

UČNI NAČRTI

interdisciplinarnega doktorskega študijskega programa

VARSTVO OKOLJA

2014

KAZALO

Obvezni metodološki predmet	5
Interdisciplinarno znanstveno raziskovalno delo	6
Temeljni predmeti	9
Ekologija z varstvom narave	10
Ekonomika in pravo okoljskega managementa.....	14
Kemija in tehnologija okolja	17
Krizni management	20
Medicina v izrednih razmerah	23
Okolje, zdravje in blagostanje	26
Okoljski in sociološki vidiki trajnostnega razvoja	30
Seizmologija in potresno inženirstvo	34
Tla in geologija okolja	39
Upravljanje s tveganji	43
Upravljanje z naravnimi in energijskimi viri	47
Zrak, klima in vode	51
Izbirni predmeti	55
Analizna kemija v kontroli okolja.....	56
Biogeokemijska kroženja.....	58
Bioindikacija in varstvo kopenskih ekosistemov	61
Biomonitoring.....	66
Ekofiziologija rastlin.....	69
Ekohidrologija.....	73
Ekologija podzemeljskih habitatov.....	76
Ekološki procesi v morju.....	78
Ekotoksikologija.....	81
Etični odnos do narave	84
Fitofarmacevtska sredstva in njihove alternative	87
Fiziologija v posebnih razmerah	91
Geokemija okolja.....	94
Geologija okolja.....	96
Geologija življenjskega okolja.....	98
Goriva, zgorevanje in okolje	100
Gospodarjenje z odpadki.....	103

Gozd in okolje	106
Hibridno modeliranje okoljskih sistemov	108
Industrijska ekologija	111
Informacijski pristopi v naravoslovju in tehniki	114
Interdisciplinarni vidiki varovanja okolja na podeželju	118
Inženirsko modeliranje ekoloških procesov v površinskih vodah	121
Kemijski procesi v okolju	124
Kovine v okolju	127
Kras in okolje	130
Mednarodnopravno varstvo okolja	134
Mikrobna ekologija	138
Mineralni materiali v kulturni dediščini	140
Načrtovanje okolju prijaznih proizvodov in tehnologij	143
Naravna tveganja v gorskem okolju	147
Nevarne snovi v tekstilijah	151
Obnovljivi viri energije	154
Ohranitveno gozdarstvo	158
Okolje, biovarnost in živalska produkcija	161
Okoljska epidemiologija	164
Okoljske politike med moralnim upravičenjem, ekonomsko analizo in politično uresničljivostjo	167
Podzemne vode	170
Politična ekologija	173
Požari in vpliv na okolje	176
Presoje okoljskih posegov in pokrajinska ranljivost	179
Prostor in okolje	183
Recikliranje kovinskih materialov	186
Remediacija tal	190
Spremembe okolja in rastline	193
Toksikokinetika zdravil za uporabo v veterinarski medicini v živalskem organizmu in okolju	196
Trajnostno razvojno usmerjene tehnologije izrabe podzemnega prostora	199
Umeščanje rizičnih/tveganih objektov v socialno okolje	203
Uporaba daljinskega zaznavanja	205
Varnost in zanesljivost v procesni tehniki	208
Varstvo krajine	210

učni načrti

Varstvo lesenih objektov kulturne dediščine	213
Vrednotenje zemljišč in gospodarjenje	216
Zaščita hidrosfere	220
Zdravstvena ekologija.....	223
Zgorevanje in prenos toplote v metalurških reaktorjih.....	226
Znanost v družbenem in okoljskem kontekstu.....	230
Živalske kužne bolezni in okolje	233

OBVEZNI 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

Jeziki /

Predavanja / Lectures: Slovenski /angleški

Languages:

Slovenian/ English

Vaje / Tutorial: /

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

Vpis v doktorski študij

Prerequisites:

Enrolment in doctoral studies

Vsebina:

Definicije znanstveno raziskovalnega dela, organizacija dela in dokazovanje hipotez. 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 klusterske analize in metode prikazane na konkretnih ekoloških znanstvenih in aplikativnih raziskavah v različnih ekosistemih.

Content (Syllabus outline):

Definitions of scientific research, organization of work and prove hypotheses. 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, analyses and synthesis, hypothesis testing and scientific explanation. Field ecological research using qualitative and quantitative samples. Multivariate and cluster analyses and methods showm in real ecological scientific and applied research in different ecosystems.

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.

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 processes in meteorological echnologies. Critical view to statistic methods, useful in the interpretation 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:

Kandidati bodo pridobili temeljna načela in osnovne metode in tehnike za raziskovalno delo. Študenti se bodo naučili pripraviti dobre projekte in dobre znanstvene članke.

Objectives and competences:

Candidates will acquire the core principles and the basic methods 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:

Znanje in razumevanje:

- Raziskovalno delo na področju varstva okolja
- Priprava projektov
- Pisanje znanstvenih člankov

Intended learning outcomes:

Knowledge and understanding:

- Research work on environment protection
- Project preparation
- Research articles

učni načrti

Metode poučevanja in učenja:

Predavanja z uporabo PP prezentacije Razprave na predavanjih Predstavitve seminarских nalog z razpravo
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Learning and teaching methods:

Lectures using PP presentation Lectures discussion Seminar presentation and discussion
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Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

pisni izpit projekt	40% 60%	Examination Project
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Reference nosilca / Lecturer's references:**Prof. dr. Mihael J. Toman:**

1. 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
2. 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.
3. **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.

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

Jeziki /

Languages:

Predavanja / Lectures:

Slovenski/ angleški

Slovenian/ English

Vaje / Tutorial:

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

Vpis v doktorski študij Varstvo okolja.

Prerequisites:

Enrolment in the doctoral study Environment protection.

Vsebina:

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 abiotične in biotične dejavnike, omejitve okolja, aklimatizacija in adaptacija, kompeticija in sukcesija). Atmosfera (zgradba, spremembe v Zemeljini zgodovini).

Celinske vode (abiotični in biotični dejavniki, stoječe in tekoče vode, omejujoči dejavniki biološke produkcije, življenski prostori in življenske združbe v vodnih telesih).

Kopensko okolje (osnovni biomi, značilnosti in

Content (Syllabus outline):

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 properties and diversity in Europe and Slovenia)

Radiation and climate (global environment on Earth,

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

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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

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.

Learning and teaching methods:

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	50% 50%	Exam: written Seminar
Oddano poročilo o opravljenih vajah od 6-10 (pozitivno) oz. 1-5 (negativno)		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.

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	EKONOMIKA IN PRAVO OKOLJSKEGA MANAGEMENTA
Coursetitle:	Economic and Law of Environmental 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: 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
7	3				240	10

Nosilec predmeta / Lecturer: Bogomir Kovač

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

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

Ni posebnih pogojev.

Prerequisites:

No special requirements

Vsebina:

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.
 4. Slovenski okoljski pravni red. Okoljska regulacija 2000-2010. Okoljske strategije in politike. Koncept

Content (Syllabus outline):

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

<p>zelene reforme.</p> <p>5. Institucionalno okolje in okoljski managerski sistemi. Managerianje okoljskih sistemov. Trajnostni razvoj in organizacije. Kontingetno vrednotenje. Vrednost vsakdanjega življenja s pravnega vidika.</p> <p>6. Managerska orodja za okoljski ekonomski in pravni management. Strateško vrednotenje in obvladovanje tveganj. Komuniciranje z deležniki.</p> <p>7. Ključne okoljske teme in managiranje rešitev. Onesnaženje, biodiverziteteta, klimatske spremembe in energetika. Okoljska prihodbnost in tragedija skupnega. Vpliv ekonomije in prava na managerske okoljske politike.</p>	<p>Market Mechanism</p> <p>4. Slovenian Legal Framework for Environmental Protection. Environmental Regulation 2000-2010. Environmental Strategies and Public Policies. Green Reform Concept.</p> <p>5. Institutional Environment and Environmental Managerial Systems. Managing Environmental Systems. Organizations and Sustainable Development. Contingency Valuation. Legal Aspect of Statistical Value of Life.</p> <p>6. Managerial Tools for Environmental Economics, Law and Management. Strategic Evaluation and Risk Assessment. Stakeholder Communication.</p> <p>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.</p>
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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:

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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

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.

Learning and teaching methods:

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:

Pisni izpit
Seminarsko delo

Delež (v %) /
Weight (in %)

70%
30%

Assessment:

Written assignment
Paper assignment

Reference nosilca / Lecturer's references:

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, Californian 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:

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:

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

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

Diplomanti študijskih programov tehniške ali naravoslovne smeri

Prerequisites:

Finished second level of university study in technical or natural sciences.

Vsebina:

- *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, koagulacija in flokulacija,*

Content (Syllabus outline):

- *Mass and energy transfer. Environmental chemistry. Ecosystem, sustainability, human impacts, engineering approaches, 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. Hydrological cycle, resources – groundwater and surface water and their treatment-coagulation,*

<p>usedanje, filtracija, desinfekcija. <i>Procesne vode</i>: hladilne vode, energetske vode (napajalne vode, kotlovne vode, kondenzat). <i>Odpadne vode</i>: zbiranje odpadnih vod, vrste in karakteristike odpadnih vod, čiščenje odpadnih vod. <i>Obdelava in odlaganje blata iz čistilnih naprav</i>: stabilizacija, zgoščevanje in odvodnavanje, kompostiranje, deponije, sežig. <i>Zakonodaja</i>.</p> <ul style="list-style-type: none"> – <i>TRDNI ODPADKI. Komunalni trdni odpadki</i>: zbiranje, možnosti dispozicije, sanitarne deponije, zmanjšanje volumna pred odlaganjem. <i>Recikliranje odpadkov</i>: separacija pri viru, procesi seaparacije trdnih odpadkov. <i>Nevarni odpadki</i>: problematika, procesiranje, ravnanje, transport, možnosti recikliranja, naprave za upravljanje z nevarnimi odpadki: izbira lokacije, incineratorji, deponije. <i>Zakonodaja</i>. – <i>ZRAK. Onesnaženje zraka</i>: tipi onesnaženja, viri onesnaženja, primarni in sekundarni polutanti, vpliv na zdravje ljudi, vegetacijo, živali, materiale in atmosfero. <i>Meteorologija in onesnaženje zraka</i>: horizontalna in vertikalna disperzija polutantov, atmosferska disperzija, čiščenje atmosfere. <i>Kontrola onesnaženja zraka</i>: korekcije pri viru nastajanja, recikliranje, čiščenje. <i>Zakonodaja</i>. 	<p>flocculation, sedimentation, filtration, disinfection. <i>Process water</i>: steam production and cooling water treatment. <i>Wastewater</i>: collection, types and characteristics, treatment. <i>Sludge treatment and disposal</i>: stabilisation, thickening, dewatering, composting, landfilling, vitrification, incineration. Legislation.</p> <ul style="list-style-type: none"> – <i>SOLID WASTE: municipal solid waste</i> collection and disposal, resource recovery. <i>Hazardous waste</i> processes and handling, resource recovery alternatives, management facilities, regulatory aspects. Remediation of contaminated soils and groundwater. Legislation. – <i>AIR. Pollution</i>: types and sources, primary and secondary pollutants, influence on humans, vegetation, animals, materials and atmosphere. <i>Meteorology and air pollution</i>: horizontal and vertical dispersion of pollutants, atmospheric dispersion, measurement of air quality, treatment. <i>Air pollution control. Legislation</i>. – <i>Practical case discussions</i>. The environmental issues in chemical industry.
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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 procesov v naravnem okolju, čistilnih napravah ter deponijah.

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.

Predvideni študijski rezultati:

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.

Intended learning outcomes:

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:

predavanja, konzultacije, projektno delo, seminar

Learning and teaching methods:

Lectures, consultations, project work, seminar

	Delež (v %) / Weight (in %)	Assessment:
Načini ocenjevanja:		
– pisni in ustni izpit		– 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	40%	
	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](https://doi.org/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](https://doi.org/10.1080/09593330.2010.536785).

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Krizni management
Course title:	Crisis 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 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
10	30			15	195	10

Nosilec predmeta / Lecturer: Vlado Dimovski

Jeziki / Languages:	Predavanja / Lectures:	Angleški /slovenski English/ Slovenian
	Vaje / Tutorial:	Angleški/slovenski English/ Slovenian

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral studies.

Vsebina:

Sodobni pristopi kontingenčnega planiranja:

- Graditev scenarijev
- Krizno planiranje

Analiza trendov in diskontinuitete

Opredeleitev področja kriznega managementa:

- Preprečitev
- Priprava
- Omejitev

Aktivacija kriznega tima in njene specifike

Odprta komunikacija

Služnostno vodenje deležnikov

Splošne značilnosti kriz (nesreč) in odzivanja nanje: endemičnost, neprekinjenost, kompleksnost, transnacionalnost, teorije odzivanja na krizo

Content (Syllabus outline):

Recent extensions of contingency planning:

- Building scenarios
- Crisis planning

Trend and discontinuities analysis

Analysis of crisis management:

- Prevention
- Preparation
- Containment

Activating the crisis management team

Crisis team management

Open communication

Servant leadership through meeting safety and emotional needs of stakeholders

General characteristics of crises (disasters) and of

(funkcionalni pristop, simbolni pristop).
Kognitivno-institucionalni pristop k proučevanju krize (nesreče): večstopenjski pristop, analitične teme.

Sistemski vidiki odzivanja na krize (nesreče): sistemske in organizacijske rešitve na področju kriznega upravljanja in vodenja (upravljanja ob nesrečah), v izbranih državah in mednarodnih organizacijah.

Medorganizacijsko sodelovanje: nujnost in načini medorganizacijskega sodelovanja pri kriznem upravljanju in vodenju, koordinacija, tipični problemi.

Funkcionalni vidiki odzivanja na krizo (nesrečo).
Komuniciranje v krizi: teorije o komuniciranju v krizi, medijizacija kriz, taktike in strategije komuniciranja, pretok informacij v krizi.

crisis response: endemity, continuity, transnationality; crisis response theories (functional approach, symbol approach).

Cognitive-institutional approach to crisis (disater) research: multi-level approach, analytical themes. System aspects of crisis (disaster) response: system and organizational solutions in the field of crisis (disaster) management in the selected countries and international organizations.

Interorganizational cooperation: necessity and ways of interorganizational cooperation in crisis management, coordination, typical problems.

Functional aspects of crisis (disaster) response. Crisis communication: crisis communication theories, mediazation of crisis, crisis communication tactics and strategies, crisis (disaster) information flow.

Temeljni literatura in viri / Readings:

Brändström, A. & Malešič, M. (Eds.). (2004). *Crisis Management in Slovenia: Comparative Perspectives*. Stockholm: CRISMART.

Boin, A., Hart, P., Stern, E., & Sundelius, B. (2005). *The Politics of Crisis Management. Public Leadership under Pressure*. Cambridge: Cambridge University Press.

Crandall, W. R., Parnell, J. A., & Spillan, J. E. (2014). *Crisis Management: Leading in the New Strategy Landscape*. SAGE Thousand Oaks

Daft, R. L. & Marcic, D. (2013): *Management: The new workplace*. Australia: South-Western Cengage Learning.

Rosenthal, U., Boin, A. R., & Comfort, L. K. (2001). *Managing Crises. Threats, Dilemmas, Opportunities*. Springfield: Charles C Thomas.

Cilji in kompetence:

Študentke in študentje bodo na osnovi teoretičnih znanj in empiričnih podatkov usposobljeni za ravnanje v kriznih situacijah.

Poudarek bo na poučevanju koordinacijskega in komunikacijskega managementa.

Izpostavljeno bo ključno razumevanje različnih vidikov kriznega managementa (ekološki, finančni, sociološki in kulturološki vidiki, učinek na sosesko, transport, situacija na trgu, reakcija konkurentov ipd.) in vključitve deležnikov (lastnikov, investitorjev, prebivalcev, politikov, lobistov ipd.).

Izpostavljena bosta sistemski in funkcionalni vidik kriznega managementa, v katerega se bodo na vajah, glede na svoj izobrazbeni profil ali svojo zaposlitev, aktivno vključevali študentke in študenti.

Objectives and competences:

Students will be equipped with theoretical and practical knowledge of crisis management.

Coordination and communication management skills are essential to manage complex crisis situations.

Understanding aspects of crisis management (ecological aspects, financial issues, social and cultural aspects, neighbourhood effect, infrastructure, transport, market situation, competitors reaction etc.) and stakeholder engagement (owners, investors, citizens, politicians, lobbyists etc.)

Special attention will be paid to the system and functional aspect of crisis management. Students will be actively involved in crisis management study according to their existing educational profile or employment.

učni načrti

Izdelati lasten načrt razvoja veščin in kompetenc kriznega managementa – t.i. integrirati teoretična znanja v uporabno vrednost za trajnostni razvoj.	Prepare a personal action plan of developing crisis management skills and competencies - integrate theoretical findings into practical added value for sustainable development.
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Predvideni študijski rezultati:

Znanje in razumevanje: Akcijska priprava raziskovalnega projekta/naloge in delo na znanstvenem članku
Veščina komuniciranja z deležniki v kriznih situacijah Sposobnost managerskih veščin za reševanje kriznih dogodkov

Intended learning outcomes:

Knowledge and understanding: Project action research preparation and work on scientific paper
Correct communication with stakeholders in the situation of crisis Managerial skills for solving crisis situation (technical, human, conceptual)

Metode poučevanja in učenja:

Predavanja z uporabo ppt/prezi Diskusije Pro et Contra in Sokratova metoda Seminarji (izdelava in predstavitev raziskovalnih nalog) Konzultacije

Learning and teaching methods:

Lectures using ppt/prezi Lecture discussion (Pro et Contra and Socrates method) Seminars (implementation and presentation of small research project) Consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pisni izpit	40%	Written examination
Seminarji (izdelava in predstavitev raziskovalnih nalog)	60%	Written seminary work with final presentation

Reference nosilcev / Lecturers references:

DIMOVSKI, Vlado, PINGER, Sandra, PETERLIN, Judita, UHAN, Miha, ČERNE, Matej, MARIČ, Miha. Napredni management, (Zbirka Maksima). 1. natis. Ljubljana: Ekonomska fakulteta, 2013. 280 str., ilustr. ISBN 978-961-240-259-4. ISBN 978-961-240-266-2. [COBISS.SI-ID 267302400]

DIMOVSKI, Vlado, ŠKERLAVAJ, Miha. A stakeholder theory approach to the organisational performance and influence of information-communication technology : model conceptualisation and testing. Economic and business review, ISSN 1580-0466, Oct. 2004, vol. 6, no. 3, str. 245-265, tabele; graf. prikazi. [COBISS.SI-ID 15125222]

DIMOVSKI, Vlado, JANEŽIČ, Matej, URŠIČ, Ivana, HODOŠČEK, Milan. Molecular interaction framework approach for modeling a learning organization. International journal of multidisciplinary thought, 2012, vol. 2, iss. 2, str. 97-103.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Medicina v izrednih razmerah
Course title:	Disaster medicine

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstvo okolja		1	
Interdisciplinary Doctoral Programme in Environmental Protection		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
20	30			20	180	10

Nosilec predmeta / Lecturer:

Radko Komadina

Jeziki /
Languages:

Predavanja / Lectures:	slovenski / angleški Slovenian / English
Vaje / Tutorial:	slovenski / angleški Slovenian / English

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral studies.

