 2006. (izbrana poglavja)
Timbrell J. *Introduction to Toxicology.* CRC Press, 2002. (izbrana poglavja)
Derelanko M.J., Mannfred A.H. 1995. Handbook of Toxicology. CRC. Press, USA.
Lah A. 1997. Kemizacija okolja in življenja-do katere meje? Narodna in univerzitetna knjižnica, Ljubljana
Lokke H., van Gestel C. A. M. 1998. Handbook of Soil Invertebrate Toxicity Tests. John Wiley & Sons, Canada
Vsa znanstveno raziskovalna in strokovna dogajanja z navedenega področja (relevantni članki). All scientific research and professional developments in that area (**relevant** articles)

Cilji in kompetence:	**Objectives and competences:**
Seznaniti slušatelje z uvodom v toksikokinetiko zdravil za uporabo v veterinarski medicini in najpogostejših onesnaževalcev okolja z močno izraženim toksičnim učinkom na domače in ljubiteljske (hišne) živali, metodami dela, z znanstvenimi in strokovnimi problemi, ki jih toksikokinetika obravnava, interdisciplinarnostjo, s toksikokinetiko različnih učinkovin na različnih nivojih biološke organizranosti in na različnih organizmih, uporabo znanja s področja toksikokinetičnih lastnosti zdravil za uporabo v veterinarski medicini in nekaterih drugih pomembnih kontaminantov okolja v praksi. Cilj je seznaniti slušatelje s toksikokinetičnimi mehanizmi, z osnovami klinične toksikologije s poudarkom na najpogostejših zastrupitvah z zdravili za uporabo v veterinarski medicini in nekaterimi drugih pomembnimi kontaminanti. Predmet nudi študentom razumevanje definicij in strokovnih izrazov iz področja toksikokinetike. Nudi razumevanje različnih	To acquaint students with an introduction to toxicokinetics of medicines for use in veterinary medicine and the most common environmental pollutants with strong expressed toxicity in domestic and hobby animals, methods of work, the scientific and technical problems which toxicokinetics deals, interdisciplinarity, toxicokinetics different substances at different levels of biological organizranosti and different organisms, using knowledge of toxicokinetic properties of medicines for use in veterinary medicine and some other important environmental contaminants in practice. The aim is to acquaint students with toxicokinetic mechanisms, with the basics of clinical toxicology with a focus on the most common poisonings by drugs for use in veterinary medicine and some other major contaminants. The course offers students an understanding of definitions and terminology in the field of toxicokinetics. It offers an understanding of the

procesov toksikokinetike. Slušatelji se bodo seznanili s temelji živalske in okoljske toksikokinetike, spoznali bodo kje se prepletata in dopolnjujeta.	different processes toxicokinetics. Students will become acquainted with the fundamentals of animal and environmental toxicokinetics, know where they are intertwined and complementary.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pri predmetu študent usvoji znanje s področja toksikodinamike zdravil in drugih onasnaževalcev in njihov učinek na okolje.	Knowledge and understanding: In this course students learn about the toxicodynamics medicines and other onasnaževalcev and their impact on the environment.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, konzultacije, raziskovalni seminarji	Lectures, consultations, research seminars

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit **raziskovalne seminarske naloge**	**60 %** **40 %**	Oral examination **research paper**

Reference nosilca / Lecturer's references:

Silvestra Kobal:

1. KOŽUH ERŽEN, Nevenka, **KOBAL, Silvestra.** Ekotoksikološki pomen veterinarskih zdravil = Ecotoxicological aspect of veterinary drugs. *Vet. nov. (Tisk. izd.)*. [Tiskana izd.], 2001, letn. 27, št. 5, str. 189-194.

2. KOŽUH ERŽEN, Nevenka, KOLAR, Lucija, KUŽNER, Jernej, JENČIČ, Vlasta, **KOBAL, Silvestra**, ČERNE, Manica, MARC, Irena, POGAČNIK, Milan, TIŠLER, Tatjana, CERKVENIK, Vesna. Izsledki naših raziskav na področju ekotoksikologije avermektinskih zdravil = Ecotoxicological researches of the avermectine drugs - our results. *Vet. nov. (Tisk. izd.)*. [Tiskana izd.], 2005, letn. 31, št. 1/2, str. 33-37.

3. JENČIČ, Vlasta, ČERNE, Manica, KOŽUH ERŽEN, Nevenka**, KOBAL, Silvestra,** CERKVENIK, Vesna. Abamectin effects on rainbow trout (Oncorhynchus mykiss). *Ecotoxicology (Lond.)*, 2006, vol. 15, no. 3, str. 249-257

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**TRAJNOSTNO RAZVOJNO USMERJENE TEHNOLOGIJE IZRABE PODZEMNEGA PROSTORA**
Course title:	SUSTAINABLE DEVELOPMENT ORIENTED TECHNOLOGIES OF UNDERGROUND SPACE USED

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Terenske vaje Field work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**45**	**20**	**10**		**145**	**10**

Nosilec predmeta / Lecturer:	**Jakob Likar,** Evgen Dervarič, Milivoj Vulić

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Predznanje s področja matematike, fizike, mehanike, inženirske geologije, mehanike tal in mehanike kamnin.	Good knowledge of mathematics, physics, mechanics, engineering geology, soil mechanics and rock mechanics.

Vsebina:	**Content (Syllabus outline):**
Osvežitev in ponovitev osnov načrtovanja gradnje podzemnih prostorov ob upoštevanju funkcionalnosti podzemnih prostorov in sodobnih principov načrtovanja, skladno s trajnostnim razvojem območij ter ohranjanja naravne in kulturne dediščine naravnega in urbanega okolja. V sklopu navedenih ciljev bodo posebej izpostavljeni pogoji rabe podzemnih prostorov v okviru trajnostnega razvoja večjih mest v luči razvoja infrastrukture	Revising the basics of planning the construction of underground structures with regarding to their functionality and modern principles of designing accordance to sustainable development large areas and in the case of development infrastructure and energy supply urban parts of the country. The emphasis of described fundamentals is on following topics: - adjustment possibility underground space use

in energetske oskrbe urbanih območij. Poudarek navedenih osnov je na tematskih sklopih, ki upoštevajo: - prilagajanje možnosti izrabe podzemnega prostora v cilju ohranjanja okolja in krajine; - umeščanje podzemnih prostorov v prostor v okviru celovitega reševanja infrastrukturnih rešitev v smislu trajnostnega razvoja posameznih območij; - preverjanje možnosti izrabe podzemnega prostora z namenom prilagajanja prihajajočim klimatskim spremembam s poudarkom na iskanju racionalnih in okolju primernih tehničnih rešitvah. Tehnično tehnološki del področja, ki pokriva rabo podzemnega prostora pa vsebuje: - sodobne metode gradnje podzemnih prostorov v nosilnih in stabilnih kamninah, - sodobne metode gradnje podzemnih prostorov v nizko nosilnih kamninah in stabilnih zemljinah, - sodobne metode gradnje podzemnih prostorov v nestabilnih zemljinah. V nadaljevanje so vključena naslednja poglavja: - uporaba sodobnih in strokovno uveljavljenih numeričnih metod s poudarkom na analizi delovanja hribina - podporje z vključevanjem reoloških zakonitosti za posamezne vrste hribin; - armiranje in utrjevanje hribinskih zlogov z injektirnimi postopki, vgradnja nosilnih jeklenih in drugih materialov, kemičnimi postopki izboljšanja nosilnih sposobnosti geomaterialov; - analize delovanja aktivnih in pasivnih sidrnih sistemov z vključevanjem časovnih sovisnosti za posamezne vrste hribin; - postopke zagotavljanja dolgoročne stabilnosti podzemnih prostorov; - kriterije ekonomičnosti načrtovanja gradnje podzemnih prostorov ob znanih geotehničnih in tehnoloških pogojev izvedbe del z upoštevanjem okoljevarstvenih zahtev; - specialne geotehnične meritve in spremljava izdelave podzemnih prostorov, vključno s povratnimi parametričnimi analizami v času gradnje in obratovanja tovrstnih objektov; - načrtovanje prezračevalnih ukrepov v času gradnje in obratovanja podzemnih prostorov;	in the name of preservation environment and region; - placement of underground spaces in the integrity frame to find infrastructure solution in the aim of country parts of sustainable development; - verification possibilities of underground space use regarding adaptation to arriving climate changing with emphasis on research rational and environmental suitable technical solutions. Technical and technological part of topics which include underground space use are: - modern methods of construction of underground structures in bearing and stable rocks; - modern methods of construction of underground structures in weak rocks and soils; - modern methods of construction of underground structures in unstable soils; - application of modern and professionally established numeric methods with emphasis on the analysis of interaction between the ground and the support by considering rheological laws for individual types of ground; - grouting and reinforcement of ground layers by injecting, installation of bearing steel structures and other materials, chemical procedures for optimizing the bearing capacity of geological materials; - performance analyses of active and passive anchoring systems by considering time interdependence of individual types of ground; - procedures for ensuring long-term stability of underground structures; - economic criteria in planning of the construction of underground structures in known geotechnical and technological conditions for the implementation of works and by considering the environmental requirements; - special geotechnical measurements and monitoring the construction of underground structures with feedback parameter analyses during the construction and operation of such structures; - designing ventilation measures during the construction and operation of such underground structures.

Temeljni literatura in viri / Readings:

- B.H.G. Brady, E.T. Brown: ROCK MECHANICS FOR UNDERGROUND MINING, George Allen & Unwin; London, 2004, 626 p.p.;
- E. Hoek: ROCK ENGINEERING FOR TUNNELS, Rockscience, 1998, 313 p.p.;
- R. Goodman: INTRODUCTION TO ROCK MECHANICS, John Willey, 1989, 562 p.p.;
- B. Singh, R. K. Goel: TUNNELING IN WEAK ROCKS, Elsevier Geo-Engineering Book Series, Volume 5, 2006; 489 p.p.;
- D. Kolymbas: TUNNELLING AND TUNNEL MECHANICS, Springer, 2005, 437 p.p.;
- B. Maidl: HANDBUCH DES TUNNEL – UND STOLLENBAUES, BAND I in BAND II, 3. Auflage, Verlag Glueckauf, 2004, 422 p.p. and 356 p.p.

revijalni članki s področja gradnje predorov, tekoča periodika, učna gradiva/ Appropriate articles from the field of tunnelling, current periodicals, teaching materials;

Cilji in kompetence:	**Objectives and competences:**
Usposobitev za uporabo znanj s področja izrabe podzemnega prostora s posebnim poudarkom na racionalnem načrtovanju podzemnih prostorov v spremenljivih geotehničnih razmerah gradnje v urbanih in neurbanih območjih v smislu trajnostnega razvoja posameznih območij in ohranjanja naravne dediščine in kulturne krajine.	The ability to use knowledge from underground space use, with particular emphasis on the rational design of underground facilities in varying geotechnical conditions relating to construction in urban and other non-urban areas particularly through sustainable development. Special attention will be paid on conservation of natural heritage and cultural landscapes for future periods.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pridobljena bodo znanja o načrtovanju podzemnih prostorov ob upoštevanju specifičnih lastnosti hribinskih območij ter principov trajnostnega razvoja posameznih območij na osnovi razumevanja sodobnih tehničnih postopkov gradnje podzemnih objektov.	Knowledge and understanding: The knowledge of the planning of underground facilities will be obtained as a subject of the specific properties of rock environments. Similar, the sustainable development principles of individual sites based on modern technical understanding of the building underground facilities will be obtained, too.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Poučevanje poteka v okviru predavanj, seminarjev in laboratorijskih vaj ter terenskih vaj, ki vključujejo oglede gradbišč podzemnih objektov. Učenje je sprotno s poudarkom na učni predelavi podane snovi, sodelovanju pri analizi seminarskh nalog, aktivni izvedbi laboratorijskih vaj, ter aktivni udeležbi na terenskih vajah.	Teaching methods include lectures, seminars and laboratory exercises and field work (visiting construction sites). Students are required to study the contents throughout the course of lectures, and must participate in preparing and analysing seminar works. Active implementation of laboratory exercises, and active participation in field work activities are required.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ob sprotnem preverjanju znanja s kolokviji, ki so načrtovani po predelanem posameznem sklopu poglavij, je obvezna izdelava vsaj ene seminarske naloge ter izdelava pisnega poročila o rezultatih laboratorijskih in terenskih vaj.		Student knowledge is tested by colloquia after every course module. Students are required to prepare at least one seminar work and submit a written report on the results of laboratory exercises and field work.

