

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	PROCESI V TEHNOLOGIJAH VARSTVA OKOLJA
Course Title:	ENVIRONMENTAL PROTECTION TECHNOLOGY PROCESSES

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Kemijsko inženirstvo, 2. stopnja	/	1.	1.
USP Chemical Engineering, 2 nd Cycle	/	1 st	1 st

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

IN214

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:Prof. dr. Andreja Žgajnar Gotvajn /
Dr. Andreja Žgajnar Gotvajn, Associate 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:

Onesnaženje: vrste in viri onesnaženja, mehanizmi transporta, pretvorb in vplivi v okolju (voda, zrak, tla).

Čiščenje onesnaženja: sodobni postopki in smeri razvoja pri čiščenju odpadnih vod, pregled konvencionalnih (koagulacija, flokulacija, adsorpcija, biološko čiščenje) in naprednih (oksidacijski procesi, katalitske in membranske tehnike) čistilnih naprav za čiščenje odpadnih vod, postopki in pregled čistilnih naprav za zrak (usedalniki, cikloni, elektrostatski precipitatorji, adsorberji, katalitski procesi), procesi remediacije in

Content (Syllabus outline):

Pollution: Types and sources, mechanisms of transport, environmental fate and impacts (water, soil, air).

Pollution reduction: overview of up-to-date processes and methods of wastewater treatment, review of conventional (coagulation, flocculation, adsorption, biological treatment) and advanced (oxidation processes, catalytic, membrane techniques) wastewater treatment systems, processes and treatment devices for air pollution control (settling chambers, cyclones, electrostatic precipitators, scrubbers, adsorbers, catalytic combustion). Remediation

bioremediacije za čiščenje onesnaženih tal in podtalnice, tehnološki/ekonomski vzvodi vodenja in nadzora čistilnih naprav/procesov, postopki optimizacije.

Okoljska ocena industrijskih procesov: politika in strategija varovanja okolja, dodatno in procesno integrirano varovanje okolja, IPPC (Integrated Pollution Prevention) direktiva, moderno upravljanje industrijskih izpustov, najboljša dostopna tehnologija BAT (Best Available Technology) - kombinacija objekta in okolja z optimalno in ekonomsko najbolj učinkovito kontrolo onesnaženja. Zakonodaja.

Zmanjševanje vplivov na okolje: načini ocenjevanja vplivov procesov na okolje, pregled globalnih problemov (vzroki, ekonomske in socialne posledice, perspektive, možne rešitve), ravnanje z odpadki in načini njihove predelave, odpadek kot surovina in energent, koncept čistejše proizvodnje. Problematika fosilnih in obnovljivih virov energije.

and bioremediation processes (ground waters, contaminated soils). Proces controll, monitoring and optimization.

Environmental Evaluation of Industrial Processes: policy and strategies of environmental protection, end-of-pipe measures and production-integrated environmental protection, IPPC Directive), the concepts of BAT (Best Available Technology processes, technical and economical measures to reduction of environmental impacts. Legislation.

Environmental Impact Reduction: environmental impact assessment approaches, global environmental problems (sources, consequences, perspectives, solutions), solid waste management and processing, waste as material and energy source, concepts of cleaner and sustainable technologies and production. Fossil and renewable sources of energy: drawbacks and benefits.

Temeljna literatura in viri / Readings:

G. Burke, B.R. Singh, L. Theodore: Handbook of Environmental Management and Technology, Wiley, 2005, 800 pages (25%).

C.C. Lee, S.D. Lin (Eds.): Handbook of Environmental Engineering Calculations, 2nd Ed., McGraw Hill, New York, 2007, 3297 pages (15%).

Žgajnar Gotvajn, A., Kalčikova G., Zagorc-Končan, A.: Procesi v tehnologijah varstva okolja, UL FKKT, 2017 (100%)

Dodatna literatura:

G. Tchobanoglous: Wastewater Engineering: Treatment and Reuse, 4th Ed. McGraw-Hill Science/Engineering/Math, 2003, 1570 pages

J. Zagorc-Končan, A. Žgajnar Gotvajn: Zbirka nalog iz ekološkega inženirstva, UL, FKKT, 2008, 45 pages (50%).

D.T. Allen, D.R. Shonnard: Green Engineering: Environmentally Conscious Design of Chemical Processes, Prentice Hall, Englewood Cliffs, 2001, 552 pages.