Vsebina:

Medicina v izrednih razmerah (disaster medicine) je nova veja medicine, ki se je razvila v zadnjih dveh desetletjih iz Disaster managementa in Emergency medicine v ZDA ob povečani nevarnosti mednarodnega terorizma in spremenjenega načina vojaškega delovanja. Ima splošni del (definicija medicinskega disastra, družbene krize, vojna, terorizem, množične nesreče), etični, socialni in psihološki vidiki disastra, javnozdravstveni vidiki na prehospitalsnem in hospitalnem nivoju, specifična obravnava posebno ogroženih skupin prebivalstva (otroci, nosečnice, starostniki), načrtovanje in izvajanje medicine v

Content (Syllabus outline):

Disaster medicine developed in past 20 years from coupling of disaster management with emergency medicine. From the US army the principle of damage control surgery was spread around the world in field of war surgery and individual multiple injured patient treatment. The student is familiar with the principles of disaster medicine (definitions of medical disaster, complex emergencies, field surgery, terrorism, mass casualty incidents), ethical, social and psychological aspects of medical disaster, with manmade and natural disasters; special assessment is dedicated to specific groups of population (children, women, and elderly

izrednih razmerah na nivoju lokalne skupnosti, države in mednarodnih organizacij. Snov predmeta obravnava tudi vojno kirurgijo (kirurgija omejevanja škode – damage control surgery), množične naravne nesreče, množične mirnodobne nesreče in nesreče ob terorističnih napadih. Ob prenosu izkušenj vojne v mirnodobno medicino se izpopolnjuje algoritem ukrepov ob masivni travmatski krvavitvi. Princip odziv medicine pri velikih nesrečah (MRMI - medical response to major incidents) omogoča pripravo racionalnih načrtov za ukrepanje v zdravstvenih zavodih ob masovnih nesrečah in drugih medicinskih katastrofah.

people) on prehospital and hospital level. In special part recent experiences from war surgery transmitted to multiple injured patient treatments with massive internal traumatic bleeding are presented with war surgical practicum. Medical response to major incidents principle and advanced trauma life support principle is presented for preparedness of health providers on individual and institutional level.

Temeljni literatura in viri / Readings:

- G.R. Cittone (ur): Disaster Medicine, 2006, Mosby
- D.E. Hogan, J.L. Burstein: Disaster Medicine, 2002, Lippincott Williams & Wilkins
- International Committee of Red Cross, Surgery for victims of war, spletna literatura www.icrc.org
- R. Komadina, V. Smrkolj: Osnove medicine v izrednih razmerah s kirurškega vidika. Celje, Splošna bolnišnica, 2009.

Cilji in kompetence:

Študent spozna principe disaster managementa, načrtovanja in ukrepanja ob množičnih nesrečah z zdravstvenega vidika in povezano z ukrepi drugih resorjev, povzročenih s človeškim faktorjem in ob naravnih nesrečah, s principi triaže, reševanja problemov pri množičnih ranitvah, z veščinami ATLS, s principi damage control kirurgije, z organizacijo zdravstva v izrednih razmerah in z javno-zdravstvenimi vidiki medicine v izrednih razmerah.

Objectives and competences:

Study of complex interdisciplinary disaster management, emergency medicine, mass casualties in manmade and natural disasters, military surgery with principles of damage control surgery, skills of ATLS, organization of field hospitals and major health problems in complex social emergencies.

Predvideni študijski rezultati:

Znanje in razumevanje:

- disaster cikel
- medresorno načrtovanje ukrepov ob katastrofah
- damage control kirurške tehnike
- razumevanje ATLS
- stopenjska oskrba v zdravstveni službi

Intended learning outcomes:

Knowledge and Understanding:

- disaster cycle
- interdisciplinary planning in disaster management
- damage control surgery
- ATLS
- from stage to stage organization of medical field service

učni načrti

Prenesljive/ključne spretnosti in drugi atributi: <ul style="list-style-type: none"> - packing (pakiranje) telesnih votlin - ATLS – veščine oživljanja - organizacija stopenjske oskrbe pri množičnih nesrečah - organizacija poljske bolnišnice 	Transferable/Key Skills and other attributes: <ul style="list-style-type: none"> - packing, external fixation of long bone fractures - skills of resuscitation - triage
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Metode poučevanja in učenja:

Predavanja, konzultacije Individualni študij na daljavo, seminarji

Learning and teaching methods:

Lectures, consulting, Individual e-learning, seminars

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
- Seminarska naloga	50 %	- Written seminar
- Pisni test	50 %	- written examination

Reference nosilca / Lecturer's references:

1. SPAHN, Donat R., BOUILLON, Bertil, CERNY, Vladimir, COATS, Timothy J., DURANTEAU, Jacques, FERNANDEZ-MONDEJAR, Enrique, FILIPESCU, Daniela, HUNT, Beverley J., KOMADINA, Radko, NARDI, Giuseppe, NEUGEBAUER, Edmund A., OZIER, Yves, RIDDEZ, Louis, SCHULTZ, Arthur, VINCENT, Jean Louis, ROSSAINT, Rolf. Management of bleeding and coagulopathy following major trauma: an updated European guideline. *Crit. care (Lond., Online)*, 2013, let. 17, št. 2, [1-45] R76. <http://ccforum.com/content/17/2/R76>, doi: [10.1186/cc12685](https://doi.org/10.1186/cc12685). [COBISS.SI-ID [607139](https://www.cobiss.si/id/607139)], [JCR, Scopus do 6. 11. 2013: št. citatov (TC): 16, čistih citatov (CI): 15, normirano št. čistih citatov (NC): 5]

1. ROSSAINT, Rolf, BOUILLON, Bertil, CERNY, Vladimir, COATS, Timothy J., DURANTEAU, Jacques, FERNANDEZ-MONDEJAR, Enrique, HUNT, Beverley J., KOMADINA, Radko, NARDI, Giuseppe, NEUGEBAUER, Edmund A., OZIER, Yves, RIDDEZ, Louis, SCHULTZ, Arthur, STAHEL, Philip F., VINCENT, Jean Louis, SPAHN, Donat R. Management of bleeding following major trauma: an updated European guideline. *Crit. care (Lond., Online)*, 2010, let. 14, št. 2, [1-29] R52, doi: [10.1186/cc8943](https://doi.org/10.1186/cc8943). [COBISS.SI-ID [464803](https://www.cobiss.si/id/464803)], [JCR, WoS do 12. 11. 2013: št. citatov (TC): 212, čistih citatov (CI): 212, normirano št. čistih citatov (NC): 74, Scopus do 12. 11. 2013: št. citatov (TC): 272, čistih citatov (CI): 270, normirano št. čistih citatov (NC): 94]

3. SPAHN, Donat R., CERNY, Vladimir, COATS, Timothy J., DURANTEAU, Jacques, FERNANDEZ-MONDEJAR, Enrique, GORDINI, Giovanni, STAHEL, Philip F., HUNT, Beverley J., KOMADINA, Radko, NEUGEBAUER, Edmund A., OZIER, Yves, RIDDEZ, Louis, SCHULTZ, Arthur, VINCENT, J. L., ROSSAINT, Rolf. Management of bleeding following major trauma: a European guideline. *Crit. care (Lond., Online)*, 2007, let. 11, št. 1, [1-22] R17. [COBISS.SI-ID [332963](https://www.cobiss.si/id/332963)], [JCR, WoS do 10. 11. 2013: št. citatov (TC): 172, čistih citatov (CI): 171, normirano št. čistih citatov (NC): 63, Scopus do 7. 10. 2013: št. citatov (TC): 206, čistih citatov (CI): 203, normirano št. čistih citatov (NC): 75]

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

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študenti doktorskega študija	PhD students
Vsebina:	Content (Syllabus outline):
<ul style="list-style-type: none"> ❖ 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 smislu zdravja in varovanja okolja 	<ul style="list-style-type: none"> ❖ 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 caused 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

<ul style="list-style-type: none"> ❖ 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). 	<p>environmental protection</p> <ul style="list-style-type: none"> ❖ 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 dilemma; factors of sustainable behaviour; managing complex system; precautionary principle. ❖ Perception of environment and attitudes toward it; mental models of environmental processes; reactions to environmental changes; social processes 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).
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Temeljni literatura in viri / Readings:

Eržen in sod. Zdravje in okolje. Medicinska fakulteta Maribor 2010, 1-208

R. Beaglehole, R. Bonita, T. Kjellstrom 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 Epidemiology, 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.

<p>Kahn P.H. (1999). The Human Relationship with Nature, Cambridge: The MIT Press.</p> <p>Kaplan R., Kaplan S. (1989). The Experience of Nature: A Psychological Perspective. Cambridge: Cambridge University Press.</p> <p>Kline M., Polič M., Zabukovec V. (1998). Javnost in nesreče, Ljubljana: ZIFF.</p> <p>Kazimir Tarman. Osnove ekologije in ekologija živali, DZS, Ljubljana 1992.</p> <p>Harold F. Hemond, Elizabeth J. Fechner. Chemical Fate and Transport in the Environment, Academic, Press, inc., 1994.</p> <p>Kelley J. D., Thelin A. Agricultural medicine – Occupational and Environmental Health for the Health Professions. Ames, Iowa: Blackwell Publishing, 2006.</p> <p>Jordening H.J., Winter J. Environmental Biotechnology. Weinheim: Wiley-VCH Verlag GmbH, 2005</p> <p>Ford David E. Scientific method for Ecological research. Cambridge: Cambridge University Press, 2000</p> <p>Wackett P.L., Hershberger C.D. Biocatalysis and Biodegradation. Washington, d.c.: ASM Press, 2001</p> <p>OIE. Animal Production Food Safety Challenges in Global markets. OIE Vol. 25 (2), 2006</p> <p>Axford, I Fayez M. Marai, H Omed. Pollution in Livestock Production Systems, Edit. I. Ap Dewi, R.F.E, AB International, 1994</p> <p>Čudina, M.: Tehnična akustika, Fakulteta za strojništvo, Ljubljana, 2001.</p> <p>Crocker, M.J., Čudina, M. et al: Handbook of noise and vibration control. Hoboken, New Jersey, USA: John Wiley & Sons, cop. 2007.</p> <p>Beranek, L.L.: Noise and Vibration Control, Institute of Noise Control Engineering, Washington, DC, 1999.</p> <p>Bilban, M. Medicina dela. Ljubljana: ZVD - Zavod za varstvo pri delu, 1999. 605 str., ilustr., tabele. ISBN 961-90350-4-6.</p> <p>Möser M.: Technical Acoustics, SPRINGER, BERLIN, 2004.</p>	
Cilji in kompetence:	Objectives and competences:
<p>Udeleženci bodo:</p> <ul style="list-style-type: none"> ❖ 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. 	<p>Participants will:</p> <ul style="list-style-type: none"> ❖ 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:
<p>Znanje in razumevanje:</p> <p>Udeleženci:</p> <ul style="list-style-type: none"> ❖ dosežejo poglobljeno razumevanje medsebojnih vplivov posameznikov, družbe in okolja predvsem z ozirom na zagotavljanje uravnoveženega družbenega in okoljskega razvoja, ❖ razumejo človeško dožemanje okolja in 	<p>Knowledge and understanding:</p> <p>The participants will:</p> <ul style="list-style-type: none"> ❖ 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

<p>njegovih tveganj ter dejavnike, ki vplivajo na okoljsko ozaveščenost,</p> <ul style="list-style-type: none"> ❖ 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 	<p>and its risks, as well as the factors influencing environmental consciousness</p> <ul style="list-style-type: none"> ❖ 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. 	
<p>Metode poučevanja in učenja:</p>	<p>Learning and teaching methods:</p>	
<p>Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah, reševanje konkretnih problemov, individualne naloge.</p>	<p>Lectures, seminars, case study, student's presentations, small group work, consultations, team work, individual work.</p>	
<p>Načini ocenjevanja:</p>	<p>Delež (v %) / Weight (in %)</p>	<p>Assessment:</p>
<p>Pisni izpit (več kot 5 kandidatov) Ustni izpit (manj kot 5 kandidatov)</p>	<p>100% 100%</p>	<p>written exam (more than 5 candidates) oral exam (les than 5 candidates)</p>
<p>Reference nosilca / Lecturer's references:</p>		
<p>Ivan Eržen</p> <ol style="list-style-type: none"> 1. 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 2. 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 3. 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 		

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, Dušanom Plutom; (nosilstvo je izmenično)

Jeziki /

Predavanja / Lectures: Slovenski / Slovenian

Languages:

Vaje / Tutorial:

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

Vpis v doktorski študij.

Requirements:

Enrolment in the doctoral study programme

Vsebina:

Raziskovanje okoljskih dilem in problemov v radikalni varianti uvaja paradigmatični 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 izčrpanje 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

Content (Syllabus outline):

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 repertoire of modern social systems. In many areas of the world the pressures on the environment have exceeded its capacities, environmental globalisation 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

načina reorganizacije družbe v smeri materialne zmernosti, socialne pravičnosti in okoske odgovornosti. Predstavljene bodo potrebne razvojne strategije, ki bi omogočile trajnostno, sonaravno organizacijo materialnega življenja 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 pogloblja 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 prilaga 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, dožemanje 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.

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 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 development – 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 environment, 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

	<p>of modern value orientations, communicative operation as a possible form of surpassing the delimitations of individual disciplines 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.</p>
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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 – Implementing 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 družbenih 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 legitimization problems of modern societies 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 legitimization potentials of preventive and curative interventions at the local, regional, national, and supranational, i.e.

	global, levels.
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Predvideni študijski rezultati:

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.

Intended learning outcomes:

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 environmental and sociological dimensions of sustainable development and the related multi-layered relationships between man and the environment/nature.

Metode poučevanja in učenja:

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.

Learning and teaching methods:

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.

Delež (v %)

Weight (in %)

Načini ocenjevanja:**Assessment:**

Ustni zagovor seminarske naloge in izpit.	60% 40%	Oral presentation of seminar paper and examination.
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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:	SEIZMOLOGIJA IN POTRESNO INŽENIRSTVO
Course title:	SEISMOLOGY AND EARTHQUAKE 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	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
10	40	30			170	10

Nosilec predmeta / Lecturer:

Andrej Gosar

Jeziki /

Predavanja / Lectures: Slovenski/Slovenian (English consultations)

Languages:

Vaje / Tutorial: Slovenski/Slovenian (English consultations)

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral studies.

Vsebina:

SEIZMOLOGIJA

- Uvod: vrste potresov, teorija elastične povratne zveze, zgodovina seizmologije
- Merjenje in opazovanje potresov: potresni valovi (prostorski in površinski valovi), seizmometer, akcelerometer, seizmograf, potresna opazovalnica, seizmogram, moč potresa, magnituda, intenziteta, evropska potresna lestvica, učinki potresov, lociranje potresov
- Potresi v prostoru in času: prostorska porazdelitev potresov, seizmičnost in tektonika plošč, časovna porazdelitev potresov, logaritmična odvisnost frekvence potresov od magnitude, frekvenca pojavljanja popotresov
- Potresi in tektonika: seizmotektonika, dolžina

Content (Syllabus outline):

SEISMOLOGY

- Introduction: earthquake types, elastic rebound theory, history of seismology
- Measurements and monitoring of earthquakes: seismic waves (body and surface), seismometer, accelerometer, seismograph, seismic station, seismogram, size of an earthquake, magnitude, intensity, European Macroseismic Scale, effects of earthquakes, locating earthquakes
- Spatial and temporal distribution of earthquakes: spatial distribution of earthquakes, seismicity and plate tectonics, temporal distribution of earthquakes, logarithmic frequency-magnitude relation, frequency distribution of aftershocks
- Earthquakes and tectonics: seismotectonics,

<p>pretrga, premik ob prelomu, žariščni mehanizmi - opredeljevanje in njihov pomen</p> <ul style="list-style-type: none"> • Ocenjevanje potresne nevarnosti: karte potresne nevarnosti, verjetnostno ocenjevanje potresne nevarnosti, vpliv lokalne geološke zgradbe na potresne valove (metoda referenčne točke, metoda spektralnega razmerja, metoda mikrotremorjev, numerično modeliranje), potresna mikrorajonizacija, krivulje potresne nevarnosti • Potresi in notranja zgradba Zemlje: analize oddaljenih potresov, seizmična tomografija, analiza disperznih krivulj površinskih valov, model lupinaste zgradbe notranjosti Zemlje, seizmične hitrosti v notranjosti Zemlje, glavne hitrostne diskontinuitete • Potresi v Sloveniji: karte seizmičnosti, tektonika plošč in ozemlje Slovenije, močnejši potresi v Sloveniji, opazovanje potresov v Sloveniji, slovenska mreža potresnih opazovalnic, potresna nevarnost v Sloveniji, karta projektnega pospeška tal, karta intenzitete po MSK lestvici 	<p>rupture length, fault slip, focal mechanisms – methods of determination and their meaning</p> <ul style="list-style-type: none"> • Seismic hazard assessment: seismic hazard maps, probabilistic seismic hazard assessment, influence of local geological structure on seismic ground motion – site effects (reference point method, spectral ratio method, microtremor method, numerical modelling), seismic microzonation, seismic hazard curves • Earthquakes and internal structure of the Earth: analyses of teleseisms, seismic tomography, analysis of surface waves dispersion curves, the models of the Earth's interior, seismic velocities in the Earth, main seismic discontinuities • Earthquakes in Slovenia: seismicity maps, plate tectonics and geological setting of Slovenia, larger earthquakes in Slovenia, Slovenian seismological network, seismic hazard in Slovenia, design ground acceleration seismic hazard map, seismic intensity (MSK) hazard map
<p>POTRESNO INŽENIRSTVO</p> <ul style="list-style-type: none"> • Učinki potresov na objekte: osnovni mehanizmi za porušitev elementov konstrukcije in sistema, opečne in kamnite zidane stavbe, armiranobetonske stavbe (okviri, okviri s polnili, stenasti objekti, stene z odprtini, mešani sistemi), jeklene stavbe, mostovi, hidrotehnični in geotehnični objekti, učinki minulih potresov v Sloveniji in po svetu • Načela za projektiranje objektov na potresno obtežbo: osnovni pojmi (togost, nosilnost, duktilnost, nihajni čas, dušenje), projektiranje objektov skozi čas, projektni potres, varnost pri projektiranju, princip redukcije potresnih sil, projektiranja po standardu Evrokod 8 • Simulacija potresnih zahtev na objektih: Enačba gibanja, spekter pospeškov, metode za določitev potresnih zahtev, vrednotenje vplivov negotovosti, verjetnostna ocena potresnih zahtev • Vrednotenje poškodovanosti v odvisnosti od potresnih zahtev: mejna stanja (razpoke, velike poškodbe, blizu porušitve, porušitev), krivulje ranljivosti za konstrukcijske in nekonstrukcijske elemente, krivulje ranljivosti za komponente občutljive na deformacije in za komponente 	<p>EARTHQUAKE ENGINEERING</p> <ul style="list-style-type: none"> • The effects of earthquakes on structures: basic failure modes of structural elements and systems, brick and stone masonry buildings, reinforced concrete buildings (frames, frames with masonry infills, wall systems, walls with openings, dual systems), steel buildings, bridges, hydrotechnical and geotechnical facilities, effects of past earthquakes in Slovenia and worldwide • Basic principles for the seismic design of structures: basic concepts (stiffness, load bearing capacity, ductility, vibration period, damping), the design of buildings over time, the design earthquake, safety in the design, concept of reduction of seismic forces, the design according to Eurocode 8 • Simulation of seismic demands on structures: Equation of motion, ground-motion intensity measures, acceleration spectrum, methods for determining seismic demand, evaluation of the impact of uncertainty, probabilistic assessment of seismic demands • Evaluation of damage depending on the seismic requirements: limit states (cracking, significant damage, near collapse, collapse),

občutljive na pospeške

- **Potresno tveganje na osnovi verjetnostnih metod:** metrika za vrednotenje potresnega tveganja, enačba tveganja, vpliv negotovosti, verjetnost porušitve objekta, pričakovane letne izgube, verjetnost prekoračitve izgub za izbrano časovno obdobje.

fragility curves for structural and non-structural elements, fragility curves for deformation-sensitive and acceleration-sensitive components

- **Seismic risk based on probabilistic methods:** metrics for the evaluation of seismic risk, the risk equation, the impact of uncertainty, the probability of collapse, the expected annual losses, probability of losses for the selected time period.