Pisni izpit	35%	Written exam
Ustni izpit	35%	Oral exam
Naloge	15%	Course work
Seminarska naloga	15%	Seminar

Reference nosilca / Lecturer's references:

Jakob Likar

1. LIKAR, Jakob, ČADEŽ, Jurij. Ventilation design of enclosed underground structures. *Tunn. undergr. space technol.*. [Print ed.], 2000, vol. 15, no. 4, str. 477-480.

2. LIKAR, Jakob, VUKADIN, Vladimir. Time-dependent back analysis of a multi anchored pile retaining wall. *J. geotech. geoenviron. eng.*, 2003, vol. 129, no. 1, str. 91-95.

3. LIKAR, Jakob. The Cenkova tunnel construction with intermediate reinforced concrete wall = Gradnja predora Cenkova z vmesno armiranobetonsko steno. *RMZ-mater. geoenviron.*, 2010, vol. 57, no. 3, str. 387-402.;

Milivoj Vulić

1. VULIĆ, Milivoj, KORELC, Jernej. The use of the logistic function for forecasting vertical movements of surface = Uporaba logistične funkcije pri napovedovanju vertikalnih premikov površine. *RMZ-mater. geoenviron.*, 2008, vol. 55, no. 3, str. 389-395.

2. VULIĆ, Milivoj, BLAGOJEVIĆ, Dragan. Recent vertical crustal movements of a part of the Balkan peninsula derived from levelling data. *Surv. rev. - Dir. Overseas Surv.*, July 2008, vol. 40, no. 309, str. 235-243.

3. RISTOVIĆ, Ivica, STOJAKOVIĆ, Milan, VULIĆ, Milivoj. Recultivation and sustainable development of coal mining in Kolubara basin. *Therm.sci.*, 2010, vol. 14, no. 3, str. 759-772. http://dx.doi.org/10.2298/TSCI091123002R, doi: 10.2298/TSCI091123002R.

Evgen Dervarič

1. DERVARIČ, Evgen, MEDVED, Milan, MALENKOVIĆ, Vladimir. Strategic factors and a model of enterprise restructuring in the coal industry in Europe with emphasis on experiences in Slovenia-Velenje coal mine case. *J. S. Afr. Inst. Min. Metall.*, 2008, vol. 108, no. 10, str. 627-640.

2. MEDVED, Milan, SKUBIN, Gorazd, DERVARIČ, Evgen. Introducing clean coal technologies for reduction of greenhouse gasses emissions = Uvajanje čistih premogovnih tehnologij za zmanjšanje emisij toplogrednih plinov. *RMZ-mater. geoenviron.*, 2009, vol. 56, no. 4, str. 459-478.

3. VUKELIČ, Željko, KLENOVŠEK, Bojan, PLACER, Ladislav, MALENKOVIĆ, Vladimir, DERVARIČ, Evgen. Geological evaluation of brown coal reserves at the Hrastnik mine - RTH, Rudnik Trbovlje-Hrastnik = Geološka evalvacija zalog rjavega premoga na območju jame Hrastnik - RTH, Rudnik Trbovlje-Hrastnik. *RMZ-mater. geoenviron.*, 2010, let. 57, št. 1, str. 75-96.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**UMEŠČANJE RIZIČNIH/TVEGANIH OBJEKTOV V SOCIALNO OKOLJE**
Course title:	PLACEMENT RISKY BUILDINGS IN SOCIAL ENVIRONMENT

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	**Drago Kos**, Mitja Brilly, Marko Polič

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski, angleški/ Slovenian, English**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Opravljene obveznosti pri temeljnih predmetih	Enrolment in doctoral studies. Completed requirements for core subjects

Vsebina:	**Content (Syllabus outline):**
Želeno in neželeno: pot do navzkrižij. Socialna konstrukcija stvarnosti in raznovrstnost družbenih interakcij. Odnos do okolja. Zaznava tveganja in njene razsežnosti. Stigmatizacija. NIMBY in podobni pojavi. Laiki in strokovnjaki. Vloga strokovnjakov različnih strok. Odnosi med interesnimi skupinami. Dejavniki sodelovanja med njimi. Vloga in pomen zaupanja. Vloga in sodelovanje javnosti. Načini komuniciranja pri predstavitvi okoljskih problemov in posegov. Obstoječe zakonske in tehnične rešitve varstva okolja in možnosti ustreznejšega razreševanja navzkrižij.	Desired and undesired: the path to conflict. Social construction of reality and diversity of social interactions. Attitude towards the environment. The perception of risk and its magnitude. Stigma. NIMBY and related events. Laymen and professionals. The role of experts in various disciplines. Relations between stakeholders. Factors cooperation between them. The role and importance of trust. The role and participation of the public. Communication methods to present environmental problems and interventions. Existing legal and technical solutions to environmental protection and the most appropriate management of conflicts.

Temeljni literatura in viri / Readings:

1. Cvetkovich G., Lofstedt R.E. (Eds.) (1999). Social Trust and the Management of Risk. London: Earthscan.
2. Cox R. (2006). Environmental Communication and the Public Sphere, London: SAGE
3. Gardner G.T., Stern P.C. (1996), Environmental Problems and Human Behavior, Boston: Allyn and Bacon
4. Gutteling J.M. & Wiegman O. (1996), Exploring Risk Communication, Dordrecht: Kluwer
5. Kasperson J. X., Kasperson R. E. (Eds.) (2005). The Social Contours of Risk, vol. I. and II., London: Earthscan
6. Bazerman, M.H., Messick D.M., Tenbrunsel A., Wade-Benzoni K.A. (Eds.)(1997). Environment, Ethics, and Behavior. San Francisco: The new Lexington Press.
7. Marega, Kos, ur. (2002): Aarhuška konvencija v Sloveniji. (2002) REC, Ljubljana.

Cilji in kompetence:	**Objectives and competences:**
Varovanje okolja zahteva tudi ustrezno umeščanje kritičnih, v javnosti iz različnih razlogov nepriljubljenih posegov (npr. Odlagališča odpadkov, tovarne, prometnice) ter preprečevanje izgradnje škodljivih objektov. Študenti se bodo seznanili z razlogi za vključevanje javnosti oz. Interesnih skupin in z načini komuniciranja in sodelovanja z njimi.	Protecting of the environment requires an appropriate placement critical, in public for various reasons unpopular interventions (eg, landfills, factories, roads), and prevent building of harmful objects. Students will learn about the reasons for public involvement or stakeholders and way of communication and cooperation with them.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Spoznali bodo dejavnike in vzroke nastanka navzkrižij med posameznimi interesnimi skupinami ter možnosti njihovega razreševanja ter spoznali potrebo po interdisciplinarnem sodelovanju družboslovnih, tehničnih in naravoslovnih strok. Znali bodo poiskati nove inovativne politične, administrativne in tehnične rešitve.	Knowledge and understanding: They will learn the factors and causes of conflicts between stakeholders and options to resolve them, and see the need for interdisciplinary cooperation social, technical and scientific disciplines. They will be able to find new innovative political, administrative and technical solutions.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarske vaje	Lectures and tutorials

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Naloge	**50%**	coursework
projekt	**50%**	project

Reference nosilca / Lecturer's references:

1. **KOS, Drago**. Participativna prenova mest = Participatory urban renewal. *Urbani izziv*, 2005, let. 16, št. 2, str. 16-23, 141-146.
2. **KOS, Drago**. Urbanistični diskurzi med strokovnostjo in strokovnjaštvom. *Urbani izziv*, 2006, letn. 17, št. 1/2, str. 85-92.
3. **KOS, Drago**. Javno mnenje o okolju. V: MALNAR, Brina (ur.), BERNIK, Ivan (ur.). *S Slovenkami in Slovenci na štiri oči : ob 70-letnici prof. Nika Toša*, (Dokumenti SJM, 11). Ljubljana: Fakulteta za družbene vede, IDV, CJMMK, 2004, str. 307-320.

1. **BRILLY, Mitja**, RUSJAN, Simon, VIDMAR, Andrej. Monitoring the impact of urbanisation on the Glinscica stream. Phys. chem. earth (2002), 2006, issue 17,
2. GOLJA, Aleš, **BRILLY, Mitja**. Urejanje podeželskega prostora za rekreacijske namene na primeru zgornjega povodja reke Soče = Planning countryside space for recreation purposes: the case of the upper water basin of the river Soča. *Urbani izziv*, 2008, letn. 19,
3. **BRILLY, Mitja.** Local flood defence systems in Europe. V: ASHLEY, Richard M. (ur.). *Advances in urban flood management*. Leiden; New York: Taylor & Francis, cop. 2007

1. POLIČ, Marko. Tveganje, odločanje in varnost. *Sanitas et labor*, št. 1, mar. 2012, str. 73-91, ilustr.
2. POLIČ, Marko. Risk, crises and control : between fear and negligence. V: KAJFEŽ-BOGATAJ, Lučka (ur.), MÜLLER, Karl H. (ur.), SVETLIK, Ivan (ur.), TOŠ, Niko (ur.). *Modern RISC-societies : towards a new paradigm for societal evolution*, (Complexity design society, vol. 14). Vienna: Echoraum, cop. 2010, str. 325-338, portret.
3. **POLIČ, Marko**. Odločanje : med razumnostjo in stvarnostjo. V: ULE, Andrej (ur.), MARKIČ, Olga (ur.), KORDEŠ, Urban (ur.). *Konteksti odločanja*, (Zbirka Dialogi, letn. 10). Maribor: Aristej, 2009, str. 111-134, 178.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Uporaba daljinskega zaznavanja**
Course title:	Application of Remote Sensing

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**35**	**10**			**180**	**10**

Nosilec predmeta / Lecturer:	Krištof Oštir

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Doktorski študentje katerekoli usmeritve.	Doctoral students of any field.

Vsebina:	**Content (Syllabus outline):**
Uvod v daljinsko zaznavanje – definicija in terminologija, zgodovinski razvoj Fizikalne osnove daljinskega zaznavanja – elektromagnetno valovanje, elektromagnetni spekter, interakcija z atmosfero, interakcija s površjem Sistemi daljinskega zaznavanja in njihove značilnosti – platforme, tirnice, prostorska, spektralna, radiometrična in časovna ločljivost Senzorji – optični, radarski, laserski Sistemi za opazovanje Zemlje – značilnosti, delovanje, pridobivanj podatkov Interpretacija podob daljinskega zaznavanja – digitalna obdelava podob, vizualna interpretacija Predobdelava podob – odprava napak v	Introduction to remote sensing – definitions and terminology, historical development Physical principles of remote sensing – electromagnetic radiation, electromagnetic spectrum, interaction with the atmosphere, interaction with the surface Remote sensing systems and their characteristics – platforms, orbits, spatial, spectral, radiometric and temporal resolution Sensors – optical, radar, laser Earth observation systems – features, operation, data acquisition Interpretation of remote sensing images – digital image processing, visual interpretation Image pre-processing – the elimination of sensors malfunctioning, geometric corrections,

delovanju senzorjev, geometrijski popravki, atmosferski popravki, popravki osvetlitve in topografska normalizacija, kalibracija senzorja Izboljšanje podob – človeški vid in barvni prostori, izboljšanje kontrasta, psevdobarvni prikazi, filtriranje Transformacije podob – aritmetične operacije, vegetacijski indeks, analiza osnovnih komponent, Kauth-Thomasova transformacija, transformacija HSI Klasifikacija podob – spektralni prostor, nenadzorovana klasifikacija, nadzorovana klasifikacija, objektna klasifikacija, ovrednotenje klasifikacije Primeri uporabe – varstvo okolja, naravne nesreče, ekologija, upravljanje prostora, gozdarstvo, agronomija, arheologija, … Izvedba praktičnega primera uporabe daljinskega zaznavanja – od izbire snemalnega sistema, prek naročanja podatkov in interpretacije do priprave izdelkov (kart, poročil)	atmospheric corrections, exposure and topographic normalization, sensor calibration Image enhancement – human vision and colour spaces, contrast enhancement, pseudo-colour display, filtering Image transformation – arithmetic operations, vegetation index, principal components analysis, Kauth-Thomas transformation, HSI transformation Image classification – spectral space, unsupervised classification, supervised classification, object-based classification, evaluation of classification Examples of use – environmental protection, natural disasters, ecology, land management, forestry, agronomy, archaeology, ... Application of a practical example of the use of remote sensing – the choice of the imaging system, ordering and interpretation of data, preparation of products (maps, reports)

Temeljni literatura in viri / Readings:

Daljinsko zaznavanje / Krištof Oštir. Ljubljana : Znanstvenoraziskovalni center SAZU, 2006.
Introduction to remote sensing / James B. Campbell, Randolph H. Wynne. New York ; London : Guildford Press, 2011.
Remote Sensing Digital Image Analysis: An Introduction / J.A. Richard in X. Jia. Berlin : Springer, 2006.
Computer Processing of Remotely Sensed Images: An Introduction / P.M. Mather. Chichester : John Wiley and Sons, 2004.

