

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	INDUSTRIJSKI PROCESI IN TRAJNOSTNI RAZVOJ
Course Title:	INDUSTRIAL PROCESSES AND SUSTAINABLE DEVELOPMENT

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VSŠP Kemijska tehnologija, 1. stopnja	/	3.	6.
PSP Chemical Technology, 1 st Cycle	/	3 rd	6 th

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

KT134

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	10	20 LV	/	/	75	5

Nosilec predmeta / Lecturer:prof. dr. Andreja Žgajnar Gotvajn /
Dr. Andreja Žgajnar Gotvajn, Full 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:

Trajnostni razvoj: definicije, terminologija, vzporednice in razlike med industrijskimi procesi in biološkimi sistemi, vpliv industrijskih sistemov na naravo in človeka, etika industrijske proizvodnje, čistejša proizvodnja za izboljšanje materialnih in energijskih izkoristkov, zaščita naravnih virov, pomen celovitega pristopa k posameznem okoljskem problemu, zakonodaja.

Orodja: vrste, viri in transport onesnaženja, vrednotenje vplivov onesnaženja na okolje, konvencionalne in sodobne tehnike za preprečevanje onesnaženja in remediacijo obstoječega onesnaženja, tehnike za doseg eko-učinkovitosti industrijskega procesa ter čistejše

Content (Syllabus outline):

Sustainable development: definitions, terminology, comparison of industrial and natural processes, the impact of industrial processes to nature and mankind, ethics of industrial production, cleaner production for reduction of material and energy use, preservation of natural resources, the importance of complex approach for solving environmental problems, legislation.

Tools: types, sources and environmental pathways of pollution, assessment of environmental impacts of pollution, conventional and advanced pollution prevention techniques, remediation techniques,

proizvodnje, optimiranje tehnoloških postopkov, energetska in snovna izraba odpadkov, zamenjava/minimizacija surovin, varčevanje z naravnimi viri in energijo, uporaba sekundarnih surovin, recikliranje, zaprti tehnološki procesi, koncept proizvodnje brez odpadkov, izobraževanje zaposlenih in uporabnikov proizvodov.

Viri energije: konvencionalni viri energije, obnovljivi viri energije, možnosti prehoda iz obstoječih na trajnostne vire energije, problematika obnovljivih virov energije (transport, dostopnost, sezonska variacija, globalen vpliv na okolje), pričakovane smernice uporabe.

Osnove industrijske ekologije: integrirana strategija preventive pred onesnaženjem, LCA (Life Cycle Assessment) izdelkov, eko-optimizacija produkta in procesa, učinkovit transport, nadzor in izboljševanje sistema, upoštevanje lokalne mikroklimе, lokalni, regionalni in globalni pristop.

Uporaba koncepta trajnostnega razvoja na primeru, ki bo relevanten s slovenskega prostora.

industrial eco-efficiency methods, methods for cleaner production, optimization of production processes, material and energy recovery of solid wastes, replacement/minimisation of natural resources usage, preservation of natural resources, use of secondary raw materials, recycling, implementation of closed loops, zero waste management, education of employees and product users.

Energy: conventional and renewable energy sources, possibilities of renewable energy usage, problems related to renewable energy implementation (logistics, availability, variations, environmental impact), expected trends.

Basics of industrial ecology: integrated pollution prevention strategies, LCA (Life Cycle Assessment) approaches, eco-optimization of products and processes, effective transportation, monitoring and improvement of existing systems, importance of local micro-conditions, local, regional and global approach.

Implementation of concept of industrial ecology: A case study with product or process relevant in time and place.

Temeljna literatura in viri / Readings:

OSNOVNA LITERATURA-knjižnica:

- P. P. Rogers, K. F. Jalal, J. A. Boyd: An Introduction to Sustainable Development, Harvard University Press, 2006, 404 strani (30%).

- G. M. Masters: Introduction to Environmental Engineering and Science, Prentice Hall, 1996, 651 strani (20%).

- J. Zagorc-Končan, A. Žgajnar Gotvajn: Zbirka nalog iz ekološkega inženirstva, UL, FKKT, 2008, 45 strani.