Temeljni literatura in viri / Readings:

- Gosar, A. 2011: Osnove seizmologije. Skripta NTF, 70 str.
- Fowler, C.M.R. 2005: The solid earth. An introduction to global geophysics. Cambridge University Press, 2nd ed., 685 pp.
- Stein, S., Wysession, M. 2003: An introduction to seismology, earthquakes, and earth structure. Blackwell, 498 pp.
- Doyle, H. 1995: Seismology. John Wiley & Sons, 218 pp.
- Yeats, R.S., Sieh, K., Allen, C.R. 1997: The geology of earthquakes. Oxford university press, 568 pp.
- Fajfar P. 1995. Osnove potresnega inženirstva, FGG, 83 pp.
- Villaverde R. 2009. Fundamental Concepts of Earthquake Engineering, CRC Press, 939 pp.
- Dolšek M. (Ed.). Protection of Built Environment Against Earthquakes, Springer, 331 pp.
- Chopra A.K. 1995. Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall, 729 pp.
- Fajfar P. 1984. Dinamika gradbenih konstrukcij, FAGG, 550 pp.
- Fajfar P., Fischinger M., Beg D., Dolšek M., Isaković T., Kreslin M., Rozman M., Vidrih Z., Čermelj B. (2009). Evrokod 8: Projektiranje potresnoodpornih konstrukcij. V: Priročnik za projektiranje gradbenih konstrukcij po Evrokod standardih (Beg D. (ur.), Pogačnik A. (ur.)). Inženirska zbornica Slovenije, 241 pp.
- FEMA 2012a. Seismic Performance Assessment of Buildings – Methodology, FEMA P-58-1, Federal Emergency Management Agency, 319 pp.
- FEMA 2012a. Seismic Performance Assessment of Buildings – Implementation Guide, FEMA P-58-2, Federal Emergency Management Agency, 365 pp.

Cilji in kompetence:

Cilji:

- seznanitev z izbranimi poglavji seizmologije, geologije potresov in notranje zgradbe Zemlje, poznavanje opredeljevanja osnovnih potresnih parametrov
- povezovanje znanja o potresih s strukturo geologijo, tektoniko in regionalno geologijo,
- poznavanje metod potresne mikrorajonizacije in povezava z inženirsko geologijo
- seznanitev s potresnimi obremenitvami in njihovimi učinki na objekte
- seznanitev z principi potresnoodpornega projektiranja objektov

Objectives and competences:

Objectives:

- knowledge of principles of seismology, geology of earthquakes and internal structure of the Earth, and determination of basic earthquake parameters
- to link the knowledge on earthquakes with structural geology, tectonics and regional geology
- knowledge of seismic microzonation methods and link with engineering geology
- introducing the concepts of seismic actions and their effects on structures
- introducing the principles of earthquake-resistant design
- introducing the seismic risk

- seznanitev s potresnim tveganjem

Kompetence:

- razumevanje nastajanja in pojavljanja potresov
- razumevanje seizmoloških metod opredeljevanja potresnih parametrov
- razumevanje metod raziskav potresov
- razumevanje vzrokov za poškodbe
- razumevanje postopkov za projektiranje objektov
- komuniciranje v zvezi s potresnih tveganjem na osnovi različne metrike, vključno na osnovi verjetnostnega pristopa

Competences:

- comprehension of earthquake occurrence
- comprehension of methods for earthquake parameters determination
- understanding the seismological investigation methods
- understanding of the seismic impact on structures
- understanding of the procedures for the design of structures
- communication of seismic risk based on various metrics, including on the basis of a probabilistic approach

Predvideni študijski rezultati:

Znanje in razumevanje:

- osnovnih zakonitosti pojavljanja potresov
- geoloških metod raziskav potresov

Uporaba:

- metod raziskav v seizmologiji
- osnovnih metod raziskav za potresno mikrorajonizacijo

Refleksija:

- razumevanje osnovnih fizikalnih zakonov na primeru potresov

Prenosljive spretnosti:

- sposobnost fizikalnega obravnavanja geoloških problemov
- sinteze seizmoloških podatkov z tektonskimi in inženirskogeološkimi podatki
- Poznavanje učinkov potresov na gradbene objekte.
- Razumevanje osnovnih fizikalnih zakonov za določitev potresnih zahtev.
- Razumevanje osnov verjetnostnega pristopa k ocenjevanju posledic potresov.
- Sposobnost komuniciranja z različnimi deležniki, vključenimi v zmanjševanje potresnega tveganja

Intended learning outcomes:

Knowledge and understanding:

- basic principles of earthquake occurrence
- geological investigations of earthquakes

Application:

- research methods used in seismology
- methods for seismic microzonation

Reflection:

- understanding basic physical principles related to earthquakes

Transferable skills:

- capability of physical approach to geological problems
- capability of synthesis of seismological data with tectonic and engineering geology data
- Knowledge about the seismic effects on structures.
- Understanding the basic laws of physics for the determination of seismic demands.
- Understanding the basics of the probabilistic approach for the assessment of the impact of earthquakes
- Ability to communicate with various stakeholders involved in the mitigation of seismic risk

Metode poučevanja in učenja:

predavanja, laboratorijske vaje, računalniške vaje, konzultacije

Learning and teaching methods:

lectures, laboratory and computer exercises, consultations

učni načrti

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt) <ul style="list-style-type: none"> • seminarska naloga • pisni ali ustni izpit 	35 % 65 %	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> • seminar report • written or oral examination

Reference nosilca / Lecturer's references:

Gosar, A. 2007: Microtremor HVSR study for assessing site effects in the Bovec basin (NW Slovenia) related to 1998 Mw5.6 and 2004 Mw5.2 earthquakes. *Engineering geology*, 91, 178-193.

Ganas, A., Gosar, A., Drakatos, G., 2008: Static stress changes due to the 1998 and 2004 Krn Mountain (Slovenia) earthquakes and implications for future seismicity. *Nat. hazards earth syst. sci.*, 8/1, 59-66.

Gosar, A. 2010: Site effects and soil-structure resonance study in the Kobarid basin (NW Slovenia) using microtremors. *Nat. hazards earth syst. sci.*, 10/4, 761-772.

Gosar, A. 2012: Application of Environmental Seismic Intensity scale (ESI 2007) to Krn Mountains 1998 Mw = 5.6 earthquake (NW Slovenia) with emphasis on rockfalls. *Nat. hazards earth syst. sci.*, 12/5, 1659-1670.

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

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

Vaje / Tutorial:

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

Vpis v doktorski študij.

Prerequisites:

Enrolment in the doctoral study programme.

Vsebina:

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 modeliranje (naravni in antropogeno vplivni sistemi, matematični modeli, modeliranje več

Content (Syllabus outline):

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 principle of actualism to predict future development). Geochemical modelling (natural and anthropogenic

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).

Plotvorni 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.

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 through 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
- **Pavšič, 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.
- **Šušteršič, 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 Properties 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*. Wiley 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. Zato je cilj prikazati tla kot naravni vir in kot element varstva okolja.

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 decomposition of organic residues and cycling of elements on the planet. Therefore, the objective is to evaluate soil as

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...).

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:

Znanje in razumevanje:
Študentje pridobijo teoretična in praktična znanja.

Prenos znanj v prakso, kreacija razvoja in raziskav.

Intended learning outcomes:

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:

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.

Learning and teaching methods:

Lectures with multimedia support and seminars, exercises which require individual work and group discussion.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
-seminar	50%	- seminar
- izpit	50%	- 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, SCHLOTTER, 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](https://doi.org/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.

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Upravljanje s tveganji
Course title:	Risk Management

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program Varstva okolja		1.	1. , 2.
Interdisciplinary doctoral program in environmental protection		1.	1., 2

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

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

Nosilec predmeta / Lecturer:

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:

Vsebina:

1. Sistemi vodenja tveganja
Osnovni elementi vodenja tveganja
Značilnosti visoko zanesljivih organizacij
2. Odgovornost: Nameni in cilji
Elementi odgovornosti: Avtoriteta, odgovornost, podpora, informacije
3. Vedenje o procesu in dokumentacija
Definicija procesa, projektni kriteriji, Načrtovanje procesa in opreme, varnostni sistemi
4. Navodila za varnostni pregled velikih projektov
Varnostni pregled, pregled projekta in varnostnih navodil

Content (Syllabus outline):

1. Systems of risk management.
Basic elements of risk management
Features of high reliability organizations
2. Accountability: objectives and goals
3. Elements of accountability: authority, responsibility, support and information
4. Process Knowledge and documentation
Definiton of process, process criteria
Process and equipment design, safety systems
5. Risk management

<p>5. Vodenje tveganja: Identifikacija nevarnosti: Kvalitativne metode Kvantitativne metode: Statistične in verjetnostne metode za kvantitativno ocenjevanje tveganj, dogodki, pogojna verjetnost, neodvisnost, porazdelitve, večrazsežne porazdelitve, pričakovane vrednosti, mere raztrosa, korelacija. Dogodki z majhno verjetnostjo in velikimi posledicami Analiza tveganja: Metode Hazop, Lopa, Drevesa odpovedi/Drevesa dogodkov, Aramis, STAMP Modeliranje posledic človeško povzročenih nezgod Upravljanje z ostalimi tveganji Vodenje procesa med nezgodami</p> <p>6. Vodenje sprememb v procesu Sprememba naprave, sprememba organizacije, sprememba navodil, stalne spremembe, začasne spremembe</p> <p>7. Integriteta procesa in opreme Zanesljivostno inženirstvo Navodila za vzdrževanje Navodila za testiranje</p> <p>8. Človeški faktor Analiza človeških napak</p> <p>9. Usposabljanje in izvrševanje Izbira in razvoj programov za usposabljanje</p> <p>10. Preiskava nezgod Velike nezgode, vključevanje zunanjih ekspertov, komunikacija, zbiranje podatkov in analiza</p> <p>11. Pregledi in popravne akcije Pregledi, ugotavljanje spoštovanja obveznosti, notranji in zunanji pregledovalci</p>	<p>Hazard identification: kvalitativne methods Quantitative methods: Statistical and probabilistic methods for quantitative assessment of risk, events, probabilities, conditional probabilities, independence, joint distributions, expected values, dispersion measures, correlation. Small probability and large consequence events. Risk assessment methods: HAZOP, LOPA, Fault tree/Event tree method, ARAMIS, STAMP Consequence modelling of man made accidents Risk Management Management of residual risks Process management during accidents</p> <p>6. Management of change Change of technology, change of organization, change of procedures, permanent changes, temporary changes</p> <p>7. Process and Equipment integrity Reliability engineering Maintenance procedures Testing procedures</p> <p>8. Human factors Human error analysis</p> <p>9. Training and Performance Selection and development of training programs</p> <p>10. Accident investigation Major accidents, inclusion of third party experts, communication, data acquisition and analysis</p> <p>11. Audits and Corrective Actions Compliance reviews Internal /External Auditors</p>
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Temeljni literatura in viri / Readings:

Glavna literatura:

- Ian Sutton: Process Reliability and Risk Management, Van Nostrand New York, 1992
- Nancy Leveson: Engineering Safer World, Systems Thinking Applied to Safety, Massachusetts Institute of Technology, 2011
- J. Reason: Managing the Risks of Organizational Accidents, Ashgate, Aldershot 1997
- K. Weick, K. Sutcliffe: Managing the Unaspected, Resilient Performance in an Age of Uncertainty, Willey and Sons, Second Edition, 2007
- J. Rice, Mathematical Statistics & Data Analysis, 3rd edition, Thompson Brooks/Cole, 2007.

Pomožna literatura:

- AIChE: Guidelines for Technical Management of Chemical Process Safety, New York 1989
- E. Van der Heide: Disaster Response, Principles of Preparation and Coordination, E. Van der Heide Atlanta, 1989
- VROM: CPR 16 E Green Book
- VROM: CPR 12 E Red Book
- VROM: CPR 14 E Yellow Book
- VROM: CPR 18 E Purple Book
- J.X.Wang, M.L.Roush: What Every Engineer should know about Risk Engineering and Management, Marcel Decker INC. , New York 2000
- ACSNI: Organizing For Safety, Health and Safety Commission, April 1993,
- Lloyd's Register The Engineering Council: Guidelines on Risk Issues, UK 1993
- Perrow C.: Normal Accidents, Living with High-Risk Technologies, Basic Books, New York, 1985
- Arendt et al: Evaluating Process Safety in the Chemical Industry, A Manager's Guide to Quantitative Risk Assessment, Chemical Manufacturers Association, Washington, USA, 1989
- Clemen, Reilly: Making Hard Decisions, PWS- Kent Publishing Company, 1991

Cilji in kompetence:

Študentje bodo spoznali, kako informacije o tveganju lahko koristijo pri načrtovanju ukrepov za zagotavljanje varnosti in razumeli, kako s pomočjo vedenja o tveganju optimiramo dejavnosti, da bodo varne in da bodo tudi prijazne do okolja.

Objectives and competences:

Students will learn how the knowledge of risk can help in planning measures to ensure safety and how all the methods and knowledge can be integrated into optimal risk managements procedures that are safe and environmentalz sound.

Predvideni študijski rezultati:

Študentje naj bi pridobili osnovna teoretska in praktična znanja, ki so potrebna za vodenje tveganj. Spoznali bodo uporabo statističnih in verjetnostnih metod v analizah tveganja, vse elemente vodenja tveganja ter kako se ti vključujejo v odločanje v pogojih negotovosti. Spoznali bodo tudi uporabnost rezultatov za različne stroke, kot so urgentna medicina, načrtovanje zaščite in reševanja kot tudi za pomembno komunikacijo tveganj ter komunikacijo v kriznih razmerah.

Intended learning outcomes:

Students will acquire the basec theoretical and practical skills to manage risk. Some statistical and probabilistic methods in risk analysis will be presented and integrated with all other elements of risk assessment under uncertainty. The methods are applicable to other fields like emergency medical care, planning protection and rescue operations as well as the important aspect of communication about risks in crisis situations.

Metode poučevanja in učenja:

Predavanja, vaje in seminar

Learning and teaching methods:

Lectures, tutorial and seminar

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Ustni izpit	70%	Oral exam.
Seminar	30%	Seminar.

Reference nosilca / Lecturer's references:

1. AL-MANSOUR, Fouad, KOŽUH, Mitja. Risk analysis for CHP decision making within the conditions of an open electricity market. *Energy*, ISSN 0360-5442. [Print ed.], 2007, vol. 32, no. 10, str. 1905-1916. [COBISS.SI-ID [20987431](#)]
2. KOŽUH, Mitja, PEKLENIK, Janez. A method for identification and quantification of latent weaknesses in complex systems. *Cognition, technology & work*, 1999, vol. 1, no. 4, str. 211-221. [COBISS.SI-ID [15086119](#)]
3. KOŽUH, Mitja. The Seveso II Directive in new european member states : the case of Slovenia. *Acta chimica slovenica*, ISSN 1318-0207. [Tiskana izd.], 2010, vol. 57, no. 1, str. 17-28. <http://acta.chem-soc.si/57/57-1-017.pdf>. [COBISS.SI-ID [33794565](#)]

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

Jeziki /

Predavanja / Lectures: Slovenski, angleški / Slovenian, English

Languages:

Vaje / Tutorial: Slovenski, angleški / Slovenian, English

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

Vpis v doktorski študij

Prerequisites:

Enrolment in the doctoral study programme

Vsebina:

- 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

Content (Syllabus outline):

- 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 protection

<p>narave</p> <ul style="list-style-type: none"> - 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 potencialov; - 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; 	<p>and nature conservation</p> <ul style="list-style-type: none"> - 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;
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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 Thermodynamics; 1998, John Wiley & Sons, UK

J. J. Kraushaar, R. A. Ristinen; Energy and Problems of Technical Society, 1993John Wiley&Sons, UK

Cilji in kompetence:

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 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.

Objectives and competences:

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 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-

učni načrti

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 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:

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.

Intended learning outcomes:

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:

avditorna predavanja, individualni seminar, osebna komunikacija

Learning and teaching methods:

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 written 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

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	ZRAK, KLIMA IN VODE
Coursetitle:	AIR, WATER AND CLIMATE

Študijski program in stopnja Studyprogramme and level	Študijska smer Studyfield	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:

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:

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

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

Prerequisites:

Vsebina:

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. Diabatske 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 skozi medij. Sončno sevanje pri jasnem nebu, solarna konstanta, oslabitev pri prehodu skozi ozračje.

Content (Syllabus outline):

Dynamics and thermodynamics of the atmosphere:
Composition of the atmosphere, basic meteorological quantities, air pressure field and its changes, quasistationary wind 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, frontogenesis) and meso-meteorological phenomena (storms). Weather analysis and forecast, concept of weather forecast, numerical weather prediction.
Radiation in the atmosphere:
EM spectrum, radiation laws, transfer of radiation

Aerosol in sipanje ter absorpcija sončnega sevanja. Planetarni albedo. Dolgovalovno sevanje, absorptivnost ozračja, emisivnost za 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 uporaba 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). Erozijski transport sedimentov (izvori plavin, rečna erozija, prodonosnost in kalnost, človekovi vplivi). Podpovršinske vode (oblike vode v tleh, lastnosti poroznega prostora, dinamika vode in snovi v topljivih v vodi). Hidrometrija (Meritve gladin,

through a medium. Solar constant solar radiation 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:
 Physical factors that shape climate. The air conditioning system and its modeling: principles and problems, types of models. Energy balance models, one-dimensional radiation-convection models and atmospheric general circulation models. The causes of climate variability, climate fluctuations, climate change. Anthropogenic influences on climate, emissions of greenhouse gases. The observed climate oscillations in the 19th and 20th century, climate forecasts 21st century. GCM results and prognosis of regional and local climate change.

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 phenomena in nature). Surface runoff (basic laws of overland flow, runoff coefficient, runoff hydrograph). Erosion and

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, eksperimentalna 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).

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 their 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., ISBN 978-961-212-111-2
- 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 Biotehniške fakultete, 1996. 98 str., ISBN 961-90148-6-3
- C. D. Ahrens, Essentials of Meteorology (with Meteorology Now and InfoTrac). 2004. ISBN-10 0534422640 ISBN-13 9780534422646
- J. Houghton: The Physics of Atmospheres, Cambridge Univ. Press, 2002, ISBN 0-512-80456-6.
- J. Houghton: Global warming : the complete briefing. Cambridge University Press, 1997, XV+251 str ISBN 0-521-62089-9
- Warneck P.: Chemistry of the Natural Atmosphere. San Diego [etc.], Academic Press, 1988. – XIII, 757 str., ISBN 0-12-735630-4
- M. Z. Jacobson: Atmospheric pollution : history, science, and regulation, Cambridge University Press, 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:

Spoznavanje tistih fizikalnih procesov v ozračju, ki opredeljuje 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.

Objectives and competences:

Getting to know those physical processes in the atmosphere, defined weather and weather formations, air movement and dispersion in the atmosphere. Understanding the processes of radiation in the atmosphere. Understanding the physical factors of climate factors. Understanding the integrity of the water regime, getting to know the characteristics of certain types of activities in water understanding of the principles and methods of regulation. Pair with hydrological models, modeling the water balance and water pollution. To determine the impact on the water regime including climate variability.

Predvideni študijski rezultati:

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.

Intended learning outcomes:

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:

Predavanja in seminarske vaje.