Cilji in kompetence:	**Objectives and competences:**
Študenti pridobijo znanje o uporabi daljinskega zaznavanja pri varstvu okolja. Spoznajo postopke obdelave digitalnih podob in se usposobijo za samostojno aplikacijo tehnologije.	Students will acquire knowledge on the use of remote sensing in environmental issues. They learn about the processing of digital images and gain the ability for stand-alone application of the technology.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študenti pridobijo naslednja znanja in sposobnosti: spoznajo načine iskanja in naročanja satelitskih posnetkov, spoznajo postopek obdelave in njegove korake, znajo samostojno uporabiti daljinsko zaznavanje v konkretni aplikaciji. Vsa teoretična podlaga se tesno povezujejo s praktičnimi primeri, zato se študenti naučijo uporabljati teorijo v praksi, so se sposobni odločati in izbirati primerne metode in podatkovne vire za določeno uporabo.	Students will acquire the following knowledge and skills: learn ways of finding and ordering satellite images, learn about the various steps of image processing, learn to independently use remote sensing in practical application. All theoretical knowledge is closely linked with practical examples, so students learn to apply theory in practice, they are able to decide and choose the appropriate methods and data sources for a particular use.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja: v predavalnici, uporaba sodobnih metod poučevanja (predstavitve z računalnikom, grafične ponazoritve in animacije, demonstracije, primeri iz prakse). Praktične vaje: izvedba v predavalnici in računalniški učilnici. Vaje se po potrebi izvajajo individualno oziroma v manjših skupinah na ustrezni opremi.	Lectures: in the classroom, the use of modern teaching methods (presentations with computer, graphic illustrations and animations, demonstrations, case studies). Practical exercises: implementation in the classroom and computer lab. Exercises are performed individually or in small groups with the appropriate equipment.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pogoj za opravljen predmet je pozitivno ocenjena **seminarska naloga**, ki predstavlja primer uporabe daljinskega zaznavanja s področja študentovega dela. Naloga mora biti predstavljena v okviru seminarskih vaj in izdelana v obliki znanstvenega oziroma strokovnega članka.	100 %	For successful completion of the course the student has a **seminar paper**. The seminar is an example of the use of remote sensing in the field of student research work. The paper should be presented in the class and prepared in the form of a scientific or technical paper.

Reference nosilca / Lecturer's references:

ZAKŠEK, Klemen, OŠTIR, Krištof. Downscaling land surface temperature for urban heat island diurnal cycle analysis. Remote sens. environ.. [Print ed.], 2012, vol. 117, str. 114-124, ilustr., doi: 10.1016/j.rse.2011.05.027.

KOKALJ, Žiga, ZAKŠEK, Klemen, OŠTIR, Krištof. Application of sky-view factor for the visualisation of historic landscape features in lidar-derived relief models. Antiquity, 2011, 85, str. 263-273, ilustr.

KOBLER, Andrej, PFEIFER, Norbert, OGRINC, Peter, TODOROVSKI, Ljupčo, OŠTIR, Krištof, DŽEROSKI, Sašo. Repetitive interpolation : a robust algorithm for DTM generation from Aerial Laser Scanner Data in forested terrain. Remote sens. environ.. [Print ed.], 2007, vol. 108, iss. 1, str. 9-23, ilustr. http://dx.doi.org/10.1016/j.rse.2006.10.013.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**VARNOST IN ZANESLJIVOST V PROCESNI TEHNIKI**
Course title:	SAFETY AND RELIABILITY IN PROCESS ENGINEERING

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilca predmeta / Lecturers:	**Borut Mavko**, Ivo Kljenak

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v doktorski študij. Predznanje s področja tehnike ali naravoslovja.	Enrollment in doctoral studies. Prior knowledge in subjects from technical or natural sciences.

Vsebina:	**Content (Syllabus outline):**
Zanesljivost v procesni industriji	Reliability in process engineering
Varnost in tveganje	Safety and risk
Matematične osnove in analitična orodja	Mathematical fundamentals and analytical tools
Identifikacija in kvantifikacija nevarnosti	Identification and quantification of threats
Verjetnostne varnostne analize	Probabilistic safety assessment
Drevesa okvar in drevesa dogodkov	Fault trees and event trees
Deterministične varnostne analize	Deterministic safety analyses
Simulacije in industrijske aplikacije	Simulations and industrial applications

Temeljni literatura in viri / Readings:

- A. Kuhlman, Introduction to Safety Science, Springer Verlag, 1985.
- I.S. Sutton, Process Reliability Risk Management, Van Nostrand Reinhold, 1991.
- N.P. Cheremisinnoff, Practical Guide to Industrial Safety, Marcel Dekker, Inc. NY 2001.
- W. Vesely, J. Dugan, J. Fragola, J. Minarick, J. Railsback, Fault Tree Handbook with Aerospace Applications, National Aeronautics and Space Administration, NASA, 2002.
- B.R. Sehgal, Nuclear Safety in Light Water Reactors, Elsevier, 2012.
- Revijalni članki s področja, tekoča periodika, učna gradiva. / Journal papers, current periodical publications, course materials.

Cilji in kompetence:	**Objectives and competences:**
Seznanitev s teoretskimi osnovami, zahtevnimi verjetnostnimi in determinističnimi metodami in orodji za ocenjevanje zanesljivosti in varnosti v procesni industriji, s poudarkom na vplivu procesne industrije na okolje.	To become acquainted with theoretical bases, advanced probabilistic and deterministic methods and tools for assessing reliability and safety in process industries, with emphasis on the influence of the process industries on the environment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Sposobnost identifikacije in analize tveganja specifičnih industrijskih postrojev za okolje ter ocene eventuelnih posledic hipotetične nesreče.	Ability to identify and analyse the risk of specific industrial plants for the environment and to assess the eventual consequences of a hypothetical accident.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- Predavanja s teoretično vsebino - Raziskovalni seminarji - Projektno delo - Individualne naloge - Vodeni individualni študij	- Theoretical lectures - Research term papers - Project works - Individual assignments - Individual studies with tutoring

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga	40%	Term paper
Pisni izpit	40%	Written examination
Zagovor pisnega izpita	20%	Oral hearing of written examination

Reference nosilca / Lecturer's references:

Borut Mavko

M.Uršič, M.Leskovar, **B.Mavko**, Simulations of KROTOS alumina and corium steam explosion experiments : applicability of the improved solidification influence modelling. *Nuclear Engineering and Design*, 2012, vol. 246, 163-174.

L.Cizelj, M.Leskovar, M.Čepin, **B.Mavko**, A method for rapid vulnerability assessment of structures loaded by outside blasts, *Nuclear Engineering and Design*, 2009, vol. 239, 1641-1646.

A.Volkanovski, M.Čepin, **B.Mavko**, Application of the fault tree analysis for the power system reliability, *Reliability Engineering and System Safety*, 2009, vol. 94, 1116-1127.

Ivo Kljenak

I.Kljenak, A.Bentaib, T.Jordan, Hydrogen behavior and control in severe accidents. B.R.Sehgal (ed.), *Nuclear safety in light water reactors : severe accident phenomenology*, Elsevier/Academic Press, 2012, 186-227.

I.Kljenak, B.Mavko, Simulation of containment thermal-hydraulics in the Marviken Blowdown 16 experiment with ASTEC and CONTAIN codes. *Nuclear Engineering and Design*, 2011, vol. 241, 1063-1070.

I.Kljenak, M.Dapper, J.Dienstbier L.E.Herranz, M.K.Koch, J.Fontanet, Thermal-hydraulic and aerosol containment phenomena modelling in ASTEC severe accident computer code. *Nuclear Engineering and Design*, 2010, vol. 240, 656-667.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**VARSTVO KRAJINE**
Course title:	**Landscape conservation**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
20	**40**	**-**	**-**	**-**	**190**	**10**

Nosilec predmeta / Lecturer:	**Mojca Golobič,** Ana Kučan

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Inscription in the PhD programme.

Vsebina:	**Content (Syllabus outline):**
Definicije in pojmi krajine v različnih strokovnih kontekstih: krajinski ekologiji, v krajinskem-varovalnem planiranju, krajinski ekologiji, kulturološki (antropološki) in politični obravnavi. Evropska konvencija o krajini: varstvo, upravljanje in načrtovanje krajine. Krajinska analiza in vrednotenje krajine. Procesi spreminjanja krajine. Tipologije krajine in tipološka ureditev slovenskih krajin. Ureditvene smernice. Varstvo izjemnih krajin. Varstvo kulturne krajine v okviru varstva kulturne dediščine. Varstvo naravne krajine v okviru ohranjanja narave. Upravljanje s krajino v sektorskih politikah (kmetijstvo, gozdarstvo, vode) in ukrepi za	Definitions and concepts of landscape in different contexts: landscape ecology, landscape planning, anthropology and cultural studies, policy making. Processes of landscape change European landscape convention: landscape conservation, management and planning. Landscape analysis and evaluation Landscape typology – focus on classification of Slovenian landscapes and guidelines for landscape management Landscape conservation instruments in different policies: nature conservation, protection of cultural heritage, agriculture, forestry, water management. Landscape planning processes and methods: vulnerability analysis strategic environmental

varstvo krajine. Krajinsko načrtovanje: izhodišča (varstvo narave, varstvo virov, varstvo bivalnega okolja), postopki in metode, varstveni pristopi: analize ranljivosti, strateške presoje vplivov na okolje, primerjalne študije variant. Varstvo in načrtovanje mestne krajine – zeleni sistemi. Participacija javnosti v postopkih varstva in urejanja krajine.	impact assessment, evaluation of alternative proposals. Conservation and planning of urban landscapes Public participation in landscape conservation

Temeljni literatura in viri / Readings:

Marušič, J. et al., 1998. Regionalna razdelitev krajinskih tipov v Sloveniji, Uvodni zvezek: Metodološke osnove in zvezki 1-5. Ljubljana: Ministrstvo za okolje in prostor RS, Urad RS za prostorsko planiranje
Ogrin D., 1989. Slovenske krajine. Državna založba Slovenije, Ljubljana
Ogrin, D. (Ur.), 1996, Varstvo narave zunaj zavarovanih območij, Ministrstvo za okolje in prostor, Urad RS za prostorsko planiranje in Biotehniška fakulteta, Inštitut za krajinsko arhitekturo, Ljubljana
McHarg I., 1969, Design with nature. Garden City, New York: Natural History Press
Kučan, A. Krajina kot nacionalni simbol, Ljubljana: Znanstveno in publicistično središče, 1998

Cilji in kompetence:	**Objectives and competences:**
Omogočiti bodočim strokovnjakom na področju varstva okolja boljše poznavanje pojmov, vrednot in metod, ki izhajajo iz koncepta varstva krajine, ter s tem izboljšati vključenost krajine v prizadevanja za varstvo okolja.	To ensure the future professionals in the field of environment protection have adequate knowledge and understanding of landscape concepts, values and methods for landscape conservation, management and planning, and thus improvement of landscape protection and cross sector coordination

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: pojmov in pristopov, ki izhajajo iz koncepta krajine tipoloških značilnosti krajin ter procesov njihovega spreminjanja izhodišč za vrednotenje krajine pristopov in metod varstva krajine v okviru različnih postopkov varstva, upravljanja in načrtovanja, pravnega in administrativnega okvira za varstvo krajin. Sposobnost interdisciplinarnega pristopa k analizi in reševanju problemov v krajini	Knowledge and understanding: of concepts and approaches related to landscape typological characteristics of landscape and processes of landscape change framework for landscape evaluation approaches and methods for landscape conservation in different frameworks of conservation, management and planning policies legal and administrative framework for landscape conservation Capability of interdisciplinary approach to landscape analysis and problem solving

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja s prosojnicami (ppt) Samostojno delo – priprava seminarske naloge na osnovi virov, konzultacij in terenskih ogledov Predstavitve seminarskih nalog z razpravo	Lectures supported with ppt prsentations Inddividual work: project on a chosen topic, with support of literature, consultations and field work Presentations of projects with discussion

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga	**70%**	Project (written)
zagovor seminarske naloge,	**30%**	Presentation and defense of the project

Reference nosilca / Lecturer's references:

Mojca Golobič

GOLOBIČ, Mojca. Transformation processes of Alpine landscapes and policy responses : top-down and bottom-up views. *Soc. nat. resour.*, 2010, letn. 23, št. 3, str. 269-280.