DODATNA LITERATURA-knjižnica:

- R. U. Ayres, L. Ayres: A Handbook of Industrial Ecology, Edward Elgar, 2002, 680 strani (15%).

Cilji in kompetence:

Cilji:

Poznavanje definicij in pomena trajnostnega razvoja. Spoznanje o lokalnih in globalnih vplivih in vpetosti industrijskega procesa v lokalno in globalno okolje.

Kompetence:

Objectives and Competences:

Objectives:

Knowledge on definitions in sustainable development and awareness of its relevance in modern society. Knowledge on local and global impacts of industrial processes and their incorporation into the local and global environment.

Znanje o pristopih in metodah za doseg trajnostnega razvoja. Razumevanje osnovnih načel za načrtovanje čistejše proizvodnje v obstoječi ali na novo načrtovani proizvodnji v različnih industrijskih branžah. Zavedanje o etični in družbeni odgovornosti in potrebi po nenehnem izpopolnjevanju že postavljenega sistema.

Competences:
Knowledge on approaches and methods for implementation of concept of sustainable development. Basics of design and implementation of clean production in existing or/and planned industrial processes. Awareness of ethical and social responsibility and need for constant improvement of existing systems.

Predvideni študijski rezultati:

<u>Znanje in razumevanje</u> Razumevanje povezav in odnosov med osvojenimi pojmi. Sposobnost vrednotenja vpliva procesov (lokalno in globalno) na ljudi in okolje. Znanje za vpeljavo koncepta trajnosti v obstoječ industrijski proces.
<u>Uporaba</u> Uporaba pridobljenih znanj pri reševanju okoljskih problemov. Sposobnost sinteze in interdisciplinarnega pristopa k reševanju problemov.
<u>Refleksija</u> Razumeti pomen izbire ustreznih tehnoloških postopkov in surovin za ohranjanje naravnih virov. 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. Uporaba ustnega in pisnega načina poročanja. Spretnost sinteze na različnih področjih pridobljenih znanj. Spretnost skupinskega dela.

Intended Learning Outcomes:

<u>Knowledge and Comprehension</u> Understanding relationships between different terms. Ability to evaluate the impact of processes to environment and people locally and globally. Ability to implement the concept of sustainability into new or existing industrial process.
<u>Application</u> Ability of applying acquired knowledge for solving environmental problems. Ability of interdisciplinary approach to problem solving.
<u>Analysis</u> Understand the importance of selection of appropriate technologies and raw materials to protect natural resources. Evaluate the work critically on local as well as global basis.
<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. Development of oral and literate skills. Developing the skill of team work.

Metode poučevanja in učenja:

Predavanja
Laboratorijske vaje
Projektno delo

Learning and Teaching Methods:

Lectures
Lab course
Project work

Načini ocenjevanja:

Opravljene obveznosti pri vajah.
Pisni in ustni izpit.
Predstavitve projekta.

Delež (v %) /
Weight (in %)

Assessment:

Accomplished lab course.
Written and oral exam.
Project presentation.

Reference nosilca / Lecturer's references:

1. ŽGAJNAR GOTVAJN, Andreja, KALČÍKOVÁ, Gabriela. Delamination of plastic-coated waste paper by enzymes of the white rot fungus *Dichomitus squalens*. *Journal of environmental management*. Dec. 2018, vol. 228, str. 165-168.
2. KALČÍKOVÁ, Gabriela, ŽGAJNAR GOTVAJN, Andreja, KLADNIK, Aleš, JEMEC KOKALJ, Anita. Impact of polyethylene microbeads on the floating freshwater plant duckweed *Lemna minor*. *Environmental pollution*. [Print ed.]. Nov. 2017, vol. 230, str. 1108-1115.
3. LUBEJ, Martin, KALČÍKOVÁ, Gabriela, PLAZL, Igor, ŽGAJNAR GOTVAJN, Andreja. Feasibility of carbon nanofiber catalyst support for the heterogeneous Fenton process. *Journal of environmental engineering*. Apr. 2016, vol. 142, iss. 4, str. 1-6.

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