Learning and teaching methods:

Lectures and tutorials

Načini ocenjevanja:

pisni izpit
 seminarska naloga

Delež (v %) /

Weight (in %)

Assessment:

examination,
 coursework

Reference nosilca / Lecturer's references:

1. ŽABKAR, Rahela, **RAKOVEC, Jože**, KORAČIN, Darko. The roles of regional accumulation and advection of ozone during high ozone episodes in Slovenia : a WRF/Chem modelling study. *Atmos. environ.* (1994). [Printed.], 2011, vol. 45, issue 5, str. 1192-1202, doi: [10.1016/j.atmosenv.2010.08.021](https://doi.org/10.1016/j.atmosenv.2010.08.021).
2. **RAKOVEC, Jože**, GABERŠEK, Saša, VRHOVEC, Tomaž. Relief shapes 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.
3. **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.

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

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

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

Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.

Prerequisites:

Enrolment in the doctoral study programme. Prerequisite knowledge of basic natural sciences.

Vsebina:

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. Standardizacija analiznih metod in zagotavljanje kakovosti rezultatov.

Content (Syllabus outline):

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. Validation of analytical results. Standardization of analytical methods and quality

	assurance.
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Temeljni literatura in viri / Readings:

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

Cilji in kompetence:

Seznani študente s pristopi v okoljski analitiki ter principi najpomembnejših analiznih metod za določanje organskih in anorganskih onesnažil v okolju.

Objectives and competences:

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:

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 ustrežni analizni pristop za reševanje konkretnih analiznih problemov ter kritično oceniti in ovrednotiti analizne rezultate.

Intended learning outcomes:

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:

predavanja, seminarji in laboratorijske vaje, konzultacije

Learning and teaching methods:

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 :

- 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.
- M. Kovačević, 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.
- J. Kristl, **M. Veber**, B. Krajncič, 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.

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

Jeziki /

Languages:

Predavanja / Lectures:

Slovenski / angleški

Slovenian / English

Vaje / Tutorial:

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

Vpis v doktorski študij. Predznanje temeljev kemije, mikrobiologije, biologije in geologije.

Prerequisites:

Inscription in the doctoral study programme. The basic knowledge of chemistry, microbiology, biology and geology.

Vsebina:

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

Content (Syllabus outline):

The formation of Earth and comparison 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, Amsterdam, 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. Killips, V.J. Killips, 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 Geochemistry, 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 vplivu 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. Important 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 acquired knowledge in experimental studies of biogeochemical processes and to understand processes involved in biogeochemical cyclings of important 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

učni načrti

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](https://doi.org/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](https://doi.org/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](https://doi.org/10.5194/bg-9-1-2012).

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

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:

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

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

Vsebina:

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 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.

Content (Syllabus outline):

Basics of bioindication in comparison with ecotoxicology. Bioindicators in phytocenology. Use of bioindicators for environmental assessments in terrestrial ecosystems as a consequence of environmental pollution and changes in land use. Types and levels of bioindication (indicators, accumulators, monitors). Air pollution and bioindication. 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, halogens, photooxidants, persistent 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:

Anonymous, 1991. Bioindikation ein wirksames Instrument der Umweltkontrolle. 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 Centre for Air Quality Management and Air Pollution Control FEA Berlin & Monitoring and Assessment Research 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:

Študent spozna osnove ugotavljanja stanja v kopenskih ekosistemih v povezavi z antropogenimi vplivi s pomočjo rastlin, gliv in živali kot indikatorskih organizmov. Seznan 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.

Objectives and competences:

Student learns basics of environmental assessment in terrestrial ecosystems in relation to human impacts by plants, fungus 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:*Znanje in razumevanje:*

Študent spozna principe 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 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.

Intended learning outcomes:*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 monitoring of air pollution in natural and anthropogenic ecosystems in relation to type of pollution and land use.

Reflection. Knowledge of bioindication methods enables student environmental monitoring in natural and anthropogenic ecosystems and directs him to use more sustainable technologies.

Transferable 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:

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.

Learning and teaching methods:

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 frequencies 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:
Udeležba 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 predavanj vsebin opravi pisni izpit.		Attendance of field course is compulsory. Student has to prepare and present the seminar and written report from field course before admission to written exam.
Predavanja: - ocena samostojnega dela študenta - preverjanje znanja	20% 80%	Lectures: - students individual efforts - assessment of the written exam
Seminar: - ocena samostojnega dela študenta in poročilo iz vaj - seminar in predstavitev seminarja	20% 40% 40%	Seminar: - students individual efforts and report from practical course - written seminar and its presentation.
Končna ocena je povprečje ocen iz predavanj in seminarja		Final mark is average from marks on lectures and seminar.
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.

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:

Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.

Prerequisites:

Enrollment in a doctoral study. Knowledge of basic science disciplines.

Vsebina:

Študenti se najprej pregledno seznanijo z načini za spremljanje stanja v okolju in določanja stopenj onesnaženosti. Dalje predmet seznanja 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 biomonitoringa (ki vključuje tudi humani

Content (Syllabus outline):

Students are first informed about the principles 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 biomonitoring methods (which also includes human

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 native 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 kulture, 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 zaključni z najnovjšimi genomi in proteomskimi pristopi 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 biotehnoških podjetij s tovrstno dejavnostjo.

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 familiarized 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 članki/relevant recent scientific articles

Cilji in kompetence:

Šlušatelji 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 biotehnoških podjetij.

Objectives and competences:

Students gain theoretical and practical knowledge 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

učni načrti

	biomonitoring.
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Predvideni študijski rezultati:

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

Intended learning outcomes:

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 bioindikacijo
- know how to design and develop new methods of biomonitoring

Metode poučevanja in učenja:

- predavanja
- konzultacije
- priprava seminarja
- priprava načrta za krajše projektno delo
- izvedba krajšega projektne delo v laboratoriju
- priprava poročila o izvedenem krajšem projektne delo

Learning and teaching methods:

- 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:

- seminar
- projektne delo s poročilom
- ustni izpit

Delež (v %) /

Weight (in %)

Assessment:

	30%	-seminar
	30%	- project work with the report
	40%	-oral exam

Reference nosilca / Lecturer's references:

1. 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 transdescantia micronucleus assay. *Environ. monit. assess.*, 2008, 1-3, 139, str. 107-118.
2. 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
3. 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](https://doi.org/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 in vabljeni predavatelji

Jeziki /

Predavanja / Lectures: Slovenski ali angleški/ Slovenian or English

Languages:

Vaje / Tutorial: Slovenski ali angleški/ Slovenian or English

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

Vpis v doktorski študij.

Prerequisites:

Immatriculation to the doctoral study programme.

Vsebina:

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

Content (Syllabus outline):

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 processes 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 nutrition.

Carbon assimilation, primary productivity: impact of

proučevanju mineralne prehrane.

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.

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 nutrition of higher plants. Druga izdaja. Academic Press London, 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:

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.

Objectives and competences:

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 physiological processes in plants in nature.

Predvideni študijski rezultati:

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 upravljanje z ekosistemi.

Intended learning outcomes:

Knowledge and understanding:
Student gets knowledge on plant response to parameters of growth and development in natural and anthropogenic ecosystems. Knows influence of single parameters on separate physiological processes and mechanisms 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 management of ecosystems.

Metode poučevanja in učenja:

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.

Learning and teaching methods:

Lectures are given in classroom equipped with computer and internet. Practical part takes place in laboratory and in the field. In the laboratory courses standard techniques and methods are used (standard laboratory equipment for plant physiology, microscope, transportable equipment for ecophysiological 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

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**Assessment:**

Predavanja: - ocena samostojnega dela študenta - preverjanje znanja	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
Vaje: - ocena samostojnega dela študenta - projekt in predstavitev seminarja Končna ocena je povprečje ocen iz predavanj in vaj.	20% 80%	

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

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	EKOHIĐROLOGIJA
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

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:

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

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

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 biodiverzitetata

Prerequisites:

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:

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

Content (Syllabus outline):

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.

<p>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.</p>	<p>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.</p>
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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 Corridor 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:

Pridobivanje znanja o hidroloških pojavih in procesih pomembnih za naravne življenjske združbe in njihovo sukcesijo.

Objectives and competences:

Gaining knowledge of hydrological phenomena and processes important for wildlife species and their succession.

Predvideni študijski rezultati:

Znanje in razumevanje:
 Znanje potrebno za določanje ekoregij, ekološko sprejemljivega pretoka in ekološko sprejemljivega režima voda.

Intended learning outcomes:

Knowledge and understanding:
 Knowledge necessary to determine the ecoregions, ecologically acceptable and ecologically acceptable flow regime water.

Metode poučevanja in učenja:

predavanja, seminarske in terenske vaje

Learning and teaching methods:

lectures, tutorials and field work

Načini ocenjevanja:

Projekt
 Ustni zagovor projekta

Delež (v %) /

Weight (in %)

Assessment:

Project
 Oral presentation of the project

Reference nosilca / Lecturer's references:

- 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.
- 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

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:

Prerequisites:

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:

- pregledni sistem podzemeljskih habitatov (votlinskih kopnih, votlinskih vodnih, intersticialnih voda)
 - abiotične značilnosti (kemijski in fizikalni ekološki parametri) podzemeljskega okolja
 - ekološke posebnosti posameznih habitatov – podzemeljski habitat kot življenjsko okolje
 - pregled podzemeljskih organizmov, njihove biološke posebnosti, biogeografija (vzorci razširjenosti, endemizem)
 - ogroženost podzemeljskega okolja in življa

Content (Syllabus outline):

- a systematic review of subterranean habitats (terrestrial in caves, aquatic in caves and fissures, interstitial)
 - abiotic characteristics (chemical and physical parameters) of the subterranean environment
 - ecological peculiarities of individual habitats – subterranean habitats as living environment
 - a review of subterranean organisms, their biological peculiarities, biogeography (distribution patterns, endemism)
 - endangerment of the subterranean

Temeljni literatura in viri / Readings:

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

Razumeti obsežnost vplivov površinskega okolja na podzemlje in pomen podzemnega okolja (zlasti podzemeljskih vodnih virov) za človeka.

Objectives and competences:

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:

Znanje in razumevanje:

Okoljevarstvenik spozna posebnosti podzemeljskih habitatov, njihovo pestrost in razloge za potrebo po varovanju.

Intended learning outcomes:

Knowledge and understanding:

The environmentalist takes knowledge with peculiarities of subterranean habitats, their diversity and the reasons for the need for protection

Metode poučevanja in učenja:

študij literature, konsultacije, terenske vaje

Learning and teaching methods:

literature, consultations, field experience

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

ustni izpit ali seminarska naloga

100%

oral exam or a coursework

Reference nosilca / Lecturer's references:

1. **SKET, Boris.** The ecology of anchihaline caves. Trends ecol. evol. (Amst.). [Print ed.], 1996, let. 11, št. 5, str. 221-225
2. **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.
3. **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

Jeziki /

Languages:

Predavanja / Lectures:

Slovenski, angleški

Slovenian/ English

Vaje / Tutorial:

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

Vpis v doktorski program. Predznanje temeljev biologije, mikrobiologije, kemije in geologije.

Prerequisites:

Inscription in the doctoral study programme. The basic knowledge of biology, microbiology, chemistry and geology.

Vsebina:

1. Morska voda, Morski sediment
2. Morski ekosistem, Struktura in funkcija, Stabilnost in nihanja ekosistemov, Principi odzivnosti, odpornost, vztrajnost
3. Ekološka niša v morskem ekosistemu, Razporeditev biodiverzitet, Epibioza, Simbioza in drugi ekološki odnosi, Prilagoditve morskih organizmov
4. Biogeokemijska kroženja in masna bilanca, Biogeokemijski modeli morja, Uporaba stabilnih in radioaktivnih izotopov ter biomarkerjev (biogeokemijskih sledilcev), Palaeocenaografske rekonstrukcije,

Content (Syllabus outline):

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, Distribution of biodiversity, Epibiosis, Symbiosis and other ecological relations, Adaptation of marine organisms
4. Biogeochemical cyclings and mass balances, Biogeochemical models of the sea, Use of stable and radioactive isotopes and geochemical biomarkers (tracers), Paleooceanographical reconstructions,

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

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.

Objectives and competences:

In this course, students are informed about factors, including anthropogenic, controlling the marine ecological processes. Important aspects are devoted to description of seawater and sediments 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:

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.

Intended learning outcomes:

Knowledge and understanding:
The students will be able to use the acquired knowledge in the experimental studies in marine ecology and to understand ecological processes in the sea including global changes

Metode poučevanja in učenja:

Predavanja, seminarji, terenska ekskurzija, nastop, sodelovanje na predavanjih domačih in tujih predavateljev

Learning and teaching methods:

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

Načini ocenjevanja:

Predstavitev seminarske naloge in ustni izpit

Delež (v %) /

Weight (in %)

Assessment:

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](http://dx.doi.org/10.1016/j.ecss.2012.03.031).

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**

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

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

Vpis v doktorski študij. Znanja iz temeljnih naravoslovnih disciplin.

Prerequisites:

Enrolment in PhD study.
Knowledge of basic natural sciences.

Vsebina:

- 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

Content (Syllabus outline):

- 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

- nadomeščanje podatkov z »*in silico*« pristopi
- koncept ocene tveganja za okolje
- 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)

- on environment
- 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 environmental 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:

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 doseg 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

Objectives and competences:

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.

učni načrti

iz svojega področja in dobil osnovno razumevanje drugih področij.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razumevanje osnovnih principov v ekotoksikologiji, uporaba pridobljenih ekotoksikoloških znanj v praksi, poznavanje aktualne okoljske problematike

Intended learning outcomes:

Knowledge and understanding:
Understanding the basic principles of ecotoxicology, application of ecotoxicological data in practice, information of the most emerging environmental topics

Metode poučevanja in učenja:

Predavanja, konzultacije, seminarji, laboratorijske vaje in problemsko orientirano učenje- projekt.

Learning and teaching methods:

Lectures, individual lectures, seminars, tutorials, problems oriented learning - project

Načini ocenjevanja:

- izdelana in predstavljena seminarja
- ustno preverjanje znanja po vseh končanih obveznostih.

Delež (v %) /

Weight (in %)

Assessment:

- Written and presented seminars
- 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/TiO₂ 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.

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

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:

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

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

Vsebina:

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

Content (Syllabus outline):

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:
 - a) Traditional religions and nature (archaic religions, Jewish religion, Buddhism)
 - b) The controversy among Biocentrists (especially depth ecology: Leopold Naess) and Anthropocentrists (Descartes, Kant, Ferry)
 - c) 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.
 - d) Utilitarianism (Bentham, Singer)
 - e) Ethics of life (Schweitzer)
 - f) Ethics of responsibility (Jonas)
 - g) Wilbers criticism of shallow ecology
 - h) The concept of the sanctity of life
 - i) Diaphoric ethics of nature (body as the mediator between nature and mind)
 - j) 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:

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 države in ravnanja do okolja oz. narave na sploh.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

klasična predavanja in problemsko naravnane diskusije (sodelovalno učenje)

Learning and teaching methods:

Lectures and issue-oriented discussions (cooperative learning)

Načini ocenjevanja:

Ali ustni izpit ali seminarsko delo –
od 6-10 (pozitivno) oz. 1-5 (negativno)

Delež (v %) /
Weight (in %)

Assessment:

oral exam or seminar paper –
6-10 (positive) viz. 1-5 (negative)

Reference nosilca / Lecturer's references:

- 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.
- 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.
- 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:	Fitofarmaceutvska 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:

Vpis v doktorski študij.

Prerequisites:

Enrollment to Doctoral Study.

Vsebina:

Škoda na rastlinah zaradi škodljivcev, bolezni in plevelov. Zgodovina in etika uporabe FFS. Prednosti in slabosti uporabe FFS. FFS v vodi, tleh, zraku. Ostanke 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 presežanja rezistence škodljivih organizmov na FFS. Pridelava živeža brez FFS. Koncepti in mehanizmi delovanja naravnih sovražnikov pri biotičnem zatiranju škodljivih organizmov. Pomen agrotehnike pri gospodarskem pomenu rastlinskih škodljivih organizmov in

Content (Syllabus outline):

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 harmful 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 harmful organisms. The role of agrotechnics in economic importance of

njihovih biotičnih agensov: kolobar, obdelava tal, čas in gostota sajenja (setve). Mešane saditve in setve, naravna fitofarmaceutvska sredstva. Pomen zavetišč (refugijev) za škodljive in koristne žuželke in druge organizme.

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 environment. 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:

Temeljni izobraževalni cilj je poglobitev znanja za samostojno raziskovalno delo na področju fitofarmaceutskih sredstev in njihovih alternativ ter seznanjenje s problemi onesnaževanja okolja zaradi nestrokovne rabe fitofarmaceutskih 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.

Objectives and competences:

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:

Znanje in razumevanje:
Slušatelji spoznajo zgodovinski razvoj fitofarmaceutskih 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 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.

Intended learning outcomes:

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 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:

Predavanja, seminarske vaje, laboratorijske vaje, samostojno delo.

Learning and teaching methods:

Lectures, seminar exercises, laboratory exercises, individual work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<ul style="list-style-type: none"> - pisni izpit - samostojno delo študenta 	<p style="text-align: center;">70 %</p> <p style="text-align: center;">30 %</p>	<ul style="list-style-type: none"> - written exam - individual work of the student
<p>Pogoja za opravljanje študijskih obveznosti – pisnega izpita:</p> <ul style="list-style-type: none"> - prisotnost na laboratorijskih vajah - zagovor seminarske vaje 		<p>Conditions for performing study obligations - written exam:</p> <ul style="list-style-type: none"> - 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:	Fiziologija v posebnih razmerah
Course title:	Physiology under special conditions

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	20			60	160	10

Nosilec predmeta / Lecturer:

Zoran Grubič

Jeziki /
Languages:

Predavanja / Lectures: Slovenski/ angleški
Slovenian/ English

Vaje / Tutorial: Slovenski/ angleški
Slovenian/ English

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

Vpis na doktorski študij.

Prerequisites:

Enrollment in the doctoral studies.

Vsebina:

V okviru predmeta se bodo študenti seznanili z mehanizmi delovanja človeškega organizma v razmerah, ki se lahko pojavijo v kriznih okoliščinah. Po krajšem uvodu v človeško fiziologijo, bodo študentje obravnavali naslednje teme: odziv na stres, krvavitev, šok, znižana telesna temperatura, zvečana telesna temperatura, stradanje, vnetje, hipoksije, spremembe zračnega pritiska, dehidracija, zmečkaninski sindrom, opekline, pnevmotoraks, bolečina, zastrupitev z organofosfati, motnje zavesti, električna poškodba, obsevalna bolezen, motnje prebave.

Content (Syllabus outline):

Students will get insight into the mechanisms underlying functioning of the human organism under normal conditions and in the circumstances met at disasters of various causes. After short introduction into the human physiology following themes are presented and discussed: response to stress, bleeding, shock, decreased body temperature, increased body temperature, starvation, inflammation, hypoxia, alterations in atmospheric pressure, dehydration, crush syndrome, burns, pneumothorax, pain, organophosphate poisoning, impaired consciousness, electricity-related accidents, radiation-related impairments, disorders of the

gastrointestinal tract.

Temeljna literatura in viri / Readings:Temeljna literatura:

Grubič Z in sod.: študijsko gradivo, prilagojeno izvajanju vsake posamične teme

Dodatna literatura:

Izbrana poglavja iz naslednjih učbenikov:

Patofiziologija s temelji fiziologije (2002; tretja, popravljena in dopolnjena izdaja), Ljubljana, Medicinska fakulteta, Inštitut za patološko fiziologijo
v pripravi je nova izdaja učbenika – izšla bo predvidoma v marcu 2014)

Temelji patološke fiziologije (2011); 2. izdaja, Ljubljana, Medicinska fakulteta, Inštitut za patološko fiziologijo.