KUČAN, Ana, **GOLOBIČ, Mojca**. Die Zukunft der Kulturlandschaften Sloweniens = The future for Slovenian cultural landscapes. *Topos (Münch.)*, June 2004, vol. 47, str. 79-86.

GOLOBIČ, Mojca. Il paesaggio come resultato del processo decisionale : tecnocrazia, consultazione, partecipazione?. V: CASTIGLIONI, Benedetta (ur.), DE MARCHI, Massimo (ur.). *Di chi è il paesaggio? : la partecipazione degli attori nella individuazione, valutazione e pianificazione*. 1. ed. Padova: CLEUP, 2009, str. 29-35.

Ana Kučan

KUČAN, Ana. Krajina kot nacionalni simbol = Landscape as a national symbol. V: MLAKAR, Barbara (ur.), BRATINA JURKOVIČ, Nataša (ur.). Evropska konvencija o krajini : konvencija iz Firenc : florence convention. Ljubljana: Ministrstvo za kulturo, 2007, str. 43-52.

KUČAN, Ana. The power of discrete change. V: DIEDRICH, Lisa (ur.). In touch : landscape architecture Europe. Basel: Birkhäuser; Wageningen: Blauwdruk, 2012, str. 175-178.

KUČAN, Ana. Constructing landscape conceptions. *Jola*. [Tiskana izd.], spring 2007, str. 30-41, ilustr.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Varstvo lesenih objektov kulturne dediščine**
Course title:	**Protection of Wooden Objects of Cultural Heritage**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
40	**5**	**15**			**190**	**10**

Nosilec predmeta / Lecturer:	Franc Pohleven

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis na doktorski študij, drugih pogojev ni.	Registration to doctoral studies; no other conditions are necessary.

Vsebina:	**Content (Syllabus outline):**
Abiotski in biotski faktorji razkroja lesa. Kemične spremembe v lesu ob razgradnji z lesnimi glivami. Lesni škodljivci: lesne glive in insekti ter vloga biotskih dejavnikov pri razkroju lesa. Poškodbe kulturno-zgodovinskih in umetniških predmetov iz lesa z lesnimi škodljivci (alge, glive in insekti). Različni postopki za ugotavljanje prisotnosti škodljivcev v lesu. Naravni pogoji, ki preprečujejo biotski razkroj (naravna zaščita) lesa s posebnim poudarkom na konstrukcijski zaščiti kulturno-zgodovinskih lesenih objektov. Biotehnološki in fizikalni (temperatura, sušenje, zaščita z zaduševanjem) postopki za	Abiotic and biotic factors of wood decomposition. Chemical changes in wood caused by wood decayed fungi. Wood pests: wood decay fungi and insects and the role of biotic factors in the decomposition of wood. Damage of wooden cultural, historical and art objects caused by wood pest (algae, fungi and insects). Various techniques for determining the presence of pests in wood. Natural conditions for the control of biological decomposition (natural protection) of wood with special emphasis on structural protection of cultural and historical wooden buildings.

preventivno in kurativno zaščito. Biocidni pripravki in postopki zaščite lesa ter negativni vplivi kemične zaščite na okolje in človeka. Novejša, okolju prijaznejša alternativna sredstva za zaščito lesa. Konzerviranje in restavriranje objektov kulturne dediščine. Varnostni ukrepi pri izvajanju zaščite lesa z biocidnimi proizvodi.	Biotechnological and physical (temperature, drying, asphyxiation) methods for preventive and curative protection. Biocidal products and methods of wood protection and negative effects of chemical preservation to the environment and humans. Novel environmentally friendly alternative products for wood preservation. Preservation and restoration of cultural heritage structures. Safety measures in wood protection using biocidal products.

Temeljni literatura in viri / Readings:

Townsend T.G., Solo-Gabriele H. 2006: Environmental Impacts of Treated Wood. CRC Press, Taylor & Francis, Boca Raton, ISBN 0-8493-6495-7, 501 str.
Unger A., Schniewind A.P., Unger W. 2001: Conservation of wood artefacts. Berlin, New York : Springer. ISBN: 3-540-41580-7, 578 str.
Ciferri O., Tiano P., Mastromei G. 2000: Of Microbes and Art. Kluwer Academic/Plenum Publishers, New York. ISBN: 0-306-46377-6, 250 str.
Ridout B. 2000: Timber decay in buildings : The conservation approach to treatment. London : E. & FN. Spon. ISBN: 0-419-18820-7, 232 str.

Cilji in kompetence:	**Objectives and competences:**
Pridobitev znanja o lesnih škodljivcih in usposobljenost za optimalne presoje in odločitve za izvajanje preventivne ali represivne zaščite lesenih objektov kulturne dediščine pred škodljivci.	To gain knowledge in wood pests and skills for optimal estimations and decisions in implementation of preventive or repressive protection of cultural heritage wooden structures against pests.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje se seznanijo z najpogostejšimi lesnimi škodljivci (glivami in insekti) ter poškodbami, ki jih povzročajo na izdelkih. Naučijo se prepoznati škodljivce ter se seznanijo z ukrepi, ki preprečijo njihovo delovanje. Pridobijo si znanja za presojo, kdaj in kako zaščititi objekte glede na njihovo izpostavitev oziroma način rabe. Študentom nato posredujemo vedenja o okolju prijaznejši zaščiti lesa s sodobnimi postopki in biocidnimi pripravki, ki v primerjavi s klasičnimi načini predstavljajo okolju sprejemljivejšo alternativo. Pri tem je poudarek na konstrukcijski zaščiti lesnih izdelkov in objektov.	**Knowledge and understanding:** Students learn about the most common wood pests (insects and fungi) and damages caused on wooden products. They learn how to identify pests and get familiar with measures that prevent their activity. They also acquire knowledge to estimate when and how to protect the objects based on their method of use or exposure. Students get skills in environmentally friendly wood preservation using modern procedures and biocidal products, which compared to traditional methods represent environmentally more friendly alternative. These lectures are mainly focused on structural protection of wood products and objects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Seminar Vaje	Lectures Seminar Tutorial

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminar kolokvij pisni izpit ustni izpit	**15%** **15%** **20%** **50%**	Seminar colloquium written exam oral exam

Reference nosilca / Lecturer's references:

GOLOBIČ, Amalija, OŽBOLT, Ljerka, **POHLEVEN, Franc**, LEBAN, Ivan, ŠEGEDIN, Primož. Synthesis, characterization, crystal structures and fungicidal activity of some copper(II) carboxylates with 3-hydroxypyridine. *Acta chim. slov.*. [Tiskana izd.], 2006, vol. 53, no. 3, str. 238-244, Graf. prikazi.

HUMAR, Miha, **POHLEVEN, Franc**. Influence of the copper-ethanolamine solutions pH value on copper fixation in wood. *Wood research*, 2007, vol. 52, no. 4, str. 29-35.

ELERŠEK, Tina, KOSI, Gorazd, TURK, Tom, **POHLEVEN, Franc**, SEPČIĆ, Kristina. Influence of polymeric 3-alkylpyridinium salts from the marine sponge Reniera sarai on the growth of algae and wood decay fungi. *Biofouling (Chur Switz.)*, 2008, no. 2, vol. 24, str. 137-143.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Vrednotenje zemljišč in gospodarjenje**
Course title:	Land Evaluation and Management

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**20**	**10**			**190**	**10**

Nosilec predmeta / Lecturer:	**Franc Lobnik**, Anka Lisec, Hubert Wiggering, Mark Kibblewhite

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij. Predznanje iz biotehniških, naravoslovnih in tehniških ved.	Enrolment in doctoral study. Knowledge from the field of biotechnical, natural and technical sciences

Vsebina:	**Content (Syllabus outline):**
Zahteva po trajnostnem upravljanju z zemljišči in po zaščiti tal postaja vse pomembnejša po vsem svetu. Poseg človeka v podeželski prostor bi moral biti v skladu s tremi osnovnimi stebri trajnostnega razvoja, ki vključujejo družbeno, gospodarsko in okoljsko komponento. Cilj predmeta je predstaviti povezavo med človekom in naravo v prostoru, ki jo pomembno odločajo parametri biotopa: geolitološka podlaga, relief, klima in hidrosfera, ki preko flore in favne, naravne in koristne, omogočajo človeku preživetje.	The need for sustainable land management and soil protection is becoming more and more important all over the world. Human intervention in the rural areas should be in compliance with the basic three pillars of sustainable development, which includes social, economic and environmental components. The objective of the course is to interpret the connection between a human and nature in the space, which is importantly determined by the elements of biotope: geolithological base, relief, climate and hydrosphere, which through the florae and