Cilji in kompetence:

Pridobitev poglobljenih znanj, potrebnih za aplikativno inženirsko reševanje okoljskih problemov na področju celovitega Znanje o načinih za identifikacijo in oceno

Objectives and Competences:

Objectives: To acquire deep knowledge on engineering tools for solving complex environmental problems. Ability to understand and apply the principles of environmental

škodljivih na okolje okolje, znanje za sodobno upravljanje industrijskih izpustov s kombinacijo ovrednotenja tehnologije, vpliva na okolje in ocene nevarnosti za okolje. Sposobnost integracije koncepta trajnostne zaščite okolja v proizvodne, ekonomske in vodstvene odločitve.

management, science and engineering.
Competences:
Knowledge on identification and determination of hazardous environmental impact assessment. Knowledge on complex management of industrial emissions and cost-effective processes which minimize pollution at a source, and/or reduce impact on health and the environment. Ability to understand integrated pollution prevention practices.

Predvideni študijski rezultati:

<u>Znanje in razumevanje</u> Samostojna uporaba inženirskih orodij in znanj za ekonomsko indružbeno sprejemljivo reševanje okoljskih problemov.
<u>Uporaba</u> Uporaba pridobljenih znanj pri reševanju kompleksnih inženirskih problemov. Sposobnost načrtovanja zahtevnih pristopov in eksperimentov ter ovrednotenja rezultatov, na podlagi katerih lahko načrtuje inženirske rešitve problemov.
<u>Refleksija</u> Razumeti svojo etično odgovornost. Kritično vrednotiti vpliv svojega dela na lokalni in globalni ravni.
<u>Prenosljive spretnosti</u> Spretnost uporabe domače in tuje literature. Spretnost identifikacije problema in pristopa k njegovemu učinkovitemu reševanju. Spretnost izvedbe in ovrednotenja zahtevnih meritev. Uporaba ustnega in pisnega načina poročanja. Delo v skupinah.

Intended Learning Outcomes:

<u>Knowledge and Comprehension</u> Ability to apply engineering approach to solve various complex environmental problems in cost-effective manner with ethical responsibility within social context.
<u>Application</u> Ability of quantification of problems and solving more complex environmental problems. Design of complex approaches and experiments and evaluation of results for design or optimisation of adequate solutions of actual problems.
<u>Analysis</u> Understand the environmental, economic and ethic consequences of technical decisions. Evaluate the work critically.
<u>Skill-transference Ability</u> Ability to search, select and apply different types of literature. Ability to independently identify various environmental problems and search for solution. The ability to design, perform and evaluate complex measurements. Development of oral and literate skills.

Metode poučevanja in učenja:

- Predavanja - Laboratorijske vaje - Projektno delo

Learning and Teaching Methods:

Lectures Lab courses Project work

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Opravljenosti obveznosti pri vajah.	10%	Accomplished lab course.
Pisni in ustni izpit.	70%	Written and oral exam.
Projektna naloga z ustnim poročanjem.	20%	Presentation of the project.

Reference nosilca / Lecturer's references:

- MARQUES, Susana, MESTRE, Ana S., MACHUQUEIRO, Miguel, **ŽGAJNAR GOTVAJN, Andreja**, MARINŠEK, Marjan, CARVALHO, Ana Paula. Apple tree branches derived activated carbons for the removal of β -blocker atenolol. Chemical engineering journal. Aug. 2018, vol. 345, str. 669-678.
- KORICA, Predrag, **ŽGAJNAR GOTVAJN, Andreja**. Models for evaluating prevention of waste on a macroeconomic level. V: JACKSON, Carla H. (ur.). Landfills and recycling centers : processing systems, impact on the environment and adverse health effects. New York: Nova Science Publishers, cop. 2015. Str. 167-197.
- ČEHOVIN, Matej, MEDIC, Alojz, SCHEIDELER, Jens, MIELCKE, Joerg, RIED, Achim, KOMPARE, Boris, **ŽGAJNAR GOTVAJN, Andreja**. Hydrodynamic cavitation in combination with the ozone, hydrogen peroxide and the UV-based advanced oxidation processes for the removal of natural organic matter from drinking water. Ultrasonics Sonochemistry. 2017, vol. 37, str. 394-404, ilustr. ISSN 1350-4177.

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