Seminarji iz patološke fiziologije (2012); 2. izdaja, Ljubljana, Medicinska fakulteta, Inštitut za patološko fiziologijo

Cilji in kompetence:

Predmet je zasnovan tako, da bodo diplomanti drugostopenjskih programov s področij kot so tehnika, družboslovje in naravoslovje, in ki nimajo predznanja iz fiziologije, dobili vpogled v delovanje človeškega organizma v normalnih in patoloških razmerah. Glede slednjih bodo obravnavane predvsem teme, ki so ožje povezane s kriznimi razmerami.

Objectives and competences:

Program of this course is adjusted in order to be comprehensive also for the students graduating from humanities or natural and technical sciences, who do not have prior knowledge in physiology. Students will get insight into the functioning of the human organism under normal and pathological conditions. As for the latter, diseases and disorders closely related to the various disasters are selected.

Predvideni študijski rezultati:

Predmet omogoči študentu razumevanje patoloških sprememb v človeškem organizmu, ki jih povzročijo krizna stanja in njihovi učinki oziroma vplivi.

Intended learning outcomes:

Course will enable students to understand pathological changes in the human organism caused by the conditions met at various disasters.

Metode poučevanja in učenja:

seminarji

Learning and teaching methods:

seminars

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**Assessment:**

pisni test

100%

written exam

Reference nosilca / Lecturer's references:

Grubič Zoran, M.D., Ph. D., professor of Pathophysiology

Pirkmajer S., Filipovic D., Mars T., Mis K., and **Grubic Z.** (2010). HIF-1 α response to hypoxia is functionally separated from the glucocorticoid stress response in the in vitro regenerating human skeletal muscle. *Am. J. Physiol. Integr. Comp. Physiol.*, 299: R1693 – R1700.

Miš K, Matkovič U, Pirkmajer S, Sciancalepore M, Lorenzon P, Marš T, and **Grubič Z.** (2013). Acetylcholinesterase and agrin : different functions, similar expression patterns, multiple roles. *Chem.-biol. interact.*, 2013: 297-301.

Poglavje v knjigi

Marš T, Mis K, Pirkmajer S, and **Grubic Z** (2009) The effects of organophosphates in the early stages of human muscle regeneration. In: Gupta RC, ed. *Handbook of Toxicology of Chemical Warfare Agents*; Elsevier, Amsterdam, Boston, Heidelberg 2009, 683-690 (2nd edition of the book is in preparation)

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:

Vpis v doktorski študij. Predznanje temeljev kemije in geologije

Prerequisites:

Inscription to PhD programme. Basic knowledge of geology and chemistry.

Vsebina:

- geokemija atmosfere in precipitativ, 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, osiromaševanje s kisikom, urbane odplake, rudniške vode

Content (Syllabus outline):

- 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
 - Oceans, marine chemistry, primary production,

učni načrti

- oceani, kemija morja, primarna produkcija, morski sedimenti – zapis globalne zgodovine okolja, geokemija lahkih izotopov
- geomedicina

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 the natural environment. Cambridge, 534 pp.
 - Wright, D. A. & Welbourn, P. 2002: Environmental toxicology. Cambridge, 630 pp.
- Revijalni članki s področja/Journal papers from the topics

Cilji in kompetence:

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 spremenjenega zraka, hidrosfere in trdne snovi s kamninami, sedimenti in tlemi.

Objectives and competences:

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:

Znanje in razumevanje:
Razumevanje ciklov posameznih geogeno- antropogenih prvin.

Intended learning outcomes:

Knowledge and understanding:
Understanding of selected geogene- anthropogene cycles of elements.

Metode poučevanja in učenja:

Predavanja, seminarji in osebne konzultacije.

Learning and teaching methods:

Lectures, seminars and personal consultations.

Načini ocenjevanja:

Predstavitev seminarske naloge in ustni izpit

Delež (v %) /
Weight (in %)

Assessment:

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 characterization 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

Jeziki /

Languages:

Predavanja / Lectures:

slovenski/ angleški

Slovenian/English

Vaje / Tutorial:

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

Vpis v doktorski študij.

Prerequisites:

Inscription to PhD programe.

Vsebina:

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

Content (Syllabus outline):

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:

Študent se seznanja 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.

Objectives and competences:

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:

Znanje in razumevanje:
Razume delovanje sistemov na Zemlji ter zna geološko znanje interdisciplinarno uporabiti.

Intended learning outcomes:

Knowledge and understanding:
Understands functioning of the Earth's systems and can inter-disciplinary use geological knowledge.

Metode poučevanja in učenja:

Predavanja, seminarji in osebne konzultacije.

Learning and teaching methods:

Lectures, seminars and personal consultations

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

Reference nosilca / Lecturer's references:**Nina Zupančič**

1. 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.
2. 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.
3. JARC, Simona, **ZUPANČIČ, Nina**. A cathodoluminescence and petrographical study of marbles from the Pohorje area in Slovenia. *Chem. Erde*, 2008.

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:

Vpis v doktorski študij.

Prerequisites:

Inscription to PhD programe.

Vsebina:

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 obolenosti zaradi geogenih dejavnikov

Content (Syllabus outline):

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:

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.

Objectives and competences:

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:

Znanje in razumevanje:

Razume vpliv geoloških dejavnikov življenjskega okolja na živa bitja in je sposoben sprejemanja varovalnih ukrepov

Intended learning outcomes:

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:

Predavanja, konzultacije, laboratorijske vaje in izdelava seminarske naloge v okviru seminarских vaj.

Learning and teaching methods:

Lectures, consultations, laboratory excersises and seminar work in frame of seminar.

Načini ocenjevanja:

Izdelana seminarska naloga in ustni izpit.

Delež (v %) /

Weight (in %)

Assessment:

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 distribution 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 vegetacije 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

Jeziki /

Languages:

Predavanja / Lectures:

slovenski ali angleški/
Slovenian or English

Vaje / Tutorial:

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

Vpis v doktorski študij. Predznanje s področja tehnike ali naravoslovja.

Prerequisites:

Enrolment in doctoral studies. Background in engineering or science.

Vsebina:

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.

Procesi vžiganja, pogoji, značilnosti in meje

Content (Syllabus outline):

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 and limits of self-ignition. Products of combustion, flue gas composition, and excess air ratio. Heat of

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 nezagoreli ogljikovodiki. Dušikovi oksidi, ukrepi za preprečevanje nastajanja NO_x, low-NO_x kurjave, primeri uspešnih rekonstrukcij. Žveplovi oksidi in kislina, mokri in suhi postopki za razžvepljevanje. CO₂ 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 žindre.

Biomasa, lesni ostanki in biogoriva kot primarni energetski vir, njihova priprava za zgorevanje, vrste zgorevalnih naprav. Etika uporabe biogoriv in ovrednotenje pozitivnih učinkov pri njihovi uporabi. Napredne tehnologije za pridobivanje toplote in električne energije in okoljevarstveni vidiki.

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 NO_x, low-NO_x 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:

Vsebina predmeta in način podajanja omogočita študentu da pridobi znanje o razpoložljivosti goriv, virov primarnih energij, lastnostih in karakteristikah goriv z energetskega stališča in načinih uporabe posameznih vrst goriv.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Seminar oz. predavanja pri večjem številu kandidatov.

Learning and teaching methods:

Seminar work or lectures in a large number of candidates.

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

a) izdelava in predstavitev projektne naloge,	60 %	a) the preparation and presentation of a research paper,
b) ustni izpit	40 %	b) oral exam

Reference nosilca / Lecturer's references:

- 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.
- OMAN, Janez, **SENEGAČNIK, Andrej**, MIRANDOLA, Alberto. Air, fuels and flue gases: physical properties and combustion constants. Padova: Progetto, 2006. 172 str., graf. prikazi.
- 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.

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:

Vpis na doktorski študijski program. Zaželeno so naravoslovna oz. tehnična predznanja.

Prerequisites:

Fullfilment of entry conditions for the study. Basic knowledge in life and technical sciencies.

Vsebina:

- 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 življenjskega 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.

Content (Syllabus outline):

- 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: pyrolysis, 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...

Temeljna 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 journals; lecture handouts.

Cilji in kompetence:

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

Objectives and competences:

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

učni načrti

(reuse) odpadkov ali njihovih strukturnih sestavin; centralizirana separacija mešanih odpadkov s ciljem reciklaže snovnih sestavin ali energetske izrabe; predelava odpadkov: trdna goriva iz odpadkov, kompostiranje in anaerobna predelava (kompost, bioplín 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.

information systems (databases, inventories), public awareness raising etc.

Predvideni študijski rezultati:

Razumevanje vsebin, navedenih v vsebini predmeta in zmožnost prenašanja v prakso.

Intended learning outcomes:

Understanding knowledge given in the lecture programme and transferring it into practice.

Metode poučevanja in učenja:

- Predavanja: Interaktivno v predavalnici.
- Samostojna izdelava izbrane raziskovalne (seminarske) teme.
- Konzultacije za potrebe izdelave seminarske naloge in opravljanje izpita.
- Oglledi industrijskih in infrastrukturnih objektov za varstvo okolja v ljubljanski regiji.

Learning and teaching methods:

- 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:

pisni izpit
seminarska naloga

Delež (v %) /
Weight (in %)

Assessment:

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](https://doi.org/10.1108/14777831111159734).
3. **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](https://doi.org/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 /

Predavanja / Lectures: Slovenski /Slovenian

Languages:

Vaje / Tutorial: Slovenski /Slovenian

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

Vpis v doktorski študijski program.
Diplomanti biotehniških in naravoslovno matematičnih usmeritev.

Prerequisites:

Inscription to doctoral study program.
Master degree in life sciences or master degree in natural sciences.

Vsebina:

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

Content (Syllabus outline):

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:

Študent dobi pregled nad gozdnimi viri, njihovimi potenciali in spremembami, seznanen se z okoljskimi vlogami gozdov in osnovami upravljanja in načrtovanja.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Predavanja (20 ur) in voden seminar (30 ur) potekajo v učilnici, vaje (10 ur) v računalniškem laboratoriju.

Learning and teaching methods:

Lectures (20 h), seminars (30 h) in the classroom, lab exercises in the computer cabinet.

Načini ocenjevanja:

- ustni ali pisni izpit
- seminar

Delež (v %) /

Weight (in %)

Assessment:

- Oral or written examination
- 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. Vienna: 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: Nataša Atanasova

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

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

Vpis v doktorski študij.
Predznanje matematike, fizike ter drugih naravoslovnih in tehniških predmetov.

Prerequisites:

Enrolment to Ph.D. studies.
Knowledge of mathematics, physics and other natural sciences and technology subjects

Vsebina:

- 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

Content (Syllabus outline):

- 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

učni načrti

- knjižnice domenskega znanja
- hibridno modeliranje
- uporaba modelov za izračun scenarijev in tolmačenje le-teh

- data preparation for data and process intensive routines
- 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.
 - ATANASOVA, Nataša, KOMPARE, Boris. Data Mining and EDSS. In: GARRIDO BASERBA, Manel (Ed.). Environmental Decision Support Systems (EDSSs) : a tool for wastewater management in the XXI century, (Novedar_Consolider, Vol. 8). [Gerona]: Universitat de Girona, 2011, str. 117-144, ilustr. [COBISS.SI-ID 6055009]
 - Ian Witten, Eibe Frank and Mark Hall. Data Mining: Practical Machine Learning Tools and Techniques. Third Edition. January 2011, Morgan Kaufman Publishers (ISBN: 978-0-12-374856-0).
 - 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:

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 (proces), 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 and competences:

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:

Znanje in razumevanje:

- študent zna optimalno izkoristiti tako teoretično znanje kot izvedene meritve
- zna zasnovati robusten, a uporaben model obravnavanega okoljskega sistema

Intended learning outcomes:

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:

Predavanja, seminarske vaje za utrditev vsebine predavanj in s praktičnimi primeri dela, ter izdelava individualne seminarske naloge na izbrano temo.

Learning and teaching methods:

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:
(1) Zagovor seminarske naloge na izbrano temo ali (2) Ustni izpit, ki se opravi takoj po zagovoru seminarske naloge.	50 % 50%	(1) Defence of the seminary work on the selected subject or (2) Oral exam right after the defence of the seminary work.

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**, DŽEROSKI, Sašo, KOMPARE, Boris, TODOROVSKI, Ljupčo, GAL, Gideon. Automated discovery of a model for dinoflagellate dynamics. *Environmental Modelling & Software*, ISSN 1364-8152. [Print ed.], 2011, vol. 26, no. 5, str. 658-668, doi: 10.1016/j.envsoft.2010.11.003. [COBISS.SI-ID 24367399]
- (4) ŠKERJANEC, Mateja, **ATANASOVA, Nataša**, ČEREPNALKOSKI, Darko, DŽEROSKI, Sašo, KOMPARE, Boris. Development of a knowledge library for automated watershed modelingM. *Environmental Modelling & Software*, ISSN 1364-8152. [Print ed.], 2014, letn. 54, str. 60-72. <http://www.sciencedirect.com/science/article/pii/S1364815213003204>. [COBISS.SI-ID 6485601]
- (5) **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:	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:

Diplomanti študijskih programov tehniških in naravoslovnih smeri.

Prerequisites:

Finished second level of university study in technical or natural sciences

Vsebina:

- *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, eco-učinkovitost, čistejša proizvodnja, zelena topila, nadzor masnih in energijskih bilanc, matematično modeliranje procesov, multidisciplinaren pristop, koncept minimizacije, zamenjava surovin, optimizacija

Content (Syllabus outline):

- *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, resource usage,

<p>procesov, recikliranje, ponovna uporaba odpadkov in stranskih produktov, razgradnja, sekundarne surovine, ciklični procesi, koncept proizvodnje brez odpadkov, zakonodaja.</p> <ul style="list-style-type: none"> – <i>Pristop k industrijski ekologiji</i>: 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. – <i>Uporaba koncepta industrijske ekologije na primeru</i>: primer industrije ali izdelka, relevanten času in slovenskemu prostoru. 	<p>regeneration, recovery, remanufacturing, degradation, zero waste management, ethical investments, legislation.</p> <ul style="list-style-type: none"> – <i>Industrial Ecology Approach</i>: 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. – <i>The concept of industrial ecology: A case study, relevant to Slovenia.</i>
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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:

Študent spozna pomen koncepta industrijske ekologije za čistejšo proizvodnjo, spozna njen pomen za ekosistem in ljudi, ter spozna orodja in metode za doseg 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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

predavanja, konzultacije, projektno delo, seminar

Learning and teaching methods:

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](https://doi.org/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](https://doi.org/10.1016/j.desal.2009.01.014).

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

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:

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

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

Vpis v doktorski študij.
Poznavanje znanstvene terminologije na področju doktorske naloge.

Prerequisites:

Enrollment in the doctoral study programme.
Familiarity with the scientific terminology in the field of doctoral thesis.

Vsebina:

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 oblikovanje in zaščiteni modeli – pregled, pomen,

Content (Syllabus outline):

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 structuring of information from patent

<p>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, prepoznavna 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.</p>	<p>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.</p>
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Temeljni literatura in viri / Readings:

1. 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/>
2. Wong S., Li C.S. Life science data mining, London: World Scientific, 2007 (izbrana poglavja/selected chapters).
3. Chowdhury, G.G. Introduction to modern information retrieval. Third edition, London: Facet Publishing, 2010 (izbrana poglavja/selected chapters).

Cilji in kompetence:

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:

- poglobljanje informacijske pismenosti in sposobnosti naravoslovno-tehničnega mišljenja,
- usposobljenost za samostojno iskanje,

Objectives and competences:

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

<p>zajemanje in obdelavo znanstvenih in tehničnih informacij s primeri za področje varstva okolja,</p> <ul style="list-style-type: none"> - suverena uporaba heurističnih informacijskih metod za urejanje in sintezo informacij v znanje, - usposobljenost za informacijsko podprto načrtovanje raziskovalnega dela ter interpretacijo rezultatov. 	<p>and technical information, on examples of environmental protection,</p> <ul style="list-style-type: none"> - sovereign application of heuristic information methods for data management and synthesis of information into knowledge, - capacity for information-aided design of research, and interpretation of research results.
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Predvideni študijski rezultati:

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.

Intended learning outcomes:

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:

- Predavanja potekajo v računalniško opremljeni učilnici - podprta so z multimedijskimi predstavitevami in dopolnjena z individualnim interaktivnim delom študentov.
- Seminarske vaje potekajo v računalniški učilnici (delo v interakciji z učiteljem ter

Learning and teaching methods:

- 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

učni načrti

vodeno samostojno učenje), v povezavi s projektnim delom in razpravami. Zaključijo se z individualnim nastopom oz. zagovorom seminarskega dela podiplomskega študenta na študentski konferenci.	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.
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Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<ul style="list-style-type: none"> - Aktivno sodelovanje pri predavanjih in seminarskih vajah, vključno z razpravami in sprotnim izpolnjevanjem delovnih listov. - Izdelava in predstavitev projektne seminarske naloge. - Ustni izpit iz teoretičnih vsebin. 	10% 40% 50%	<ul style="list-style-type: none"> - Active participation at lectures and tutorials, including discussions and completion of the study worksheets. - Preparation and presentation of the seminar project. - Oral exam in theoretical contents.

Reference nosilca / Lecturer's references:

<ol style="list-style-type: none"> 1. STAREŠINIČ, Marica, BOH, Bojana. Patent informatics : the issue of relevance in full-text patent document searches. <i>Online inf. rev. (Print)</i>, 2009, vol. 33, no. 1, str. 157-172, ilustr. 2. JUVAN, Simona, BARTOL, Tomaž, BOH, Bojana. Data structuring and classification in newly-emerging scientific fields. <i>Online inf. rev. (Print)</i>, 2005, vol. 29, str. 483-498. 3. BOH, Bojana. Bioinformatics. V: <i>Encyclopedia of life support systems : EOLSS</i>. Eolls Publishers: Oxford, [2004-], 9 p.

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

Jeziki /

Predavanja / Lectures: Slovenski (možna angleščina) / Slovenian (possibly English)

Languages:

Vaje / Tutorial: Slovenščina (možna angleščina) / Slovenian (possibly English)

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in doctoral studies.

Vsebina:

- 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 posledice 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 kulturne krajine.
- Prednosti in slabosti slovenskega

Content (Syllabus outline):

- 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 conservation, conservation of biodiversity and cultural landscape.

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 fitofarmaceutskih sredstev, pridelovalci hrane in njeni potrošniki. Obveščенost, ozaveščенost, ravnanja in nadzor pri posegih v podeželski prostor.
- Vzgoja pridelovalcev in potrošnikov hrane ter obiskovalcev podeželja (npr. turistov) za varovanje naravnih virov.

- 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

Huylensbroeck, 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. 2010. 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 Environment and Development, Journal of Sustainable Tourism, Agriculture, Ecosystems and Environment, Journal of Environmental Management.

Cilji in kompetence:

Cilj predmeta je razviti interdisciplinarne vsebinske, upravljaljske 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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Predavanja, seminarji, terenske delavnice

Learning and teaching methods:

Lectures, seminars, field workshops

Načini ocenjevanja:

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).

Delež (v %) /
Weight (in %)

100%

Assessment:

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: PETROVIČ, Tanja (ur.), AVSENIK NABERGOJ, Irena, BANDELJ, David, ČERNIČ ISTENIČ, Majda, HOFMAN, Ana, HUBER, Ivanka, KIRN, Gal, KNEŽEVIČ HOČEVAR, Duška, LUTHAR, Oto, MARUŠIČ, Franc, POGAČAR, Martin, PROMITZER, Christian, ŽAUCER, Rok, PETROVIČ, Tanja. Politike reprezentacije v Jugovzhodni Evropi na prelomu stoletij, (Kulturni spomin). Ljubljana: Založba ZRC, 2011, str. 76-99
- KNEŽEVIČ 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 development, Vol. 16). Bingley: Emerald Group Publishing Limited, cop. 2010, str. 77-91.