Vsebine: Tla kot naravni vir-definicije. Nastanek tal. Tlotvorni dejavniki in procesi, tla kot trifazni sistem. Kategorizacija zemljišč na osnovi potencialne rabe in naravnih danosti. Degradacijski procesi v tleh (erozija, zmanjšanje organske snovi, onesnaževanje, pozidava, zbitost tal, zmanjšanje biodiverzitete, zaslanjevanje). Principi in metode gospodarjenja na zemljiščih različnih tipov tal. Principi, tehnike in metode vračanja (rekultivacije) zemljišč v naravne oblike in temu prilagojenega gospodarjenja. Zaraščanje kmetijskih zemljišč, principi, tehnike in metode nove sonaravne rabe. Spreminjanje rabe kmetijskih zemljišč kot posledica procesa urbanizacije v Sloveniji. Vplivi različnih dejavnikov (stvarne pravice in drugi pravni vplivi; naravni dejavniki, kot so lastnosti tal, klima, relief; oddaljenost od večjih središč in naselij, infrastrukture ipd.) na trg in tržno vrednost kmetijskih zemljišč. Ekonomski in okoljevarstveni učinki izkoriščanja naravnih virov (glinokopi, peskokopi kamnolomi) in koncepti njihove sanacije (rekultivacije). Uporaba zemljišč v rekreacijske namene. Vrednotenje zemljišč ob posegih v prostor za različne uporabnike. Presoja vplivov na okolje; elementi, tehnike, napovedi in vrednotenje (rangiranje vplivov). Principi,tehnike in metode varovanja najboljših kmetijskih zemljišč. Uporaba talnega informacijskega sistema za vrednotenje tal kot naravnega vira, rabo v kmetijstvu in gozdarstvu ter pri prostorskem planiranju na ravni države, regije, občine, in projektnih odločitev. Interpretacija laboratorijskih podatkov (fizikalnih, kemijskih, biotičnih), dobljenih iz vzorcev terenskih preiskav. Sistem zemljiške administracije in zemljiškega informacijskega sistema, njuna vloga pri upravljanju zemljišč; metode spremljanja spremembe rabe zemljišč. EU in slovenska zakonodaja na področju varovanja in rabe tal, okoljski standardi in normativi.	fauna, natural and advantageous, enable the survival of human. Contents: Soil as natural source. Soil formation. Factors and processes of soil formation, soil as three-phased system. Land categorisation based on the land use potential and natural characteristics. Soil degradation processes (erosion, decline in organic matter, local and diffuse contamination, sealing, compaction, decline in bio-diversity and salinisation.). Management principles and methods of different soil types. Principles, techniques and methods of land re-cultivation in natural forms, the adjusted land management. Overgrowing of agricultural land, principles, techniques and methods of new sustainable use. Agricultural land use change as the consequence of urbanisation in Slovenia. The influence of different factors (material rights and other legal factors, natural factors, such as soil characteristics, climate, relief, distance to bigger centres, settlements and infrastructure etc.) on land market and market value of agricultural land. Economic and environmental effects of natural sources (clay pits, sand pits, stone pits) and concepts of their sanitation (re-cultivation). Land use for the purpose of recreation. Land evaluation for the purpose of intervention in the space for different users. Environmental assessment; elements, techniques, predictions and assessment (ranging of influences). Principles, techniques and methods for protection of qualitative agricultural land. The use of soil information system for the purpose of soil evaluation as the natural source, on the fields of agriculture and forestry and spatial planning at the state, regional and municipal levels, and project decisions. Interpretation of laboratory data (physical, chemical and biotical) based on the samples acquired in the terrain work. Land administration system and land information system, their role for land management; methods for monitoring land use change. European and Slovenian legislation in the fields of soil protection and land use, environmental standards and norms.

Temeljni literatura in viri / Readings:

Rowel,D.,R. 1996. *Soil Science*. Longman.
Briggs, D., Smithson, P., Addison, K., Atkinson, K. 1998. *Fundamentals of the Physical Environment*. Routledge, New York.
Bernhardsen T. 1999. *Geographic Information Systems. An Introduction*. John Wiley&Sons, Inc. New York.
Heywood.I., Cornelius, S., Carver, S. 2006. *An Introduction to Geographical Information Systems*. Pearson Education Limited, Harlow.
McRae. 1988. *Practical Pedology, Studying Soils in the Field*. Ellis Horwood Limited, Chichester.
Francis, C., Butler. C., Kong, L. 1990. *Sustainable Agriculture in Temperate Zones*. John Wiley&Sons, Inc. New York.
Taylor A.G., Gordon J.E., Usher M.B. 1996. *Soils, Sustainability and the Natural Heritage*. HMSO,
Edinburgh.
Morris, P., Therivel R. 1996. *Methods of Environmental Impact Assessment*. UCL Press, London.
Larsson, G. 1997. *Land management – public policy, control and participation*. Byggforskningsradet, Stockholm.
Helming, K., Wiggering,H. 2003. *Sustainable Development of Multifunctional Landscapes*. Springer-Verlag Berlin.
Lobnik. F, *sodelavci, Študijski pripomocki za študente na CD-ju.*
Digitalna pedološka karta *v merilu 1: 25 000*
Digitalna pedološka karta *v merilu 1: 250.000*

Cilji in kompetence:

Tla nastajajo zelo počasi in se zaradi različnih vplivov razvijejo v avtomorfna, hidromorfna, halomorfna in subakvalna. To pa pomeni, da je raba zemljišč (tal) omejena in je sonaravno gospodarjenje z njimi pomemben proces ohranjanja naravnih virov. Študent spozna dejavnike in procese nastajanja tal in njihovo multifunkcionalnost. Spozna osnove ekologije tal. Seznani se s parametri in indikatorji kakovosti tal in vrednotenja zemljišč pri različni rabi. Spozna tehnike presoje vplivov na okolje, metode upravljanja in nadzora rabe zemljišč. Spozna podatkovne baze o tleh (TIS-talni informacijski sistem) in zemljiščih ter njihovo uporabo v kombinaciji z drugimi bazami (GIS) za vrednotenje prostora in gospodarjenja z zemljišči.

Objectives and competences:

Soil and land formation is a long lasting process; due to different influences soil are being developed into automorphic, hydromorphic, saline and subaqutic soils. As the consequence, the land (soil) use is limited and its sustainable management is an important protection process of natural sources. Student gets knowledge about factors and processes of soil formation and its multifunctionality. He/she becomes familiar with basics of soil ecology. He/she gets knowledge about the parameters and indicators about soil quality and for land evaluation of different use. Student becomes familiar with the environmental assessment techniques, land management methods and land use control. He/she gets insight into soil databases (soil information system) and land databases, their use in combination with other databases (GIS) for evaluation of the space and land management.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje pridobijo teoretična in praktična znanja. Prenos znanj v prakso, kreacija razvoja in raziskav.	Knowledge and understanding: The students obtain theoretical and practical knowledge. Transfer the knowledge into practice, creation of new development and research.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Poleg predavanj, ki vključujejo multimedijske pripomočke (ppt, video, spletne strani, izvedeni projekti) so sestavni del tudi seminarji in vaje, ki od študenta zahtevajo individualno delo in skupinsko diskusijo.	Lectures with multimedia support and seminars, exercises which require individual work and group discussion.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
-seminar - izpit	50% 50%	- seminar - exam

Reference nosilcev / Lecturer's references:

Franc Lobnik:

1. ZUPAN, Marko, EINAX, Jürgen W., KRAFT, Jörg, **LOBNIK, Franc**, HUDNIK, Vida. Chemometr characterization of soil and plant pollution: Part 1: Multivariate data analysis and geostatistical determination of relationship and spatial structure of inorganic contaminants in soil. *Environ. sci. pollut.*
res. int., 2000, vol. 7, no. 2, str. 89-96, graf. prikazi.

2. SUHADOLC, Marjetka, SCHROLL, Reiner, HAGN, Alexandra, DÖRFLER, Ulrike, SCHLOTER, Michael, **LOBNIK, Franc.** Single application of sewage sludge - Impact on the quality of an alluvial agricultural soil. *Chemosphere (Oxford)*. [Print ed.], 2010, vol. 81, no. 11, str. 1536-1543, ilustr. http://dx.doi.org/10.1016/j.chemosphere.2010.08.024, doi: 10.1016/j.chemosphere.2010.08.024.

3**.** PINTAR, Marina, VELIKONJA BOLTA, Špela**, LOBNIK, Franc**. Nitrogen isotope enrichment factor as an indicator of denitrification potential in top and subsoil in the Apače Valley, Slovenia. *Aust. J. Soil Res.*, 2008, vol. 46, no. 8, str. 719-726, ilustr.

Anka Lisec

1. **LISEC, Anka**, PINTAR, Marina. Conservation of natural ecosystems by land consolidation in the rural landscape. *Acta agric. Slov.*. [Tiskana izd.], 2005, let. 85, št. 1, str. 73-82, ilustr.

2. **LISEC, Anka**, FERLAN, Miran, **LOBNIK, Franc,** ŠUMRADA, Radoš. Modelling the rural land transaction procedure. *Land use policy*. [Print ed.], 2008, letn. 25, št. 2, str. 286-297, graf. prikazi.

3. **LISEC, Anka**, FERLAN, Miran, ŠUMRADA, cquisition and expropriation of real property for the public benefit in Slovenia. *Land use policy*. [Print ed.], 2013, letn. 32, str. 14-22, ilustr., doi: 10.1016/j.landusepol.2012.10.004.

Mark Kibblewhite

1. KIBBLEWHITE, Mark., Rubio, J.L., Kosmas, C., Jones, R., Arrouays, D., Huber, S. and Verheijen, F. (2007) Environmental assessment of soil for monitoring desertification in Europe.

Eighth Session of the Conference of the Parties (COP7) to the United Nations Convention to Combat Desertification (UNCCD), Madrid, Spain, September 2007. 2. Morvan, X., Saby, N., Arrouays, D., Le Bas, C Jones, R.J.A., Bellamy, P., Stephens, M.,

2. KIBBLEWHITE, Mark.G. (2007) Soil monitoring in Europe: a review of existing systems and requirements for harmonisation. Science of the Total Environment (Accepted for publication).

3. **KIBBLEWHITE, Mark**.G., Ritz, K. and Swift R.S. (2007) Soil health in agricultural systems Phil. Trans. Royal Society, Series B. **prof. dr. Hubert Wiggering:** 1. Helming, K. ; Tscherning, K. ; König, B. ; Sieber, S. ;

Hubert WIGGERING

1. WIGGERING, Hubert. ; Kuhlman, T. ; Wascher, D. ; Perez-Soba, M. ; Smeets, P. ; Tabbush, Dilly, O. ;
Hüttl, R.F. ; Bach, H. (2008): Ex ante impact assessment of land use change in European regio the
SENSOR approach. - In: Helming, K. [Hrsg.] ; Pérez-Soba, M. [Hrsg.] ; Tabbush, P. [Hrsg.]: Sustainability
impact assessment of land use changes: 77-105; Berlin (Springer).

2. Helming, K. ; Kuhlman, T. ; Wascher, D. M. ; Perez-Soba, M. ; Sieber, S. ; Tabbush, P. ; Dilly ; Bach, H. ; Tscherning, K. ; König, B. ; Müller, K. ; **WIGGERING, Hubert**. (2007): Land use functionality as a frame
for impact assessment. - In: Knierim, A. [Hrsg.] ; Nagel, U. J. [Hrsg.] ; Schäfer, C. [Hrsg.]: Managing
Economic, Social and Biological Transformations : Proceedings of the First Green Week Scienti
Conference: 33-44; Weikersheim (Margraf).

3. **WIGGERING, Hubert.** ; Dalchow, C. ; Glemnitz, M. ; Helming, K. ; Müller, K. ; Schultz, A. ; Stachow, U. ; Zander, P. (2007): Indicators for multifunctionality impacts in landscapes. - In:
25 years of landscape ecology : scientific principles in practice ; proceedings of the 7th IALE W
Congress, 8 - 12 July, Wageningen, The Netherlands, July, 2007: 817-818; Wageningen (IALE).

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**ZAŠČITA HIDROSFERE**
Course title:	**Protection of Hydrosphere**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**10**	**-**			**210**	**10**

Nosilec predmeta / Lecturer:	**Jože Panjan**, Boris Kompare

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij.	Enrollment in the doctoral study programme.

Vsebina:	**Content (Syllabus outline):**
Procesi (samo)čiščenja v naravi, na čistilnih napravah in kanalskih sistemih in njihova inženirska obravnava. Masna bilanca snovi in osnove inženirske limnologije Kriteriji za zaščito voda (količina vode, kakovost, kisik, hranila…) Osnove modeliranja kakovosti rek, jezer, morja, bilanca kisika, hranil, evtrofnost. Inženirske metode povezovanja naravnih procesov (samočistilne sposobnosti narave) z umetno vodenimi procesi v čistilnih napravah in drugih umetno ustvarjenih sistemih. Problematika hidrodinamične disperzije polutantov v tekočih in mirujočih vodah. Metode zaščite in umetnega bogatenja	Processes of (self) cleaning in nature, wastewater treatment plants, sewage systems and their engineering evaluation Mass balance and basics of engineering limnology Criteria for water protection (water quantity, quality, oxygen content…) Basic modelling for quality of rivers, lakes, seas, oxygen balance, eutrophication. Engineering methods for connecting natural processes (natural selfcleaning ability) with artificial conducted processes in wastewater treatment plants and other artificially created systems Problems of hydro-dynamical dispersion of pollutants in running and standing waters Protection methods and artificial enrichment of

potalnice Pomen vključevanja naravnih samočistilnih sposobnosti voda in zemljine pri načrtovanju vodovarstvenih del. Obravnava in koncipiranje sistemov za zaščito voda in njihov vpliv na kakovost voda (razbremenjevanje, zadževanje, izpusti v morje, sanacija jezer in akumulacij).	groundwater Importance of incorporating natural water self-cleaning and soil for planning water treatment works Concepts of water protection and their influence on water quality (owerflow -discharge, retaining – stormwater tanks, releases to the sea, sanitation of lakes and accumulations).

