UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	OSNOVE OKOLJSKEGA INŽENIRSTVA
Course Title:	INTRODUCTION TO ENVIRONMENTAL ENGINEERING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja	**/**	**2.**	**4.**
USP Chemical Egineering, 1st Cycle	**/**	**2nd**	**4th**

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: INSI2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	**15**	**15 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer: doc. dr. Gabriela Kalčíková /
Dr. Gabriela Kalčíková / Assistant Professor

Jeziki / Languages:

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Osnove okoljske problematike: osnovni procesi v okolju, soodvisnost elementov okolja, orodja okoljskega inženirja, kvantifikacija okoljskih problemov, lokalni in globalni okoljski vplivi človeka, trajnostni razvoj, etična izbira, ekonomski principi.

Onesnaženje: viri, tipične vrste in vplivi, dinamika onesnaženja, mehanizmi transporta, elementi in principi ekologije, kinetika (bio)kemijskih reakcij, večfazni sistemi in interakcije, masne bilance ekosistemov, zakonodaja.

Vode: hidrološki cikel, kemija površinskih in odpadnih vod ter podtalnice, parametri za

Content (Syllabus outline):

Fundamentals: Basic environmental processes, fundamentals of ecosystems, relationship between environmental compartments, resources and society, quantification of regional, local and global impacts, engineering approaches, economics and the environment, sustainable development, ethics and engineering decisions.

Pollutants: types, origins, effects, fate in the environment, mass transport, transformation, kinetics of (bio)chemical reactions, multi-phase systems, environmental mass balances, legislation.

UL FKKT

vrednotenje kvalitete vode, osnove izbire in dimenzioniranja naprav za pripravo pitnih in tehnoloških vod, zbiranje in transport odpadnih vod, načini čiščenja in osnove dimenzioniranja čistilnih naprav (konvencionalne in napredne tehnologije, kombinacije različnih tehnologij), postopki obdelave blata iz čistilnih naprav. Tla: transport polutantov, pregled remediacijskih tehnik (In situ in Ex situ biološke in fizikalno-kemijske metode) Zrak: primarni in sekundarni polutanti, kemija zračnih polutantov (regijski in globalni pojavi), mobilni in stacionarni viri polutantov, lokalni in globalni problemi, osnove modeliranja disperzij polutantov, tehnologije kontrole emisij, recikliranje, osnove načrtovanja in dimenzioniranja čistilnih naprav. Trdni odpadki: karakterizacija odpadkov, zbiranje in ravnanje z odpadki (nevarni in nenevarni), snovna in energetska izraba, deponije in termična obdelava.	Water: hydrological cycle, sources and effects of pollution, chemistry of surface, underground and wastewaters, water quality assessment parameters, systems used in water supply, systems for conditioning of drinking and industrial waters, wastewater collection systems, wastewaters and their treatment (conventional and advanced processes, combinations), sludge treatment and disposal. Soil: Transport and fate of pollutants, remediation and bioremediation techniques (In Situ and Ex Situ biological and physico-chemical methods). Air: Primary and secondary pollutants, fundamentals of air chemistry, regional and global pollution, stationary and mobile sources of pollutants and problems (consequences, possible solutions), fundamentals of modelling of pollutants dispersions, treatment and control technologies, fundamentals of treatment plant design, recycling of pollutants. Solid waste: solid waste collection and disposal, resource recovery, hazardous waste processing and handling, material and energy recovery, landfilling and thermal processing

Temeljna literatura in viri / Readings:

- P.A. Vesilind, S.M. Morgan: *Introduction to Environmental Engineering,* 2nd Ed., Thomson Brooks/Cole, London, 2004, 479 strani (30%)
- M.L. Davis, S.J. Masten: *Principles of Environmental Engineering and Science,* McGraw-Hill, 2004, 704 strani, (10%).

ŽGAJNAR GOTVAJN, Andreja, ZAGORC-KONČAN, Jana. *Osnove okoljskega inženirstva : praktikum*. 1. izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2015 (100%)

Dodatna literatura:

- G.M. Masters: *Introduction to Environmental Engineering and Science*. 2nd Ed., Prentice-Hall International, London, 1998, 651 strani (20%).
- J.Zagorc-Končan, A. Žgajnar Gotvajn: *Zbirka nalog iz ekološkega inženirstva*, UL, FKKT, 2008, 45 strani.