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:

Vpis v doktorski program.

Prerequisites:

Enrolment in Ph.D. programme.

Vsebina:

- 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,

Content (Syllabus outline):

- 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

učni načrti

vloga modelov turbulence, vpliv toplotne in 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.

solution, 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., Bendricchio, 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:**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.

Objectives and competences:**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 reliability 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:**Znanje in razumevanje:**

- Študenti znajo uporabljati kompleksne ekološke modele pri oceni vplivov na okolje.
- Zna načrtovati potrebne meritve okoljskih parametrov, potrebnih za umerjanje

Intended learning outcomes:**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.

učni načrti

modelov.	
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Metode poučevanja in učenja:

Predavanja, prikazi praktičnih primerov modeliranja ter izdelava individualne seminarske naloge.
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Learning and teaching methods:

Lectures, practical examples of modelling with case studies, elaboration and defence of seminar work.

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

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., Simnik, 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 Idrija 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:

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.

Prerequisites:

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:

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 snovi v vodah in v zemlji in spremljajoči problemi). Slabo

Content (Syllabus outline):

Atmosphere - evolution and properties. Sources and reaction mechanisms of principal pollutants: sulphurous 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 degradation of organic substances in the environment

učni načrti

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.

(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:

Predstaviti študentom glavna onesnažila atmosfere, vod in zemlje in njihove kemijske spremembe pod vplivom okoljskih dejavnikov.

Objectives and competences:

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:

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 pisni obliki; sposobnost razreševanja konkretnih okoljskih problemov.

Intended learning outcomes:

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:

predavanja, seminarji in konzultacije

Learning and teaching methods:

lectures, seminar coursework, consultations

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

Reference nosilca / Lecturer's references:**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:	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 /

Predavanja / Lectures: Slovenski ali angleški / Slovenian or English

Languages:

Vaje / Tutorial:

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

Vpis v doktorski študij. Predznanje s področja naravoslovja ali tehnike.

Prerequisites:

Inscription to doctoral programme. University graduation of natural science or natural science technology study.

Vsebina:

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, 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

Content (Syllabus outline):

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:

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 seminarских 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...).

Objectives and competences:

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:

Znanje in razumevanje: Po končanem izpitu naj bi študent obvladoval in razumel zgoraj naštetih 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 razumevanju osnovnih procesov v naravi kot tudi k boljšemu razumevanju problematike drugih predmetov.

Intended learning outcomes:

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:

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.

Learning and teaching methods:

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:

Pisni izpit, ocena pisnega dela seminarja in predstavitve seminarskega dela.

Izpit: ocene od 6-10 (pozitivno) oz. 1-5 (negativno), ob upoštevanju Statuta UL.

Delež (v %) /

Weight (in %)

Assessment:

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.

LONCENAR, 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 Studyfield	Letnik Academicyear	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: Mihael Brenčič

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

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral study programme.

Vsebina:

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. Meritve in izračunavanje denudacije kraških kamnin.

Content (Syllabus outline):

Karst definition 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 distribution of karstic rock denudation. Measurements and calculations of karstic rock denudation processes.

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.

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:

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.

Objectives and competences:

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:

Znanje in razumevanje:
Slušatelji se teoretsko in praktično spoznajo z metodami krasoslovja s pomočjo katerih bodo znali izluščiti kritične parametre in jih prostorsko

Intended learning outcomes:

Knowledge and understanding:
Students will learn practical and theoretical methods of karstology that will help them understand important parameters and to determine

učni načrti

opredeliti.

them spatially and temporally.

Metode poučevanja in učenja:

Predavanja (v primeru zadostnega št. študentov) ali individualne konzultacije (v primeru nezadostnega št. študentov), terenske vaje.

Learning and teaching methods:

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:	Mednarodnopravno varstvo okolja
Course title:	International Environmental Law

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:

Vasilka Sancin

Jeziki /

Predavanja / Lectures: Slovenski ali angleški/ Slovenian or English

Languages:

Vaje / Tutorial: Slovenski ali angleški/ Slovenian or English

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral study programme.

Vsebina:

1. Uvod
 - 1.1. Razvoj mednarodnega okoljskega prava
 - 1.2. Viri mednarodnega okoljskega prava
 - 1.3. Nezavezujoče »mehko« mednarodno okoljsko pravo
2. Načela mednarodnega okoljskega prava
 - 2.1. Prepoved povzročanja škode
 - 2.2. Dolžnost opozorila in posvetovanja
 - 2.3. Previdnostno načelo
 - 2.4. Načelo onesnaževalec plača
 - 2.5. Načelo skupnih vendar različnih obveznosti
 - 2.6. Načelo trajnostnega razvoja
3. Mednarodni sistem okoljskega upravljanja

Content (Syllabus outline):

1. Introduction
 - 1.1. Development of international environmental law
 - 1.2. Sources of international environmental law
 - 1.3. International environmental soft law
2. Principles of international environmental law
 - 2.1. No Harm Principle
 - 2.2. Duty to Notify and to Consult
 - 2.3. Precautionary Principle
 - 2.4. Polluter Pays Principle
 - 2.5. Common but Differentiated Responsibility
 - 2.6. Sustainable Development
3. International environmental governance

<p>3.1. Države 3.2. Mednarodne organizacije 3.3. Telesa mednarodnih pogodb 3.4. Vloga znanstvenih organizacij 3.5. Vloga nevladnih akterjev 3.6. Oblikovanje mednarodnopravnega okoljskega režima</p> <p>4. Varovanje okolja na mednarodni in evropski ravni 4.1. Čezmejno varovanje okolja 4.2. Skupna dediščina, skupna ozemlja in skupni interes 4.3. Sladkovodni viri 4.4. Oceani in onesnaževanje morja 4.5. Onesnaževanje zraka 4.6. Ozon in vesolje 4.7. Podnebne spremembe 4.8. Biološka raznolikost 4.9. Nevarni odpadki</p> <p>5. Mednarodno okoljsko pravo v povezavi z drugimi pravnimi področji 5.1. Varovanje okolja in človekove pravice 5.2. Varovanje okolja in mednarodni mir in varnost 5.3. Varovanje okolja in mednarodno gospodarsko pravo</p> <p>6. Izpolnjevanje mednarodnih obveznosti in odgovornost držav 6.1. Izpolnjevanje obveznosti iz mednarodnih pogodb in mehanizem izvrševanja 6.2. Pravila o odgovornosti 6.3. Odgovornost držav</p> <p>7. Reševanje sporov 7.1. Reševanje sporov v okviru mednarodnih pogodb 7.2. Reševanje sporov pred mednarodnimi telesi</p>	<p>3.1. States 3.2. International organizations 3.3. Treaty bodies 3.4. The role of scientific organizations 3.5. The role of non-state actors 3.6. International environmental treaty regime-building</p> <p>4. International and European Environmental Protection 4.1. Transboundary Environmental protection 4.2. Common heritage, common areas and common concern 4.3. Freshwater sources 4.4. Oceans and marine pollution 4.5. Air pollution 4.6. Ozone and outer space 4.7. Climate change 4.8. Biodiversity 4.9. Hazardous Waste</p> <p>5. International environmental law and other areas of law 5.1. Environmental protection and human rights 5.2. Environmental protection and international peace and security 5.3. Environmental protection and international economic law</p> <p>6. Compliance and responsibility 6.1. Compliance with treaty law and enforcement mechanisms 6.2. Liability 6.3. State responsibility</p> <p>7. Dispute settlement 7.1. Under international environmental law treaties 7.2. Judicial dispute settlement</p>
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Temeljni literatura in viri / Readings:

- BIRNIE, P., BOYLE A. and REDGWELL, C.: International Law and the Environment, 3rd edition, Oxford University Press, Oxford 2009.
- SANDS, P., and PEEL, J.: Principles of International Environmental Law, 3rd edition, Cambridge University Press, Cambridge 2012.
- BEYERLIN, U. and MARAUHN, T.: International Environmental Law, Hart Publishing, Oxford 2011.
- SANCIN, V. (ed.): International Environmental Law: Contemporary Concerns and Challenges, GV Založba, Ljubljana 2012.
- SANCIN, V. and KOVIČ DINE, M.: International Environmental Law: Contemporary Concerns and Challenges in 2014, GV Založba, Ljubljana, 2014

- SANCIN, V.: Mednarodno pravo v hierarhiji pravnih virov EU in njenih članic, Uradni list RS, Ljubljana 2009
- SHAW, M.: International Law, Sixth Edition, Cambridge University Press, 2007
- SANCIN, V.: Nekateri aktualni mednarodnopravni vidiki urejanja kitolova, Pravna praksa, leto 33, št. 19, 15. maj 2014
- SANCIN, V.: Odgovornost državnih organov za kršitve mednarodnega prava, XIII. Dnevi mednarodnega prava in javnega managementa, Portorož 2007
- KOVIC DINE, M., PUCELJ VIDOVIC, T. and SANCIN, V.: Pravne obveznosti glede varstva volkov kot zaščitene vrste v Sloveniji, Dignitas 2014.
- KOVIC DINE, M.: Mednarodne obveznosti držav za zagotavljanje trajnostnega razvoja gozdov. Zbornik znanstvenih razprav, letnik 73, 2013.
- Ustanovna listina Združenih narodov
- Relevantne mednarodne pogodbe

Cilji in kompetence:

Cilj predmeta je pregleden študij izbranih temeljnih poglavij mednarodnega okoljskega prava. Študent pridobi poglobljeno teoretično znanje vprašanj mednarodnega okoljskega prava. Na njihovi podlagi pridobi sposobnost znanstvenega analiziranja problemov, vrednotenja različnih teoretičnih izhodišč, uporabe primerjalno pravne metode, kritičnega analiziranja prakse držav in mednarodne judikature ter pisnega oblikovanja zahtevnejše argumentacije.

Objectives and competences:

The objectives of the course are to give the student an overview of the selected elementary issues of international environmental law. The student will gain an indepth teoretical knowledge on the addressed international environmental law issues. On the basis of this knowledge the student will be able to scientifically analyze the international environmetnal law problems, evaluate various theoretical and practical views, use comparative legal methods, critically analyze state practice and decisions of international tribunals and arbitration and express though legal argumentation

Predvideni študijski rezultati:

Znanje in razumevanje:
Študentje pridobijo znanje s področja mednarodnega okoljskega prava, ki ga lahko uporabijo pri svojem delu v katerikoli disciplini povezani s področjem varovanja okolja. Študentje pri predmetu pridobijo razumevanje mednarodnopravnega urejanja področja, obveznosti držav za varovanje okolja ter odnosov med državami in nedržavnimi akterji.

Intended learning outcomes:

Knowledge and understanding:
The students will gain the basic knowledge of international environmental law, that they will need in their work in any other discipline concerned also with environmental protection. The students will gain an understanding of the international legal regulation of the field, the obligations and responsibilities of states and the relationship between states and non-state actors.

učni načrti

Metode poučevanja in učenja:

Predavanja – predavajo se izbrane teme
 Seminarske vaje – na seminarskih vajah študentje predstavijo vsebino seminarske naloge
 Drugo – izdelava seminarske naloge, ki obravnava zahtevnejši pravni problem z navedenih področij.
 Individualni študij za izpit.

Learning and teaching methods:

Lectures – lectures on selected topics
 Seminars – presentation of an extended essay on a topic of choice
 Other – research work and preparation of the extended essay
 Individual study for the exam

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)
 Ustni izpit.
 Seminarska naloga.
 Za pristop k izpitu se zahteva uspešno izdelana in predstavljena seminarska naloga.

75%

25%

Type (examination, oral, coursework, project):
 Oral exam.
 Extended Essay
 Successful presentation of the extended essay predisposition for the oral exam.

Reference nosilca / Lecturer's references:

Doc. dr. Vasilka Sancin, univ.dipl.prav
 - SANCIN, V.: Položaj mednarodnega prava v hierarhiji pravnih virov Evropske unije in njenih članic, s posebnim ozirom na okoljsko pravo (doktorska disertacija), Pravna fakulteta Univerze v Ljubljani, 2007.)
 - SANCIN, V. (ed.): International Environmental Law: Contemporary Concerns and Challenges, GV Založba, Ljubljana 2012.
 - SANCIN, V. and KOVIČ DINE, M.: International Environmental Law: Contemporary Concerns and Challenges in 2014, GV Založba, Ljubljana, 2014
 - SANCIN, V.: Mednarodno pravo v hierarhiji pravnih virov EU in njenih članic, Uradni list RS, Ljubljana 2009
 - SANCIN, V.: Nekateri aktualni mednarodnopravni vidiki urejanja kitolova, Pravna praksa, leto 33, št. 19, 15. maj 2014
 - SANCIN, V.: Odgovornost državnih organov za kršitve mednarodnega prava, XIII. Dnevi mednarodnega prava in javnega managementa, Portorož 2007
 - SANCIN, V.: Članstvo Slovenije v mednarodnih organizacijah, Dnevi slovenskih pravnih, Portorož 2011
 - KOVIČ DINE, M., PUCELJ VIDOVIČ, T. and SANCIN, V.: Pravne obveznosti glede varstva volkov kot zaščitene vrste v Sloveniji, Dignitas 2014.

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

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:

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

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

Prerequisites:

Vsebina:

Temeljna vsebinska področja pri predmetu so:

1. različnost mikrobnih habitatov in niš
2. ekstremna okolja mikroorganizmov
3. mikrobna ekofiziologija
4. mikrobne združbe in simbioze
5. značilnosti mikrobne kroženja elementov
6. biofilmi
7. mikrobiologija odpadnih voda,
8. mikrobiologija tal, voda in sedimentov
9. biorazgradljivost in bioremediacija
10. proizvodnja mikrobne biomase in biogoriv.

Content (Syllabus outline):

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:

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.

Objectives and competences:

This course in Microbial ecology is mainly intended for students that are not masters of Microbiology, but would like to obtain basic knowledge 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:

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.

Intended learning outcomes:

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:

Predavanja,
 konzultacije

Learning and teaching methods:

lectures,
 consultations

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**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. ODIČ, Duško, BUDIČ, Bojan, MANDIČ-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](https://doi.org/10.1007/s00248-009-9557-1).
2. BORIČ, 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](https://doi.org/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.

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

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:

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:

Vsebina:

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 spremembe, nastanek sekundarnih mineralov), zaščita in restavriranje

Content (Syllabus outline):

Mineral materials as the elements of cultural heritage: natural stone, hydraulic binders (natural and artificial), plasters, mortars, pavements, aggregates, 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.

učni načrti

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:

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.

Objectives and competences:

Elements of cultural heritage where nonmetal mineral materials were used are natural stone, glass, air and hydraulic binders, ceramic materials. 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 anthropogenic 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 consequences of environmental factors on their durability.

Predvideni študijski rezultati:

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.

Intended learning outcomes:

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:

Predavanja in laboratorijske vaje, konzultacije, seminarska naloga

Learning and teaching methods:

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:

1. KRAMAR, Sabina, LUX, Judita, MLADENOVIC, 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](https://doi.org/10.1016/j.clay.2011.12.00).
2. 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>.
3. KRAMAR, Sabina, ZALAR, Vesna, UROŠEVIČ, Maja, KÖRNER, Wilfried, MAUKO, Alenka, **MIRTIČ, Breda**, LUX, Judita, MLADENOVIC, 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](https://doi.org/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

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:

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

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

Pogoj za vključitev v delo oziroma za opravljanje študijskih obveznosti je vpis v 1. letnik doktorskega študija.

Prerequisites:

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:

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 življenjskega 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 življenjske 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.

Content (Syllabus outline):

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 Jersey: 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 naravnost 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 naravnosti 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.

učni načrti

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<p>Način opravljanja izpita:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ocena projektnega dela (30 %) ocena pisnega dela izpita (30 %) ocena ustnega dela izpita (40 %) <p>od 6-10 (pozitivno) oz. 1-5 (negativno) oz. opravil / ni opravil; ob upoštevanju Statuta UL in fakultetnih pravil.</p> <p>Opravljeno in uspešno predstavljeno projektno delo je pogoj za pristop k pisnemu in ustnemu izpitu.</p>	<p>30 %</p> <p>30 %</p> <p>40 %</p>	<p>Type of examination:</p> <ul style="list-style-type: none"> • 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.

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

Jeziki /

Languages:

Predavanja / Lectures:

Slovenski /angleški/nemški

Slovenian/ English/ German

Vaje / Tutorial:

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

Vpis na doktorski študij.

Prerequisites:

Enrollment to doctoral studies.

Vsebina:

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

Content (Syllabus outline):

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

<p>metod urejanja ogroženih območij zaradi naštetih naravnih tveganj, metod dimenzioniranja posameznih varovalnih objektov ter načinov njihovega vzdrževanja.</p> <p>3. 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).</p> <p>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.</p>	<p>landslide control – overview of risk mitigation methods, especially structural and bioengineering methods of mitigation in risk areas due to before mentioned natural risks, designing methods of single protection structures, and ways of their maintenance.</p> <p>3. 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.</p> <p>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.</p>
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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 Gefahregrundlagen, 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:

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).

Objectives and competences:

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:**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.

Intended learning outcomes:**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:

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.

Learning and teaching methods:

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:

Izdelava poročila o krajšem raziskovalnem projektu oz. predstavitev seminarske naloge ali objava raziskovalnega članka.

Delež (v %) /

Weight (in %)

Assessment:

Report on a short research project resp. presentation of a seminar work or publication of a research paper.

100%**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.

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

Jeziki /
Languages:Predavanja / Lectures: Slovenski, angleški/
Slovenian, English

Vaje / Tutorial: /

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

Vpis v doktorski študij

Prerequisites:

Enrolment in the programme

Vsebina:

Vsebina predmeta se prilagaja študijskemu načrtu in raziskovalnemu delu doktoranda. Poglobljeno se predelajo vsebine izbrane izmed naslednjih poglavij:

Vrste tekstilnih vlaken in ploskih tekstilij.

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. Opoprečne substance (formaldehid, težke kovine, pesticidi, biocidi, alergeni...). Toksičnost tekstilij in tekstilnih pomožnih sredstev. Toksičnost barvil in pigmentov. Analitika opoprečnih substanc. Ekološke oznake

Content (Syllabus outline):

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
- Environmental 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

tekstilij (npr. Eko-Tex standard 100). Pridobivanje certifikatov. Okoljska zakonodaja. Tekstilni odpadki; odlaganje in recikliranje.

- Eco-labels and certification
- Environmental legislation
- 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:

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.

Objectives and competences:

Students get information of fundamentals of textile technology and the influence of fiber and textile production on the environment. 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 forbidden 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:

- 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.

Intended learning outcomes:

- Knowledge and understanding:
- Influence of textile industry on environment
 - Environmentally 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

učni načrti

Metode poučevanja in učenja:

predavanja, konzultacije, seminar, študij po literaturnih virih

Learning and teaching methods:

Lecturing, consulting, seminar, individual study,

Načini ocenjevanja:

- Izdelava seminarja z zagovorom ali objavo
- ustno spraševanje

Delež (v %) /

Weight (in %)

Assessment:

Project performance or publication

60%

Oral exam

40%

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](https://doi.org/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](https://doi.org/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>.