Temeljni literatura in viri / Readings:

Imhoff K., Imhoff K. R. (1999), Taschenbuch der Stadentwaesserung, 28. Auflage, Oldenbourg Verlag, Muenchen , Wien, 442 strani.
Degremont, I. (2007), Water Tretment Handbook, Lavoisier Publishing, Paris, 1928 strani. (izbrane vsebine)
Lee, C., C, (2007), Handbook of environmental engineering calculations, McGraw Hill, New York, 1770 strani (izbrane vsebine)
Shamsi, U., M., (2005), GIS Application for Water, Wastewater and Stormwater Systems, Taylor&Francis Group, Boca Raton, London, New York, Singapure, 413 strani
Hosang, W., Bischof, W., (1998), Abwassertechnik, B.G. Teubner Stuttgart, Leipzig, 724 strani.
Gerald, T.O. (1983), Mathematical Modelling of Water Quality, John Wiley & Sons, 518 strani.
Panjan, J., (2008) Zaščita voda (skripta), 128 strani.
Panjan, J., (2008) Količinske in kakovostne lastnosti voda, skripta 95 strani.

Elektronski viri:
spletne strani s podatkovnimi bazami, predvsem DIKUL, CTK in NUK, UL FGG in IZH v Power Point in pdf
svetovni splet

Cilji in kompetence:	**Objectives and competences:**
seznanitev s temeljnimi načeli, osnovnimi metodami, modeli in tehnikami zaščite hidrosfere spoznavanje metode ekološkega modeliranja in prognoziranja kakovostnih sprememb v rekah, jezerih, morju in podtalnici zaradi antropogenih in naravnih vplivov. optimiziranje ekološke odločitve in rešitve. **Kompetence**: zna uporabljati baze podatkov, in drugo področja okolja pri izdelavi disertacije.	Acquaintance with basic principles, methods, techniques and models for protection of hydrosphere Acquaintance with method of ecological modelling and forecast of quality changes in rivers, lakes, sea and groundwater due to anthropogenic and natural influences Optimizing ecological decisions and solutions

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: **da** študent razume pogoje in zakonitosti in zna zasnovati rešitve in predlagati najboljše variante. zna izdelati in uporabljati matematične modele, pripraviti osnutek rešitev in jih zna komentirati in inženirsko ovrednotiti.	Knowledge and understanding:

Metode poučevanja in učenja:	**Learning and teaching methods:**
Uvodn(o)a predavanja, seminarske vaje za utrditev vsebine predavanj in s praktičnimi primeri dela, ter izdelava individualne seminarske naloge na izbrano temo.	Lectures, exercises with practical examples. Preparation of seminar with selected topic

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Zagovor seminarske naloge na izbrano temo.	60 %	Seminar
Ustni izpit, ki obsega teoretični in praktični del (vsebino predavanj ter obvezne in priporočene literature), ko študent ne opravi prvič zagovora seminarske naloge s pozitivno oceno.	40 %	Oral exam

Reference nosilca / Lecturer's references:

DREV, Darko, SLANE, Mitja**, PANJAN, Jože**. Assesment Load in Lake Cerknica with Nitrogen and Phosphorus. *Wasserwirtschaft*, 2009, vol. 99, issue 12, str. 32-37.
PANJAN, Jože. Die Messung von Partikelgrößen und ihre Anwendung bei Flockungs- und Absetzprozessen. *KA, Wasserwirtsch. Abwasser Abfall*, marec 2006, letn. 53, št. 3, str. 260-264, graf. prikazi.
PANJAN, Jože. Analyse der Einflüsse auf Sedimentation und Flotation = Analysis of the influences on sedimentation and flotation processes. *Wasserwirtschaft*, 1988, let. 78, št. 4, str. 161-164.
KOMPARE, Boris. Estimating environmental pollution by xenobiotic chemicals using QSAR (QSBR) models based on artificial intelligence. *Water sci. technol.*, 1998, vol. 37, no. 8, str. 9-18, graf. prikazi.

PANJAN, Jože, BOGATAJ, Marija, **KOMPARE, Boris**. Statistična analiza gospodarsko enakovred-nih nalivov = Statistical analysis of the equivalent design rainfall. *Stroj. vestn.*, 2005, letn. 51, št. 9, str. 600-611.

KOMPARE, Boris, TODOROVSKI, Ljupčo, DŽEROSKI, Sašo. Modeling and prediction of phytoplankton growth with equation discovery : case study - Lake Glunsø, Denmark. *Verh. - Int. Ver. Theor. Angew. Limnol.*, 2001, vol. 27, str. 3626-3631.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Zdravstvena ekologija**
Course title:	Health ecology

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje Clinical work**	**Druge oblike študija Other forms of study**	**Samost. delo Individ. work**	**ECTS**
20	**40**				**190**	**10**

Nosilec predmeta / Lecturer:	Marjan Bilban

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovenski jezik / Slovenian language**
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites for involvement and performance of study commitments:**
Vpis v doktorski študij	Enrolment in the doctoral programme

Vsebina:	**Content (Syllabus outline):**
Zdravje in okolje Interakcija človeka in okolja – zgodovinska in sodobna perspektiva Dejavniki tveganja v naravnem in delovnem okolju: biološki, fizikalni, kemični in biomehanični dejavniki in njihov vpliv na zdravje prebivalstva Osnovne zahteve za zdravo okolje: zrak, voda, živila,bivalno okolje Spremljanje indikatorjev razmer v okolju Opredelitev specifičnih vplivov na zdravje: ocena tveganja za zdravje, obvladovanje okoljskega tveganja za zdravje Javno zdravje Zdravstvene ekologija v izrednih razmerah Zdravstveno varstvo posebnih skupin prebivalstva Pomembnejši dejavniki delovnega okolja in vpliv na zdravje populacije	Health and the environment Interaction of man and environment – historical and contemporary perspectives Risk factors in the natural and occupational environments: biological, physical, chemical, and biomechanical factors and their impact on general public health Essentials of a healthy environment: air, water, foodstuffs, living environment Tracking the indicators of environmental conditions Determination of specific health effects: environmental health risk assessment and management Public health Health ecologies in emergency situations Healthcare for special population groups Important factors of the occupational environment

Kazalci negativnega zdravja Veliki javno zdravstvenim problemi Etika v javnem zdravju Seminarji: predstavitev specifičnih tem zdravstvene ekologije, na katerih je slušatelj opravljal dosedanje delo oz. raziskave s pokritjem najpomembnejše problematike zdravstvene ekologije slovenskega prostora (zrak, voda, delovno in bivalno okolje, sevanje, ergonomija…) Seminarji: predstavitev specifičnih tem zdravstvene ekologije, na katerih je slušatelj opravljal dosedanje delo oz. raziskave s pokritjem najpomembnejše problematike zdravstvene ekologije slovenskega prostora (zrak, voda, delovno in bivalno okolje, sevanje, ergonomija…)	and their influence on general public health Negative health indicators Major public health issues Ethics in public health Seminars: presentation of specific areas of health ecology in which the candidate had been working in the past or carried out research covering the most pressing issues of health ecology of Slovenia (air, water, occupational and residential environment, radiation, ergonomics ...)

Temeljni literatura in viri / Readings:

1. Bilban, M.: *Medicina dela za študente tehniške varnosti*. ZVD, Ljubljana 2005
2. Valić, F.: *Zdravstvena ekologija*. Medicinska naklada, Zagreb 2001
3. Yassi, A., et al.: *Basic Environmental Health*. Oxford University Press 2001
4. Eržen, I. (ur.): *Zdravje in okolje* – izbrana poglavja. MF UM, Maribor 2010
5. Čakš, T., et al.: *Priročnik iz higiene*. Inštitut za higieno, MF UL, Ljubljana 2002
6. Zaletel Kragelj, L., I. Eržen, M. Premik: *Uvod v javno zdravje*. Katedra za javno zdravje, MF UL, Ljubljana, 2007
7. Bilban, M.: *Medicina dela*. ZVD, Ljubljana 1999
8. Bilban, M.: *Medicina dela za zdravnike družinske medicine*. SZD – ZMDPŠ, Ljubljana 2002
9. Sušnik, J.: *Ergonomska fiziologija*, Didakta, 1992
10. Šarić, M., E. Žuškin: *Medicina rada i okoliša*, Medicinska naklada, Zagreb 2002
11. Vidaković, A.: *Medicina rada*. KCS – Institut za medicinu rada i radiološku zaštitu, Udruženje za medicinu rada Jugoslavije, Beograd 1996 in 1997

Cilji in kompetence:	**Objectives and competences:**
Študentke in študenti bodo spoznali vplive širšega in ožjega bivalnega okolja ter delovnega okolja na človekovo zdravje, bodisi v dobrem-pozitivnem, bodisi v slabem-negativnem smislu. Cilj predmeta je približati razumevanje pomena zagotavljanja osnovnih predpogojev za zdravo življenjsko in delovno okolje.	Students will learn about the positive and negative impacts of immediate and general residential and occupational environment on human health. The course aims to familiarize the student with the importance of essential prerequisites for a healthy residential and occupational environment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Namen predmeta je tudi študentom pomagati razumeti specifične metode dela pri odkrivanju in obvladovanju škodljivosti v delovnem in bivalnem okolju.	Knowledge and understanding: The course aims to help students understand the methods involved in the discovery and management of harmful factors in the occupational and residential environment.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah – reševanje konkretnih problemov, individualne naloge, spoznavanje realnih razmer.	Lectures, seminars, case studies, discussions, presentations, group work – solving real-life problems, individual assignments, familiarization with actual situations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelava in zagovor projekta	**100%**	Elaboration and presentation of a project

Reference nosilca / Lecturer's references:

BILBAN, Marjan, BILBAN-JAKOPIN, Cvetka. Incidence of cytogenetic damage in lead-zinc mine workers exposed to radon. *Mutagenesis*, 2005, let. 20, št. 3, str. 187–191.
BILBAN, Marjan. Mutagenetic Testing of Workers Exposed to Toulene-Diisocyanates During Plastics Production Process. *American Journal of Industrial Medicine* 2004, 45: str. 468–474.
BILBAN, Marjan, BILBAN-JAKOPIN, Cvetka, OGRINC, D. Cytogenetic tests performed on operating room personnel: the use of anaesthetic gases. *Int. arch. occup. environ. health*, 2005, let. 78, št. 1, str. 60–64.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**ZGOREVANJE IN PRENOS TOPLOTE V METALURŠKIH REAKTORJIH**
Course title:	**COMBUSTION AND HEAT TRANSFER IN METALLURGICAL REACTORS**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet / Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
25	**30**	**35**			**160**	**10**

Nosilec predmeta / Lecturer:	**Borut KOSEC**, Tomaž KOLENKO, Jakob LAMUT, Ladislav LAZIĆ

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski (Angleški) / Slovenian (English)
	Vaje / Tutorial:	Slovenski (Angleški) / Slovenian (English)

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogoj za vključitev v delo oziroma za opravljanje študijskih obveznosti je vpis v 1. letnik doktorskega študija.	The condition to attend in the teaching course and to perform study obligations is an entry in the first year of doctoral study.