UL FKKT

Cilji in kompetence:	**Objectives and Competences:**
Cilji: Razvijati zavest in znanje za kritičen in kvantitativen sistematičen interdisciplinaren inženirski pristop k okoljskim problemom. Kompetence: Poznavanje osnovnih procesov v okolju, vplive polutantov na okolje, poznavanje metod preprečevanje onesnaženja in čiščenja obstoječega onesnaženja. Sposobnost prenosa teoretičnih znanj v prakso za reševanje konkretnih okoljskih problemov ob upoštevanju ekonomskih, etičnih in zakonskih omejitev.	Objectives: Development of knowledge and awareness for critical and quantitative interdisciplinary approach of an engineer to environmental problems. Specific competences: Knowledge on fundamental processes in the environment and the impact of different pollutants. Knowledge principles of pollution prevention, tretament and remediation. Development of ability to transfer theoretical knowledge into practice to solve actual environmental problems within economical, social and legislative limits.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Razumevanje kompleksnih soodvisnosti in zakonitosti procesov v okolju (zrak, tla in voda) in vpliva človeka na ekosistem. Poznavanje, razumevanje in sposobnost uporabe inženirskih orodij in znanj za reševanje okoljskih problemov. Razumevanje in uporaba koncepta trajnosti, etičnih in ekonomskih načel pri načrtovanju in vodenju procesov.	<u>Knowledge and Comprehension</u> Understanding of complex correlations between processes in the environment (air, soil and water). Deep understanding of human impacts on ecosystems. Ability to recognise engineering approach as the fundament for realising solutions to a range of environmental issues. Knowledge on sustainable development principles, economic aspects and social responsibility of engineers when designing and operate different processes.
<u>Uporaba</u> Sposobnost kvantifikacije okoljskih problemov in uporaba zakonitosti pri reševanju kompleksnejših inženirskih problemov. Sinteza inženirskih principov in tehnik skupaj z znanjem naravoslovja za iskanje rešitev specifičnih problemov.	<u>Application</u> Ability of quantification of environmental problems and application of natural laws in solving more complex engineering environmental problems. Synthesis of engineering principles and techniques together with knowledge on fundamental environmental principles to solve particular problems
<u>Refleksija</u> Sposobnost prepoznavanja in kvantifikacije okoljskih problemov in vplivov, sposobnost poiskati povezavo med teorijo in problemi v lastni okolici. Razumeti svojo etično	<u>Analysis</u> Ability to recognize and quantify environmental problems and impacts, connect theoretical knowledge and actual local and regional environmental problems. Understand own

UL FKKT

odgovornost.	ethical responsibility.
Prenosljive spretnosti Spretnost uporabe domače in tuje literature. Sinteza znanja različnih naravoslovnih področij (kemije, biologije, fizike, tehnike). Razvoj sposobnosti povezati praktične probleme s teoretičnimi znanji. Uporaba ustnega in pisnega načina poročanja. Razvoj sposobnosti dela v skupini.	Skill-transference Ability Ability to search, select and apply different types of literature. Synthesis of different fields of basic science (chemistry, physics, biology, engineering sciences). Ability to connect theoretical and practical approach. Development of oral and literate skills. Development of ability to work in teams.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
- Predavanja - Laboratorijske vaje - Strokovna ekskurzija	Lectures Lab courses Field trip

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene obveznosti pri vajah. Pisni izpit.	**25%** **75%**	Accomplished lab course. Written exam

Reference nosilca / Lecturer's references:

KALČÍKOVÁ, Gabriela, ALIČ, Branko, SKALAR, Tina, BUNDSCHUH, Mirco, ŽGAJNAR GOTVAJN, Andreja. Wastewater treatment plant effluents as source of cosmetic polyethylene microbeads to freshwater. *Chemosphere*, ISSN 0045-6535. [Print ed.], Dec. 2017, vol. 188, str. 25-31.

KALČÍKOVÁ, Gabriela, ŽGAJNAR GOTVAJN, Andreja. From dumping to sustainable landfilling : the concept of aerobic landfills. V: JACKSON, Carla H. (ur.). *Landfills and recycling centers : processing systems, impact on the environment and adverse health effects*, (Environmental remediation technologies, regulations and safety). New York: Nova Science Publishers. cop. 2015, str. 199-221.

KALČÍKOVÁ, Gabriela, TRATAR-PIRC, Elizabeta, ŽGAJNAR GOTVAJN, Andreja. Aerobic and anaerobic biodegradation potential of leachate from old active landfill. *Desalination and water treatment*, ISSN 1944-3994. [Print ed.], 2016, vol. 57, iss. 19, str. 8619-8625

UL FKKT