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

Jeziki /

Predavanja / Lectures: Slovenski, angleški / Slovenian, English

Languages:

Vaje / Tutorial: Slovenski, angleški / Slovenian, English

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

Vpis v doktorski študij

Prerequisites:

Admission to the doctoral programme

Vsebina:

Splošni modul

- 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 študije izvedljivosti;

Content (Syllabus outline):

General module

- 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

<p>- vloga OVE v energetskih politikah držav EU; perspektive oskrbe z energijo v prihodnosti.</p> <p><u>Modul sončne energija</u></p> <ul style="list-style-type: none"> - 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. <p><u>Modul fotovoltaike:</u></p> <ul style="list-style-type: none"> - pregled tehnologij za pridobivanje elektrike iz sonca, ekološki in ekonomski vidiki - <i>sončne celice</i>: 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. - <i>fotonapetostni moduli</i>: značilnosti, tehnološki trendi in standardi kristalnosilicijevih, tankoplastnih in koncentratorskih PV modulov. Vrednotenje zmogljivosti, analiza izgub in energijskega izplena. Modeliranje, simulacije in karakterizacija. - <i>Fotonapetostni sistemi</i>: omrežni in samostojni PV sistemi, načrtovanje, gradnja in vzdrževanje; močnostni regulatorji in razsmerniki, zaščitni elementi; priključevanje na omrežje, ekonomika PV sistemov. <p><u>Modul izkoriščanje energije vode in vetra</u></p> <ul style="list-style-type: none"> - 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 	<p>utilization of RES;</p> <ul style="list-style-type: none"> - Efficiency of technologies and feasibility studies; - The role of RES in the EU energy policies; - Perspective of energy supply in the future. <p><u>Solar energy module</u></p> <ul style="list-style-type: none"> - 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. <p><u>PV module:</u></p> <ul style="list-style-type: none"> - 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 sensitized 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; <p><u>Water energy and wind power utilisation module</u></p> <ul style="list-style-type: none"> - 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.
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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 Wiley&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, Californiy, 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., Namac 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 različnih državah umeščeni v energetska politika in kako se uporaba

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 the

učni načrti

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.

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:

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.

Intended learning outcomes:

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:

avditorna predavanja, laboratorijske vaje, individualni raziskovalni seminar, osebna komunikacija

Learning and teaching methods:

Auditorial lectures, lab experiments, individual research seminar, personal communication

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

Pisni izpit,	60%	Examine: written and oral, public presentation of project report
ustni zagovor,	25%	
javna predstavitev seminarske naloge s področja teme doktorske disertacije	15%	

Reference nosilca / Lecturer's references:**prof. dr. Sašo Medved:**

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

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:

Vpis v doktorski študij.

Prerequisites:

Enrollment in doctoral studies.

Vsebina:

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

Content (Syllabus outline):

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

gospodarjenje – trajnostno 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.

management – sustainable management; Conservation of 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, Wallingford, 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:

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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Predavanja s sodelovalnim, reflektivnim učenjem / poučevanjem in diskusijo. Vodeno seminarsko delo v kabinetu in na terenu. Poudarek je na sprotne 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, izdelava 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-upravljaljske vidike doktorske naloge.

Learning and teaching methods:

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: (1) ocene sodelovanja na predavanjih (2) ocene seminarских nalog s terena (3) ocene vsebine in predstavitve obsežnejše seminarske naloge (4) pisnega izpita.	20% 20% 20% 40%	Final grade will be comprised of: (1) grade for lecture participation (2) grade for field seminar reports (3) grade for the comprehensive final seminar (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

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:

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

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

Prerequisites:

Vsebina:

- 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.

Content (Syllabus outline):

- 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,

- obvladovanje sistema biovarnosti kot politike in 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

- zoonoses, animal and plant diseases, 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 NH₃ 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 – Occupational and Environmental Health for the Health Professions. Ames, Iowa: Blackwell Publishing, 2006.
- Axford, I Fayed 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:

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

Objectives and competences:

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:

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

Intended learning outcomes:

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:

Učenje se izvede s predavanji, skupinskimi (diskusijske ure) in individualnimi konzultacijami, seminarskimi nalogami in praktičnimi vajami

Learning and teaching methods:

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.	50%	Oral examination.
Seminarska naloga	50%	Seminar exercise.
Ocenjevalna lestvica: 6-10 pozitivno, 1-5 negativno, skladno z določili statuta UL.		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, MIČUNOVIĆ, 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:	ENVIRONMENTAL 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

Jeziki /

Predavanja / Lectures: Slovenski/ Slovenian

Languages:

Vaje / Tutorial: Slovenski/ Slovenian

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

Študenti doktorskega študija.

Prerequisites:

PhD students.

Vsebina:

- ❖ 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

Content (Syllabus outline):

- ❖ 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

- ❖ okolja ter tehnik za njihovo zmanjševanje
- ❖ Obravnava posameznih primerov okoljskih škodljivosti ter analiza pristopov, ki so bili uporabljeni v okviru proučevanja razmer
- ❖ Načrtovanje okoljskih raziskav ter priprava metode dela

- ❖ Errors and bias in environmental epidemiology and techniques to reduce
- ❖ 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. Kjellstrom Basic Epidemiology. World Health Organisation (WHO). 1994
 Lilienfeld AM, Lilienfeld ED. Foundations of Epidemiology, Oxford, New York: Oxford University Press, 1980.<http://themes.eea.eu.int/>

Cilji in kompetence:

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

Objectives and competences:

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:

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,

Intended learning outcomes:

Knowledge and Understanding:

On the completion 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 solutions in environmental epidemiology,

učni načrti

❖ s pridobljenim znanjem razumeli principe na dokazih temelječega ukrepanja na področju zmanjševanja škodljivih vplivov okolja na zdravje.

❖ will know legal and ethical frames in public health,
❖ will understand the principles of evidence based environmental epidemiology.

Metode poučevanja in učenja:

Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah, reševanje konkretnih problemov, individualne naloge.

Learning and teaching methods:

Lectures, seminars, case study, student's presentations, small group work, consultations, team work, individual work.

Delež (v %) /
Weight (in %)

Načini ocenjevanja:

Assessment:

Ustni izpit	100%	Oral examination
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Reference nosilca / Lecturer's references:

Ivan Eržen

1. 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
2. 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
3. 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

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 FEASIBILITY

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 /

Predavanja / Lectures: slovenski, angleški/ Slovenian, English

Languages:

Vaje / Tutorial:

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

Vpis v doktorski študij.

Prerequisites:

Enrolment in the doctoral study.

Vsebina:

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 inženiring, moralni status

Content (Syllabus outline):

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,

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 kolektivna 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.

moral status of 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.

Temeljna 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: Vročje, Krtina, 2010

Cilji in kompetence:

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 študentje so:

- sposobnost smotrne uporabe osnovnega instrumentarija normativne moralne, politične in ekonomske filozofije,
- sposobnost 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.

Objectives and competences:

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 discourse, 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

učni načrti

	policies.
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Predvideni študijski rezultati:

Znanje in razumevanje:
Študenti bodo spoznali in razumeli oblikovanje okoljskih politik kot iskanje ravnovesja med moralnim upravičenjem ekonomsko učinkovitostjo in politično uresničljivostjo.

Intended learning outcomes:

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:

Uvodni, konceptualni del bo podan prek predavanj, aplikativni del pa pretežno v seminarski obliki, ki bo vključevala tudi individualne konzultacije

Learning and teaching methods:

The introductory conceptual part will be delivered through lessons; the applied part will take mainly in seminar form, including individual consultations.

Načini ocenjevanja:

Ustno izpraševanje, seminarska naloga.

Delež (v %) /
Weight (in %)

Assessment:

Oral examination, seminar work

	50%	
	50%	

Reference nosilca / Lecturer's references:

doc. dr. Igor Pribac:

- Igor Pribac:** Konsenz kot kriterij legitimnosti političnih odločitev, v: »Revija 2000«, št. 189-191, 2007, str. 45 – 54.
- Igor Pribac:** Javna etika, v: Javna etika in integriteta, (ur. Bečir Kečanović), Komisija za preprečevanje korupcije, Ljubljana 2012, str. 141-150.
- 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	/
Interdisciplinary Doctoral Programme in Environmental Protection	/	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:

Zaključen študijski program druge stopnje s področja naravoslovno matematičnih ali tehničnih usmeritev.

Prerequisites:

Master degree in mathematics, natural or technical sciences.

Vsebina:

Študent se seznani s pojavljanjem 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

Content (Syllabusoutline):

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,

učni načrti

metode, izhodišči 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 izviri, 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.

inflow tests, 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:

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.

Objectives and competences:

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 from 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:

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.

Intended learning outcomes:

Knowledge and understanding:
 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:

Predavanja (v primeru zadostnega št. študentov) ali individualne konzultacije (v primeru nezadostnega št. študentov), terenske vaje.

Learning and teaching methods:

Lectures (when number of students is adequate) or individual consultations (when number of students is less than required), seminar work.

učni načrti

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:

Vpis v doktorski študijski program.

Prerequisites:

Doctoral programme enrolment

Vsebina:

- 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 ideje, zakonitosti delovanja in vzpostavljanje, nacionalna in internacionalna raven)
 - Komunikacijski in odločevalni procesi (struktura akterjev, pravila komuniciranja, sistemska in

Content (Syllabus outline):

- 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 participatory ideas, and the legality of the establishment, national and international level)
 -- Communication and decision-making processes

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).

(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.
- Lukšič A. Andrej (1998): Rizična tehnologija: izziv demokraciji (k politični 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. Routledge. London, New York.
- Lukšič A. Andrej, M. Bahor (2008): eZbornik znanstvenih člankov s področja politične ekologije, Center za kritično politologijo, FDV, Ljubljana.

Cilji in kompetence:

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);

Objectives and competences:

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:

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.

Intended learning outcomes:

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.

učni načrti

Metode poučevanja in učenja:

predavanja z aktivno komunikacijo s študenti

Learning and teaching methods:

lectures with active communication with students

Načini ocenjevanja:

Naloga v obsegu 30.000 znakov in zagovor

Delež (v %) /

Weight (in %)

100%

Assessment:

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:

Vpis v doktorski študij.

Prerequisites:

Enrollment in doctoral studies.

Vsebina:

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.

Content (Syllabus outline):

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, Quincy, 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

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.

ustrezno rešeni.

Predvideni študijski rezultati:

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.

Intended learning outcomes:

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:

Na predavanjih pridobi študent temeljna teoretična znanja. S seminarsko nalogo samostojno pod mentorstvom visokošolskega učitelja rešuje problematiko požarov v obliki projektne oz. laboratorijske naloge.

Learning and teaching methods:

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:

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).

Pisni izpit
Ustni zagovor
Seminar - projekt

Delež (v %) /
Weight (in %)

50%
30 %
20 %

Assessment:

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).

Written exam
Oral exam
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:

Izpolnjeni pogoji za vpis v doktorski študij.

Prerequisites:

The student must meet the criteria for enrolment in the Ph.D. programme

Vsebina:

- vzdrževanje dinamičnega ravnovesja kot temeljna zahteva pri pokrajinskoekološki presoji posegov;
- možnosti in oblike prenosa ekosistemskih mehanizmov ravnovesja v pokrajinskoekološke presoje;
- občutljivost posameznih pokrajnotvornih sestavin na antropogeno obremenjevanje in posege;
- kvantitativni in kvalitativni kazalci za njihovo vrednotenje;
- pomen različne ranljivosti okolja v

Content (Syllabus outline):

- 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

specifičnih mikrogeografskih okoljih in prepoznavanje vzrokov za zmanjšan naravni 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 pokrajnotvornih sestavin in pokrajinskoekoloških enot in njen pomen za načrtovanje trajnostnega razvoja;
- trajnostno gospodarjenje z občutljivimi ekosistemi.

vulnerabilities in specific microgeographic environments and 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 Slovenica 33/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:

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 pokrajnotvornih sestavinah oziroma različnih ekosistemih. Gre predvsem za prepoznavanje in posledično preprečevanje onesnaževanja okolja v območjih s specifičnimi pokrajinskimi značilnostmi. Z razumevanjem mrežne 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.

Objectives and competences:

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 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:

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.

Intended learning outcomes:

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:

predavanje, projektno delo, individualne seminarske naloge, sodelovanje v raziskovalnih projektih

Learning and teaching methods:

Lectures, project work, individual seminar papers, participation in research projects

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<ul style="list-style-type: none"> • preizkusi znanja ob reševanju konkretnih raziskovalnih problemov, • pozitivno ocenjena poročila o opravljenih seminarskih delih in raziskovalnih projektih 	<p>40%</p> <p>60%</p>	<ul style="list-style-type: none"> • 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:

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.

Prerequisites:

Basic knowledge in the fields of spatial sciences, which are offered by curricula on the master level or university degree level of following studies: geography, surveying, civil engineering, architecture, landscape planning, environmental protection, geoinformatics and others.

Vsebina:

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

Content (Syllabus outline):

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, production of energy, traffic, water management, mining, tourism and other land uses. Vulnerability and attractiveness; early warning systems. Legal foundations of planning and environmental protection. Sustainable spatial development on the levels of local

učni načrti

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.

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 Perspectives (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, Copenhagen
 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:

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.

Objectives and competences:

Knowledge of the research methods in spatial sciences. Understanding the conflicts of development and protective 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:

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.

Intended learning outcomes:

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:

Predavanja in individualne konzultacije. Terensko delo ob spoznavanju konkretne naloge. Individualna izdelava seminarske naloge z obveznimi konzultacijami in končno prezentacijo

Learning and teaching methods:

Lectures and individual consultations. Field work related to practical seminary task. Individual seminary work with obligatory consultations. Final presentation is compulsory.

Načini ocenjevanja:

Pisni izpit
 Izdelava in zagovor seminarske naloge

Delež (v %) /
 Weight (in %)

50%
 50%

Assessment:

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

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

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

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.

Prerequisites:

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:

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 avtomobilске baterije oz. akumulatorji.
 Sistemi in standardi za zagotavljanje kakovosti sekundarnih surovin.
 Analiza življenjskega kroga proizvoda. Načrtovanje življenjskega kroga izdelka in njegovo recikliranje.
 Načrtovanje programov recikliranja in uvajanje v proizvodnjo.
 Pregled postopkov in zakonodaje sosednjih sdržav s področja recikliranja odpadnih snovi.
 Študij praktičnih problemov.
 Projektno delo.

Content (Syllabus outline):

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 Series 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:

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 naravnosti 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.

Objectives and competences:

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:

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 naravnost 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.

Intended learning outcomes:

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:

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.

učni načrti

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<p>Način opravljanja izpita:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ocena projektnega dela (30 %) ocena pisnega dela izpita (30 %) ocena ustnega dela izpita (40 %) <p>od 6-10 (pozitivno) oz. 1-5 (negativno) oz. opravi / ni opravi; ob upoštevanju Statuta UL in fakultetnih pravil.</p>	<p>30 %</p> <p>30 %</p> <p>40 %</p>	<p>Type of examination:</p> <ul style="list-style-type: none"> • 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, MCGUINNESS, Paul J., KOBE, Spomenka. Microstructural changes in Fe-doped Gd₅Si₂G₂. J. magn. magn. mater., 2009, vol. 321, no. 4, pp. 300-304.

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

Vaje / Tutorial:

Slovenian / English

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

- 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.

Prerequisites:

- Student has to be enrolled in the doctoral study.
- Basic knowledge of mathematics, chemistry, (micro)biology and biochemistry. Mandatory presence at seminars.

Vsebina:

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, vitifikacija.

Content (Syllabus outline):

Pollution in soil and vadose 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

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.

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. Government 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:

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 remediacije tal. Spoznajo metode določevanja koncentracije in (bio)dostopnosti / dosegljivosti onesnažil v tleh, metode ocenjevanja tveganja onesnaženja ter metode obvladovanja tveganja onesnaženja.

Objectives and competences:

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.

učni načrti

Predvideni študijski rezultati:**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.

Intended learning outcomes:**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:

Predavanja, seminarji, skupinsko ali individualno delo.

Learning and teaching methods:

Lectures, seminars, team or individual work.

Načini ocenjevanja:

Ocena izpita:

- aktivna udeležba
- pisni izpit
- ocena projekta/seminarja

Delež (v %) /

Weight (in %)

10%

60%

30%

Assessment:

Lectures assessment:

- active participation
- written exam
- 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

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

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

Vpis v doktorski študij Varstvo okolja.

Prerequisites:

Enrolment in the doctoral study Environment protection.

Vsebina:

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 (kislina 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,

Content (Syllabus outline):

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, ozone layer, greenhouse effect). Air pollutants and plants

topla 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.

(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 Imprint 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 Staij, 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.

Revije / Journals

Plant Ecology,
Photosynthetica,
Plant, Cell and Environment

Cilji in kompetence:

Razumevanje delovanja abiotskih in biotskih dejavnikov na rastline in vloge rastlin pri preoblikovanju okolja ter ekosistemskih storitev. Razumevanje antropogenih vplivov in globalnih sprememb na rastline.

Objectives and competences:

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:

Znanje in razumevanje. Študenti spoznajo osnovne vloge rastlin pri oblikovanju atmosfere, pedosfere in biosfere, ter grožnje rastlinam zaradi sprememb ter ohranitvene in omilitvene ukrepe ter načine izboljšanja stanja.

Uporaba. Razumevanje pomena rastlin za vzdrževanje ugodnih razmer ter njihovo prilagojenost 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.

Intended learning outcomes:

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:

Predavanja, seminarji, laboratorijske vaje, projektna naloga in terensko delo

Learning and teaching methods:

Lectures, seminar, coursework, laboratory exercises, field work

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**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>.

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 /

Predavanja / Lectures: Slovenski / Slovenian

Languages:

Vaje / Tutorial: Slovenski / Slovenian

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

Splošni pogoji za vpis na doktorski študij.
Predznanje temeljev kemije, farmakologije, mikrobiologije, biologije in geologije.

Prerequisites:

General requirements for admission to PhD study with knowledge of the foundations of chemistry, pharmacology, microbiology, biology and geology.

Vsebina:

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 onesnaževalcev 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 veterinarski medicini, zlasti iz skupine

Content (Syllabus outline):

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 veterinary medicine, and in particular from the

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.

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:

Seznantiti 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 organiziranosti 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

Objectives and competences:

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

strokovnih izrazov iz področja toksikokinetike. Nudi razumevanje različnih procesov toksikokinetike. Slušatelji se bodo seznanili s temelji živalske in okoljske toksikokinetike, spoznali bodo kje se prepletata in dopolnjujeta.

definitions and terminology in the field of toxicokinetics. It offers an understanding of the 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:

Znanje in razumevanje:
Pri predmetu študent usvoji znanje s področja toksikodinamike zdravil in drugih onasnaževalcev in njihov učinek na okolje.

Intended learning outcomes:

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:

Predavanja, konzultacije, raziskovalni seminarji

Learning and teaching methods:

Lectures, consultations, research seminars

Načini ocenjevanja:

Ustni izpit
raziskovalne seminarske naloge

Delež (v %) /

Weight (in %)

Assessment:

Oral examination
research paper

60 %
40 %

Reference nosilca / Lecturer's references:**Silvestra Kobal:**

- 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.
- 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.
- 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

Jeziki /
Languages:Predavanja / Lectures: Slovenski in/ali angleški
Slovenian and/or EnglishVaje / Tutorial: Slovenski in/ali angleški
Slovenian and/or English

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

Predznanje s področja matematike, fizike, mehanike, inženirske geologije, mehanike tal in mehanike kamnin.

Prerequisites:

Good knowledge of mathematics, physics, mechanics, engineering geology, soil mechanics and rock mechanics.

Vsebina:

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

Content (Syllabus outline):

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 rešitev.

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 sidrskih 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:

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.

Objectives and competences:

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:

Znanje in razumevanje:
Pridobljena bodo znanja o načrtovanju podzemnih prostorov ob upoštevanju specifičnih lastnosti hribovskih območij ter principov trajnostnega razvoja posameznih območij na osnovi razumevanja sodobnih tehničnih postopkov gradnje podzemnih objektov.