Vsebina:	**Content (Syllabus outline):**
Spoznavanje vrste goriv in njihovih lastnosti. Glede na potrebe procesa določiti ustrezno razmerje goriva in zraka ali zraka z dodanim kisikom. Zgorevanje s čistim kisikom ter njegove prednosti in slabosti. Ugotavljanje količine toplote v plinih na izhodu iz reaktorja in ureditev ukrepov za izkoriščanje te toplote, ki se jo lahko vrača v proces ali pa porabi za druge namene. Ugotavljanje količine toplote odpadnih plinov iz sestave in temperature. Smotrnost več stopenjskega zgorevanja. Možnosti in načini izkoriščanja odpadne	Understanding the types of fuels and their properties. Depending on the needs of the process to determine the appropriate ratio of fuel and air or air with added oxygen. Special cases with pure oxygen combustion and its advantages and disadvantages. Determination of the amount of heat in the gas at the outlet of the reactor and regulation measures to exploit this heat, which can be returned to the process or for other purposes. Determination of the amount of heat from the waste gas composition and temperature. Functionality of multi-step combustion. Possibilities of waste heat

toplote. Študij prenosa toplote v izmenjalnikih toplote, ki je nato podlaga za izbiro in izračun izmenjalnikov toplote za ogrevanje zraka za zgorevanje.	exploitation. Study of heat transfer in heat exchangers, which form the basis for the selection and calculation of the heat exchanger for heating air for combustion.

Temeljni literatura in viri / Readings:

DESHMUKH, Y.V. *Industrial Heating – Principles, Techniques, Materials, Applications and Design.* London: Taylor & Francis, 2005.
GWYTHER, D.N. *Worked Examples: Heat Transfer, Fuels & Refractories, Fluid Flow and Furnace Technology, The Institution of Metallurgists, Monograph No. 12.* London: The Chameleon Press, 1985.
LINDON, C.T. *Heat Transfer*. New Jersey: Prentice-Hall, 1992.
KAMINSKI, D.A. in JENSEN, M.K. Introduction to Thermal and Fluid Engineering. New York: Wiley International Edition, 2005.
KAVIANY, M. *Principles of Heat Transfer.* New York: John Wiley & Sons, 2002.
LAZIĆ, L. *Numeričke metode u toplinskoj analizi.* Sisak: Sveučilište u Zagrebu, Metalurški fakultet, 2007.
MULLINGER, P. in JENKINS, B. *Industrial and Process Furnaces: Principles, Design and Operation*. Amsterdam: Butterworth-Heinemann, 2008.
OLOMAN, C. *Material and Energy Balances*. London: Imperial College Press, 2009.
Advances in Heat Transfer, Elsevier, ISSN: 9780-1237
Combustion and Flame, Elsevier, ISSN: 0010-2180
Gas, Wärme International, Vulkan Verlag, ISSN: 0368-0932
International Journal of Heat and Fluid Flow, Elsevier, ISSN: 0142-727x
International Communications in Heat and Mass Transfer, Elsevier, ISSN: 0735-1953
Progress in Energy and Combustion Science, Elsevier, ISSN 0360-1285

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta Zgorevanje in prenos toplote v metalurških reaktorjih je nadgraditi znanje študentov na področju zgorevanja in mehanizmov prenosa toplote, s poudarkom na aplikaciji znanj na področje metalurških reaktorjev. Študent se v okviru predmeta usposobi za kompleksno analizo pojavov s področja zgorevanja, prenosa toplote in snovi, metalurških reaktorjev ter njihovega vpliva okolje. Navaja se na samostojno in timsko raziskovalno in projektno delo ter uporabo strokovne literature in drugih - sodobnih virov informacij.	The aim of the course Combustion and heat transfer in metallurgical reactors is to build students' knowledge in the field of combustion and heat transfer mechanisms, with an emphasis on application of knowledge in the field of metallurgical reactors. Students in this course qualifies for analyzing complex phenomena in the field of combustion, heat and mass transfer, metallurgical reactors and their impact environment. Student gets used to independent and team research and project work and the use of literature and other - contemporary sources of information.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Pri predmetu Zgorevanje in prenos toplote v metalurških reaktorjih študent pridobi znanja za kompleksno analizo pojavov s področja zgorevanja, prenosa toplote in snovi, metalurških reaktorjev ter njihovega vpliva okolje. Študent pridobi znanja o ekološki naravnanosti posameznih tehnoloških procesov in postopkov. Nauči se pravilnega ravnanja z odpadki,	Knowledge and understanding: In the course Combustion and heat transfer in metallurgical reactors the student acquires knowledge useful for complex analyses of phenomenon from the fields of combustion, heat and mass transfer, metallurgical reactors, and their impact on the environment. Student acquires knowledge about the ecological orientation of individual technological processes and procedures. Learn the proper handling of waste, their impact on the

njihovim vplivom na obremenitev okolja ter se seznani z zakonskimi predpisi in standardi. Študent pri predmetu nadgradi pridobljena znanja s področja prenosa toplote in snovi, toplotne tehnike in industrijskih peči z uporabo eksperimentalnih in numeričnih modelov in simulacij. Študent se navaja na samostojno sprejemanje odločitev, povezuje in vrednoti analitične, eksperimentalno in numerično dobljene rezultate. Navaja se na samostojno in timsko delo, na projektno in raziskovalno delo, uporabo strokovne literature in sodobnih virov informacij. Pridobi sposobnosti za samostojno znanstveno raziskovalno delo, razvoj, organizacijo in vodenje industrijskih in temeljnih raziskovalnih projektov.	environment and become acquainted with the legislative regulations and standards. Student will deepen the acquired knowledge on the field of Heat and Mass transfer, Thermal engineering, and Industrial Furnaces through the use of experimental methods and numerical simulations. Student will get accustomed to reach decision individually. Link and asses analytical, experimental and numerical acquired results. Gets accustomed to individual and team, project and research work, and expert literature and modern information sources application. Student will acquire knowledge for individual scientific work, development, organization and conduction of industrial and fundamental scientific and research projects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, računske vaje in simulacije. Računalniške simulacije in eksperimentalno delo. Samostojno reševanje postavljenih problemov. Individualno raziskovalno in projektno delo.	Lectures. Exercises solving and simulations. Computer simulations and experimental work. Team and individual problem solving. Project work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način opravljanja izpita: ustni /pisni izpit – teorija in naloge, reševanje odprtih nalog (problemov), izdelava in uspešen zagovor projektnega dela predmet se zaključi z izpitom, ki ga sestavljata pisni in ustni del. Končno oceno predmeta sestavljajo: ocena projektnega dela (35 %) ocena pisnega dela izpita (30 %) ocena ustnega dela izpita (35 %) Opravljen ustni del izpita velja 3,5 ECTS kredita, opravljen pisni del 3 ECTS kredita ter opravljeno projektno delo 3,5 ECTS kredita. Opravljeno in uspešno predstavljeno projektno delo je pogoj za pristop k pisnemu in ustnemu izpitu.	35 % 30 % 35 %	Type of examination: oral /written examination – theory and calculation tasks, solving case studies, successfully presented project work the course ends with passing the examination which is composed of written and oral examination: The mark is composed of: the mark of project work (35%) the mark of written examination (30%) the mark of the oral examination (35%) Passed oral exam: 3.5 ECTS credit, Passed written exam: 3 ECTS credit and successfully presented project work: 3.5 ECTS credit. Completed and successfully presented project work is required before taking the written and oral exam.

Reference nosilca / Lecturer's references:

Borut KOSEC

KOSEC, Borut, BREZIGAR, Matjaž, KOSEC, Gorazd, BERNETIČ, Jure, BIZJAK, Milan. Heat treatment of cold formed steel forgings for the automotive industry. Journal of Achievements in Materials and Manufacturing Engineering, 2007, vol. 22, issue 2, pp. 87-90.

KOSEC, Borut, KARPE, Blaž, BUDAK, Igor, LIČEN, Metod, ĐORĐEVIĆ, Miroslav, NAGODE, Aleš, KOSEC, Gorazd. Efficiency and quality of inductive heating and quenching of planetary shafts. Metallurgy, 2012, vol. 51, no. 1, pp. 71-74.

ZORC, Borut, **KOSEC, Borut**, KOSEC, Ladislav, NAGODE, Aleš. Analysis of hot water pipeline system leakage. Engineering Failure Analysis, 2013, vol. 28, pp. 78-81.

Tomaž KOLENKO

JAKLIČ, Anton, VODE, Franci, **KOLENKO, Tomaž.** Online simulation model of the slab-reheating process in a pusher type furnace. Appl. therm. eng., 2007, vol. 27, no. 5-6, pp. 1105-1114.

KOLENKO, Tomaž, JAKLIČ, Anton, LAMUT, Jakob. Development of a mathematical model for continuous casting of steel slabs and billets. Math. comput. model. dyn. syst., 2007, vol. 13, no. 1, pp. 45-61.

KARPE, Blaž, KOSEC, Borut, **KOLENKO, Tomaž**, BIZJAK, Milan. Heat transfer analyses of continuous casting by free jet meltspinning device. Metallurgy, 2011, vol. 50, no. 1, pp. 13-16.

Jakob LAMUT

FALKUS, Jan, **LAMUT, Jakob**. Model testing of the bath flow through the tundish of the continuous casting machine. Archives of metallurgy and materials, 2005, jg. 50, no. 3, str. 709-718.

KOLENKO, Tomaž, JAKLIČ, Anton, **LAMUT, Jakob**. Development of a mathematical model for continuous casting of steel slabs and billets. Math. comput. model. dyn. Syst., 2007, vol. 13, no. 1, str. 45-61.

LAMUT, Jakob, FALKUS, Jan, JURJEVEC, Beno, KNAP, Matjaž. Influence of inclusions modification on nozzle clogging. Archives of metallurgy and materials, 2012, vol. 57, no. 1, pp. 319-324.

Ladislav LAZIĆ

LAZIĆ, Ladislav, VARGA, Augustin, KIZEK, Jan. Analysis of combustion characteristics in a aluminium melting furnace. Metallurgy,2005, vol. 44, no. 3, pp. 195-199.

CRNKO, Josip, JELIČ, Predrag, **LAZIĆ, Ladislav**. Operation indicators of the rotating-hearth furnace in restrictive manufacturing conditions. Metallurgy, 2007, vol. 46, no. 4, pp. 291-293.

LAZIĆ, Ladislav, Vladimir L. Brovkin, Vjacheslavi Gupalo, Elena V. Gupalo Numerical and experimental study of the application of roof flat-flame burners, Applied Thermal Engineering, 2011, vol. 31, no. 4, , pp. 513-520.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Znanost v družbenem in okoljskem kontekstu**
Course title:	Science in the social and in the environmental context

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30	**30**				**190**	**10**

Nosilec predmeta / Lecturer:	Andrej Ule

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis na doktorski študij	Registration in the doctoral study

Vsebina:	**Content (Syllabus outline):**
Predmet podaja osnovna znanja o medsebojnim prežemanjem znanosti in družbe, o etični in okoljski problematiki znanosti. Glavne teme so: - družbeni značaj znanstvenega znanja - znanost kot norma racionalnosti, kot produktivna sila, kot družbeni kapital - kritična razmerja med znanostjo/tehniko, demokracijo in civilno družbo - okoljska tveganja, znanost in družba - etične dileme razvoja znanosti in tehnike v kontekstu trajnostnega razvoja. Posamezni problemski sklopi bodo po uvodni razlagi obravnavani skozi analizo izbranih besedil.	The subject gives the basic knowledge on the mutual pervasion of science and society, on ethical and ecological problems of science. The main themes are: Social nature of scientific knowledge Science as the norm of rationality, as a productive force, and as a social capital Critical relationships between science/technology, democracy and civil society Ecological risks, science and society Ethical dilemmas of the development of science and technology in the context of sustainable development. Some individual problem topics will be discussed after the introductive explanation, by the analysis of the selected texts.

Temeljni literatura in viri / Readings:

Beck, Ulrich (1992): Risk Society. Towards a New Modernity. Sage: London.
Fuller, Steve (1999): The Governance of Science: Ideology and the Future of Open Society. Open Univ. Press: Buckingham/Phil.
Kitcher, Philip (2001): Science, Truth and Democracy. Oxford Univ. Press: Oxford.
Lacey, Hugh (1999): Is Science Value-Free? Values and Scientific Understanding. Routledge: London.
Strydom, Piet (2002): Risk, Environment and Society Ongoing Debates,Current Issues and Future Prospects. Open University Press: Buckingham.