Intended learning outcomes:

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:

Poučevanje poteka v okviru predavanj, seminarjev in laboratorijskih vaj ter terenskih vaj, ki vključujejo ogled gradbišč podzemnih objektov. Učenje je sprotno s poudarkom na učni predelavi podane snovi, sodelovanju pri analizi seminarskih nalog, aktivni izvedbi laboratorijskih vaj, ter aktivni udeležbi na terenskih vajah.

Learning and teaching methods:

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:

Ob sprotne 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.

Delež (v %) /

Weight (in %)

Assessment:

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.

učni načrti

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.;

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

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:

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

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

Vpis v doktorski študij. Opravljene obveznosti pri temeljnih predmetih

Prerequisites:

Enrolment in doctoral studies. Completed requirements for core subjects

Vsebina:

Željeno in neželjeno: 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 ustrežnejšega razreševanja navzkrižij.

Content (Syllabus outline):

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:

Varovanje okolja zahteva tudi ustrezno umeščanje kritičnih, v javnosti iz različnih razlogov neprijetljivih 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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Predavanja in seminarske vaje

Learning and teaching methods:

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.

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

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:

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:

Vsebina:

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, pridobivanje podatkov
Interpretacija podob daljinskega zaznavanja – digitalna obdelava podob, vizualna interpretacija
Predobdelava podob – odprava napak v delovanju

Content (Syllabus outline):

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

senzorjev, geometrijski popravki, atmosferski popravki, popravki osvetlitve in topografska normalizacija, kalibracija senzorja
 Izboljšanje podob – človeški vid in barvni prostori, izboljšanje kontrasta, psevdo-barvni 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)

malfunctioning, geometric corrections, 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)

Temeljna 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:

Študenti pridobijo znanje o uporabi daljinskega zaznavanja pri varstvu okolja. Spoznajo postopke obdelave digitalnih podob in se usposobijo za samostojno aplikacijo tehnologije.

Objectives and competences:

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:

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 povezuje 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.

Intended learning outcomes:

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:

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.

Learning and teaching methods:

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.

Delež (v %) /

Weight (in %)

Načini ocenjevanja:

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 seminarских vaj in izdelana v obliki znanstvenega oziroma strokovnega članka.

100 %

Assessment:

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:

1. 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.
2. 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.
3. KOBLEK, 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

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

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

Vpis v doktorski študij.
Predznanje s področja tehnike ali naravoslovja.

Prerequisites:

Enrollment in doctoral studies.
Prior knowledge in subjects from technical or natural sciences.

Vsebina:

Zanesljivost v procesni industriji
Varnost in tveganje
Matematične osnove in analitična orodja
Identifikacija in kvantifikacija nevarnosti
Verjetnostne varnostne analize
Drevesa okvar in drevesa dogodkov
Deterministične varnostne analize
Simulacije in industrijske aplikacije

Content (Syllabus outline):

Reliability in process engineering
Safety and risk
Mathematical fundamentals and analytical tools
Identification and quantification of threats
Probabilistic safety assessment
Fault trees and event trees
Deterministic safety analyses
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. Cheremisinoff, 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:

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.

Objectives and competences:

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:

Sposobnost identifikacije in analize tveganja specifičnih industrijskih postrojev za okolje ter ocene eventualnih posledic hipotetične nesreče.

Intended learning outcomes:

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:

- Predavanja s teoretično vsebino
- Raziskovalni seminarji
- Projektno delo
- Individualne naloge
- Vodeni individualni študij

Learning and teaching methods:

- Theoretical lectures
- Research term papers
- Project works
- Individual assignments
- Individual studies with tutoring

Načini ocenjevanja:

- Seminarska naloga
- Pisni izpit
- Zagovor pisnega izpita

Delež (v %) /

Weight (in %)

Assessment:

- Term paper
- Written examination
- 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.

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

Jeziki /

Predavanja / Lectures: Slovenski/ Slovenian

Languages:

Vaje / Tutorial:

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

Vpis v doktorski študij.

Prerequisites:

Inscription in the PhD programme.

Vsebina:

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. Proces 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 varstvo

Content (Syllabus outline):

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 impact assessment, evaluation of alternative

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.

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:

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.

Objectives and competences:

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:

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

Intended learning outcomes:

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

učni načrti

Metode poučevanja in učenja:

Predavanja s prosojnicami (ppt)
Samostojno delo – priprava seminarske naloge na osnovi virov, konzultacij in terenskih ogledov
Predstavitve seminarskih nalog z razpravo

Learning and teaching methods:

Lectures supported with ppt presentations
Individual work: project on a chosen topic, with support of literature, consultations and field work
Presentations of projects with discussion

Načini ocenjevanja:

Seminarska naloga
zagovor seminarske naloge,

Delež (v %) /

Weight (in %)

70%**30%****Assessment:**

Project (written)
Presentation and defense of the project

Reference nosilca / Lecturer's references:**Mojca Golobič**

1. **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.
2. KUČAN, Ana, **GOLOBIČ, Mojca**. Die Zukunft der Kulturlandschaften Sloweniens = The future for Slovenian cultural landscapes. *Topos (Münch.)*, June 2004, vol. 47, str. 79-86.
3. **GOLOBIČ, Mojca**. Il paesaggio come risultato 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.

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

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:

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

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

Prerequisites:

Vsebina:

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 preventivno in kurativno zaščito.

Content (Syllabus outline):

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. Biotechnological and physical (temperature, drying, asphyxiation) methods for preventive and curative

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.

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:

Pridobitev znanja o lesnih škodljivcih in usposobljenost za optimalne presoje in odločitve za izvajanje preventivne ali represivne zaščite lesenih objektov kulturne dediščine pred škodljivci.

Objectives and competences:

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:

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 izpostavitve 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.

Intended learning outcomes:

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:

Predavanja
 Seminar
 Vaje

Learning and teaching methods:

Lectures
 Seminar
 Tutorial

učni načrti

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Seminar	15%	Seminar
kolokvij	15%	colloquium
pisni izpit	20%	written exam
ustni izpit	50%	oral exam

Reference nosilca / Lecturer's references:

1. 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.
2. 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.
3. 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

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:

Vpis v doktorski študij.
Predznanje iz biotehniških, naravoslovnih in tehniških ved.

Prerequisites:

Enrolment in doctoral study.
Knowledge from the field of biotechnical, natural and technical sciences

Vsebina:

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: geolitoška podlaga, relief, klima in hidrosfera, ki preko flore in favne, naravne in koristne, omogočajo človeku preživetje.

Content (Syllabus outline):

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 fauna, natural and advantageous, enable the

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 odločitvah. 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.

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 pripomočki 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. Seznan 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 subaquatic 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:

Znanje in razumevanje:

Študentje pridobijo teoretična in praktična znanja.

Intended learning outcomes:

Knowledge and understanding:

The students obtain theoretical and practical knowledge.

učni načrti

Prenos znanj v prakso, kreacija razvoja in raziskav.

Transfer the knowledge into practice, creation of new development and research.

Metode poučevanja in učenja:

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.

Learning and teaching methods:

Lectures with multimedia support and seminars, exercises which require individual work and group discussion.

Načini ocenjevanja:

Delež (v %) /

Weight (in %) /

Assessment:

-seminar	50%	- seminar
- izpit	50%	- exam

Reference nosilcev / Lecturer's references:**Franc Lobnik:**

1. ZUPAN, Marko, EINAX, Jürgen W., KRAFT, Jörg, **LOBNIK, Franc**, HUDNIK, Vida. Chem characterization of soil and plant pollution: Part 1: Multivariate data analysis and geos determination of relationship and spatial structure of inorganic contaminants in soil. *Environ. sci. p res. int.*, 2000, vol. 7, no. 2, str. 89-96, graf. prikazi.

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

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

Jeziki /

Predavanja / Lectures: Slovenski/ Slovenian

Languages:

Vaje / Tutorial:

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

Vpis v doktorski študij.

Prerequisites:

Enrollment in the doctoral study programme.

Vsebina:

- 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, eutrofnost.
- 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.

Content (Syllabus outline):

- 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

<ul style="list-style-type: none"> - Metode zaščite in umetnega bogatenja 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). 	<ul style="list-style-type: none"> - Protection methods and artificial enrichment of 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 (overflow - discharge, retaining – stormwater tanks, releases to the sea, sanitation of lakes and accumulations).
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Temeljni literatura in viri / Readings:

- Juuti S. Petri,(2007), Environmental History of Water, IWA Publishing Cornwall, UK
- Takashi Asano & all, Water Reuse (2007), Metacif&EDDY/AECOM,
- 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, Singapore, 413 strani.
- Gerald, T.O. (1983), Mathematical Modelling of Water Quality, John Wiley & Sons, 518 strani.
- Imhoff K., Imhoff K. R. (1999), Taschenbuch der Städtentwaesserung, 28. Auflage, Oldenbourg Verlag, Muenchen , Wien, 442 strani.
- Degremont, I. (2007), Water Treatment 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, Singapore, 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:

- 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.
- zna uporabljati baze podatkov, in drugo področja okolja pri izdelavi disertacije.

Objectives and competences:

- 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:

- **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.

Intended learning outcomes:

- design solutions and propose the best option.
- knows how to create and use mathematical models to prepare a draft solutions and is able to comment and evaluate engineering.

Metode poučevanja in učenja:

Uvodn(o)a predavanja, seminarske vaje za utrditev vsebine predavanj in s praktičnimi primeri dela, ter izdelava individualne seminarske naloge na izbrano temo.

Learning and teaching methods:

Lectures, exercises with practical examples. Preparation of seminar with selected topic

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

Zagovor seminarske naloge na izbrano temo, ki je pogoj za pristop k ustnemu izpitu.	60 %	Seminar
Ustni izpit	40 %	Oral exam

Reference nosilca / Lecturer's references:

KOLBL, Sabina, PALOCZI, Attila, **PANJAN, Jože**, STRES, Blaž. Addressing case specific biogas plant tasks : industry oriented methane yields derived from 5 l Automatic Methane Potential Test Systems in batch or semi-continuous tests using realistic inocula, substrate particle sizes and organic loading. Bioresource technology 153 (2014), str. 180-188, ISSN 0960-8524, <http://www.sciencedirect.com/science/article/pii/S0960852413018270>, doi: 10.1016/j.biortech.2013.12.010

Maslo A., **PANJAN, J.**, ŽAGAR, D., Large-scale oil spill simulation us-ing the lattice Boltzmann method, validation on the Lebanon oil spill case Marine Pollution Bulletin 84 (2014), str. 225-235, 6603105], [JCR, SNIP

DREV, Darko, SLANE, Mitja, **PANJAN, Jože**. Untersuchungen über die ländlichen Badegewässer in Slowenien und Massnahmen zu deren Verbes-serung. Wasserwirtschaft, 2008, letn. 98, št. 12, str. 36-40, ilustr.

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.

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 / Slovene language
Vaje / Tutorial:

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

Vpis v doktorski študij

Prerequisites for involvement and performance of study commitments:

Enrolment in the doctoral programme

Vsebina:

- Zdravje in okolje
- Interakcija človeka in okolja – zgodovinska in sodobna perspektiva
- Dejavniki tveganja v naravnem in delovnem okolju: biološki, fizikalni, kemični in biomehantični 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

Content (Syllabus outline):

- 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

učni načrti

<ul style="list-style-type: none"> – Pomembnejši dejavniki delovnega okolja in vpliv na zdravje populacije – 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...) 	<ul style="list-style-type: none"> – Important factors of the occupational environment 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 ...)
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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 higijene*. 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:

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.

Objectives and competences:

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.

učni načrti

Predvideni študijski rezultati:

Znanje in razumevanje:
Namen predmeta je tudi študentom pomagati razumeti specifične metode dela pri odkrivanju in obvladovanju škodljivosti v delovnem in bivalnem okolju.

Intended learning outcomes:

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:

Predavanja, seminarji, študij primerov, diskusije, nastopi, delo v manjših skupinah – reševanje konkretnih problemov, individualne naloge, spoznavanje realnih razmer.

Learning and teaching methods:

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

Jeziki /

Predavanja / Lectures: Slovenski (Angleški) / Slovenian (English)

Languages:

Vaje / Tutorial: Slovenski (Angleški) / Slovenian (English)

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

Pogoj za vključitev v delo oziroma za opravljanje študijskih obveznosti je vpis v 1. letnik doktorskega študija.

Prerequisites:

The condition to attend in the teaching course and to perform study obligations is an entry in the first year of doctoral study.

Vsebina:

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 toplote. Študij prenosa toplote v izmenjalnikih toplote, ki je nato podlaga za izbiro in izračun izmenjalnikov

Content (Syllabus outline):

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 exploitation. Study of heat transfer in heat exchangers, which form the basis for the

toplote za ogrevanje zraka za zgorevanje.	selection and calculation of the heat exchanger for heating air for combustion.
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Temeljni literatura in viri / Readings:

<p>DESHMUKH, Y.V. <i>Industrial Heating – Principles, Techniques, Materials, Applications and Design</i>. London: Taylor & Francis, 2005.</p> <p>GWYTHYER, D.N. <i>Worked Examples: Heat Transfer, Fuels & Refractories, Fluid Flow and Furnace Technology, The Institution of Metallurgists, Monograph No. 12</i>. London: The Chameleon Press, 1985.</p> <p>LINDON, C.T. <i>Heat Transfer</i>. New Jersey: Prentice-Hall, 1992.</p> <p>KAMINSKI, D.A. in JENSEN, M.K. <i>Introduction to Thermal and Fluid Engineering</i>. New York: Wiley International Edition, 2005.</p> <p>KAVIANY, M. <i>Principles of Heat Transfer</i>. New York: John Wiley & Sons, 2002.</p> <p>LAZIĆ, L. <i>Numeričke metode u toplinskoj analizi</i>. Sisak: Sveučilište u Zagrebu, Metalurški fakultet, 2007.</p> <p>MULLINGER, P. in JENKINS, B. <i>Industrial and Process Furnaces: Principles, Design and Operation</i>. Amsterdam: Butterworth-Heinemann, 2008.</p> <p>OLOMAN, C. <i>Material and Energy Balances</i>. London: Imperial College Press, 2009.</p> <p><i>Advances in Heat Transfer</i>, Elsevier, ISSN: 9780-1237</p> <p><i>Combustion and Flame</i>, Elsevier, ISSN: 0010-2180</p> <p><i>Gas, Wärme International</i>, Vulkan Verlag, ISSN: 0368-0932</p> <p><i>International Journal of Heat and Fluid Flow</i>, Elsevier, ISSN: 0142-727x</p> <p><i>International Communications in Heat and Mass Transfer</i>, Elsevier, ISSN: 0735-1953</p> <p><i>Progress in Energy and Combustion Science</i>, Elsevier, ISSN 0360-1285</p>

Cilji in kompetence:

<p>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.</p> <p>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.</p>
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Objectives and competences:

<p>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.</p>

Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>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.</p> <p>Študent pridobi znanja o ekološki naravnosti posameznih tehnoloških procesov in postopkov.</p> <p>Nauči se pravilnega ravnanja z odpadki, njihovim vplivom na obremenitev okolja ter se seznanj z zakonskimi predpisi in standardi.</p> <p>Študent pri predmetu nadgradi pridobljena znanja</p>
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Intended learning outcomes:

<p>Knowledge and understanding:</p> <p>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.</p> <p>Student acquires knowledge about the ecological orientation of individual technological processes and procedures. Learn the proper handling of waste, their impact on the environment and become acquainted with the legislative regulations and</p>
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učni načrti

<p>s področja prenosa toplote in snovi, toplotne tehnike in industrijskih peči z uporabo eksperimentalnih in numeričnih modelov in simulacij.</p> <p>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.</p> <p>Pridobi sposobnosti za samostojno znanstveno raziskovalno delo, razvoj, organizacijo in vodenje industrijskih in temeljnih raziskovalnih projektov.</p>	<p>standards.</p> <p>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.</p> <p>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.</p> <p>Student will acquire knowledge for individual scientific work, development, organization and conduction of industrial and fundamental scientific and research projects.</p>
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Metode poučevanja in učenja:

Predavanja, računske vaje in simulacije.
Računalniške simulacije in eksperimentalno delo.
Samostojno reševanje postavljenih problemov.
Individualno raziskovalno in projektno delo.

Learning and teaching methods:

Lectures. Exercises solving and simulations.
Computer simulations and experimental work.
Team and individual problem solving. Project work.

Načini ocenjevanja:

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.

Delež (v %) /
Weight (in %)

35 %
30 %
35 %

Assessment:

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

učni načrti

Engineering, 2007, vol. 22, issue 2, pp. 87-90.

2. **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.
3. ZORC, Borut, **KOSEC, Borut**, KOSEC, Ladislav, NAGODE, Aleš. Analysis of hot water pipeline system leakage. Engineering Failure Analysis, 2013, vol. 28, pp. 78-81.

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:

Vpis na doktorski študij

Prerequisites:

Registration in the doctoral study

Vsebina:

Predmet podaja osnovna znanja o medsebojnem 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.

Content (Syllabus outline):

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 introductory 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:

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.

Objectives and competences:

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:

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.

Intended learning outcomes:

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:

Predavanja in seminarji

Learning and teaching methods:

Lectures and seminars

Načini ocenjevanja:

naloge,
ustni izpit

Delež (v %) /
Weight (in %)

30%
70%

Assessment:

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:	ŽIVALSKÉ 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

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:

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

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

Prerequisites:

Vsebina:

Živalske kužne bolezni so vsekakor eden od pomembnejših faktorjev, ki ne vpliva samo na ekonomiko živilno-rejske 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

Content (Syllabus outline):

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

okolju, ki lahko 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.

spreading. Pathogens are spread from animal 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 government publishing service.
- Mc Ferran JB, McNulty MS (1993): Virus infections in birds. Amsterdam: Elsevier Science Publisher.
- Alexander DJ (2000). A review 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 al. 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, Salleres 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:

Izobraževalni cilj predmeta je podati osnovna znanja o povzročiteljih aktualnih živalskih kužnih boleznih, o pojavnosti in razširjenosti teh boleznih, o načinih odkrivanja in zatiranja teh boleznih ter vplivih teh boleznih kakot tudi metod zatiranja na okolje. Študent se bo seznanil z osnovnimi epidemiološkimi pristopi vplivov na širjenje živalskih kužnih ter z nekaterimi mehanizmi širjenja boleznih 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 vsodbuditi k povezovanju tehnoloških ali socioloških znanj z biomedicinskimi znanji.

Objectives and competences:

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 infectious diseases and encourage them to reflect on approaches that provide protection from their harmful effects to the environment and to humans. We aim to encourage the students to integrate technological and sociological skills with biomedical methods.

Predvideni študijski rezultati:

Znanje in razumevanje:
Predmet povezuje znanja iz področja kužnih boleznih živali, epidemiologije in analize rizika z znanjem iz področja vplivov živali na okolje in okolja na živali

Intended learning outcomes:

Knowledge and understanding:
The subject connects the knowledge of animal contagious diseases, epidemiology and risk analysis with knowledge of influence of animals on environment and environment on animals.

Metode poučevanja in učenja:

- predavanja
- literatura

Learning and teaching methods:

- lectures
- literature

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

- izdelava seminarske naloge
- izpit

80%
20%

- seminar paper
- examination

Reference nosilca / Lecturer's references:

1. 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.
2. 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.
3. **POGAČNIK, Milan**, TADIČ, Marko, PAVLAK, Marina, MALOVRH, Tadej, POSEDI, Janez, HOSTNI K, 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-Veterinarska Uprava RS, Ljubljana, 2008