Cilji in kompetence:	**Objectives and competences:**
Prepoznavanje družbene pomenljivosti znanstvenih spoznanj ter odgovornosti načrtovalcev za - posege v naravno, družbeno in kulturno okolje - razumevanje družbene, kulturne in etične problematike sodobnih znanosti - prevpraševanje vloge znanosti v rizični družbi.	Reconsideration of the social relevance of scientific knowledge and the responsibility of the planners for the Interventions in natural, societal and cultural environment Understanding of societal, cultural and ethical problems of modern science Request of the role of science in the risk society.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: razumevanje problematike, povezane z družbeno, kulturno in etično relevantnostjo znanstvenih in tehničnih dosežkov poznavanje povezav med epistemološko, socialno in etično problematike sodobnih znanosti sistemsko razumevanje dinamičnih procesov v naravi in družbi poznavanje medsebojnih razmerij med civilno družbo, znanostjo in tehniko.	Knowledge and understanding: Understanding of problems, connected with social, cultural and ethical relevance of scientific and technical achievements Knowledge of links between epistemological, social and ethical problems of modern science Systemic understanding of dynamical processes in nature and society Knowledge of the interrelationships between civil society, knowledge and technology.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarji	Lectures and seminars

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
naloge, ustni izpit	**30%** **70%**	coursework, oral examination

Reference nosilca / Lecturer's references:

Ule, A. (2006): Znanost, družba, vrednote. Maribor: Aristej
Ule, A. (2009): Science on the path towards new horizons and beyond. V: Žerovnik, E. Markič, O., Ule, A. (ur.). Philosophical Insights About Modern Science. New York: Nova Science Publ., str. ix-xxxi.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**ŽIVALSKE KUŽNE BOLEZNI IN OKOLJE**
Course title:	**INFECTIOUS ANIMAL DISEASES AND THE ENVIRONMENT**

Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Interdisciplinarni doktorski študijski program Varstvo okolja	**/**	**1, 2**	**/**
Interdisciplinary Doctoral Programme in Environmental Protection	**/**	**1, 2**	**/**

Vrsta predmeta / Course type	Izbirni predmet/ Elective course
Univerzitetna koda predmeta / University course code:	/

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
50					**200**	**10**

Nosilec predmeta / Lecturer:	**Milan Pogačnik**, Peter Hostnik

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vpis v doktorski študij	Enrollement in the doctoral programme

Vsebina:	**Content (Syllabus outline):**
Živalske kužne bolezni so vsekakor eden od pomembnejših faktorjev, ki ne vpliva samo na ekonomiko živinorejske proizvodnje, ampak na celotno družbeno dogajanje. Poznane so številne živalske kužne bolezni, nekatere med njimi, ki so nevarne tudi za človeka uvrščamo med zoonoze. V pogojih modernega življenja se zaradi uporabe hitrih vrst transporta in številnih migracij živali in ljudi povečujejo možnosti za širjenje živalskih kužnih bolezni. Opažamo pa tudi, da imajo klimatske spremembe izredno pomemben vpliv na pojavljanje kužnih bolezni, saj se v Evropi v zadnjih letih srečujemo z boleznimi, ki smo jih pred nekaj leti uvrščali v skupino eksotičnih bolezni. Nekatere med njimi so izrazito vezane na določene pogoje v okolju, ki lahko	Infectious animal diseases are certainly one of the more important factors influencing not only the economics of animal husbandry but also the society as a whole. We know several infectious animal diseases, some of which (zoonoses) pose a threat to humans as well. Modern living conditions that include fast transportation of animals and numerous migrations of animals and people increase the probability of the spread of infectious animal diseases. It has also been observed that climate change is a very important factor in the incidence of diseases: we are currently noticing diseases in Europe that were considered exotic a few years ago. Some are directly linked to certain factors in the environment that enable and influence their spreading. Pathogens are spread from animal

pogojujejo in omogočajo njihovo širjenje. Povzročitelji bolezni se iz okuženih živali na zdrave ne prenašajo samo z neposrednim kontaktom, ampak lahko v naravi nastopajo različni živi in neživi vektorji prenosa. Poznavanje tovrstnih vsebin je pomembno pri urejevanju razmerij v okolju in preprečevanju možnosti širjenja živalskih kužnih bolezni po teh poteh. Moderni principi epidemiologije obravnavajo sisteme dejavnikov tveganja, s pomočjo katerih lahko predvidimo poti širjenja živalskih kužnih bolezni in ocenimo stopnjo tveganja za posamezne primere. Slušatelji bi z vsebino tega predmeta pridobili osnovno znanje o pogojih v okolju, ki vplivajo na način in hitrost širjenja živalskih kužnih bolezni. Podana bo temeljna informacija o nekaterih najpomembnejših živalskih kužnih boleznih in zoonozah, predstavitev mehanizmov delovanja živalskih kužnih bolezni in njihove poti širjenja in prenašanja, pomen pogojev v okolju za širjenje živalskih kužnih bolezni in zoonoz (tla, zrak, voda, veter, vektorji). Prikazana bo epidemiologija nekaterih najpomembnejših živalskih kužnih bolezni (steklina, slinavka in parkljevka, BSE, bolezen modrikastega jezika, bolezen zahodnega Nila) in metode preprečevanja širjenja teh živalskih kužnih bolezni z ukrepi v okolju. Širjenje nekaterih bolezni je vezano na posamezne vektorje, kot so insekti , ptice, netopirji. Nekatere spremembe nastale zaradi posegov človeka v okolje lahko bistveno vplivajo na pojav teh bolezni.	to animal not only with direct contact, but also via living and non-living vectors in nature. Knowing these problems is imperative for successful regulation of environmental interactions and prevention of the spread of these diseases. The modern principles of epidemiology employ a system of risk factors that enables us to predict the spread of infectious animal diseases and assess the level of risk for individual cases. Students attending this course will obtain basic knowledge on the environmental conditions that impact the way and rate of the spread of infectious animal diseases. They will obtain basic information on the most important infectious diseases and zoonoses, their mechanisms of action, spread and transmission, as well as the importance of environmental factors for the spread of infectious animal diseases and zoonoses (soil, air, water, wind, vectors). Epidemiology of the most important infectious animal diseases will be shown (rabies, foot and mouth disease, BSE, bluetongue, West Nile virus) and the methods for the prevention of their spread with measures taken in the environment. Spreading of some diseases is linked to vectors such as insects, birds, bats, etc. Some human-induced changes of the environment can significantly impact the occurrence of these diseases.

Temeljni literatura in viri / Readings:

- Geering W.A., Forman A.J., Nunn M.J. (1995): Exotic diseases of animals. Vanberra, Australian goverment publishing service.
- Mc Ferran JB, McNulty MS (1993): Virus infections in birds. Amsterdam: Elsevier Science Publisher.
- Alexander DJ (2000). A rewiev of avian influenza in different bird species. Vet Microbiol 74: 3-13.
- Bear GM (2000). The natural history of rabies. 2nd edition, Boca Raton, CRC press.
- Dinter Z., Morein B. (1990): Virus infections of ruminants, Amsterdam, Elsevier science publishers
- King AA, GS Turner . Rabies: A Review. *J. Comp. Path* 1993, 10; 1-39.
- Schumacher et all. SAG-2 oral rabies vaccine. *J.Vet.Res.* 60 (1993), 459-462.
- Pastoret PP and Brocheir B. Epidemiology and elimination of rabies in Western Europe. *Vet. J.*, 156 (1998), 83-90.
- Geering WA, Forman AJ, Nunn ML *Exotic diseases of animals*. 1995; Australian Gov. Publish., Canberra.
- Wittmann. *Herpesvirus diseases of cattle, horses and pigs*. 1995, Kluwer Acad. Publish. Boston, London.
- Mann JA, Selleres RF. Foot and mouth disease Virus. In *Virus infection of ruminants*. Dinter Z(eds).1990, Elsevier sci Publ., Amsterdam, 503 - 517.
- Vries - AAF, Rotier PJM. Arteriviridae. In: *Virus infections of equines*. Studdert MJ (eds).

Elsevier,
Amsterdam, 1998, 169-201.

Cilji in kompetence:	**Objectives and competences:**
Izobraževalni cilj predmeta je podati osnovna znanja o povzročiteljih aktualnih živalskih kužnih boleznih, o pojavnosti in razširjenosti teh bolezni, o načinih odkrivanja in zatiranja teh bolezni ter vplivih teh bolezni kakot tudi metod zatiranja na okolje. Študent se bo seznanil z osnovnimi epidemiološkimi pristopi vplivov na širjenje živalskih kužnih ter z nekaterimi mehanizmi širjenja bolezni v okolje. Namen tega predmeta je spoznati nekatere aktualne kužne bolezni in vzpodbuditi razmišljanje o pristopih, ki omogočajo zavarovati okolje in človeka pred njihovimi škodljivimi vplivi ter vspodbuditi k povezovanju tehnoloških ali socioloških znanj z biomedicinskimi znanji.	The academic objective of the course is to provide students with basic knowledge on the common causative agents of infectious animal diseases, the incidence and prevalence of these diseases, methods for their detection and control, as well as the impact of both diseases and their treatment on the environment. Students will be familiarised with the basics of epidemiological approaches to the spreading of infectious animal diseases and some mechanisms of their spread in the environment. The aim of this course is to introduce the students to some topical infecitous diseases and encourage them to reflect on approaches that provide protection from their harmful effects to the environment and and to humans. We aim to encourage the students to integrate technological and sociological skills with biomedical methods.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Predmet povezuje znanja iz področja kužnih bolezni živali,epidemiologije in analize rizika z znanjem iz področja vplivov živali na okolje in okolja na živali	Knowledge and understanding: The subject connetc the kowledge of animal contagious diseases,epidemiology and risk analysis with knowledge of influence of animals on environement and environemet on animals.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- predavanja - literatura	- lectures - literature

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
- izdelava seminarske naloge - izpit	**80%** **20%**	- seminar paper - examination

Reference nosilca / Lecturer's references:

VENGUŠT, Gorazd, BIDOVEC, Andrej, **POGAČNIK, Milan**. Damage caused by large carnivores on domestic grazing animals in Slovenia = [Pregled škod velikih zveri na pašnih živalih v Sloveniji]. *Slov. vet. res.*. [English ed.], 2006, vol. 43, no. 4, str. 169-175.
JUNTES, Polona, PESTEVŠEK, Uroš, **POGAČNIK, Milan**. Morphologic and morphometric analysis of adrenal gland cortex of sheep grazing on pastures with the ground of electrofilter ash. *Int. j. environ. pollut.*, 2007, vol. 31, no. 1/2, str. 56-64.
POGAČNIK,Milan,TADIČ,Marko,PAVLAK,Marina,MALOVRH,Tadej,POSEDI,Janez,HOSTNIK,Peter,GOMBAČ,Mitja,WERNIG-MAURER,Jedrt,HROVATIN,Breda,ČADONIČ ŠPELIČ,Vida: Ocena tveganja za vnos bolezni modrikastega jezika(Blutongue) v R Slovenijo. Univerza v Ljubljani,Veterinarska fakulteta in Min.za kmetijstvo,gozdarstvo in prehrano-VeterinarskaUprava RS,Ljubljana,2008

HOSTNIK, Peter, RIHTARIČ, Danijela, GROM, Jože, MALOVRH, Tadej, TOPLAK, Ivan. Maintenance and control of vaccination belt along neighbouring rabies infected area. *Acta vet. (Beogr.)*, 2011, vol. 61, no. 2/3, str. 163-174

GRILC FAJFAR, Aleksandra, JENČIČ, Vlasta, MANKOČ, Sara, BARLIČ-MAGANJA, Darja **HOSTNIK ,Peter .**Genotyping of Slovenian infectious hematopoietic necrosis virus isolates based on the 'mid-G' region sequences of the glycoprotein gene. *Bull. Eur. Assoc. Fish Pathol.*, 2011, vol. 31, no. 2, str. 47-57.

RIHTARIČ, Danijela, **HOSTNIK, Peter**, GROM, Jože, TOPLAK, Ivan. Molecular epidemiology of rabies virus isolates in Slovenia 1994-2010. *Vet. microbiol.*. [Print ed.], 2011, no. 1/2, vol. 152, str. 181-186