

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	TEHNOLOGIJE ZA ZMANJŠEVANJE ONESNAŽEVANJA OKOLJA
<b>Course title:</b>	TECHNOLOGIES FOR REDUCTION OF ENVIRONMENTAL POLLUTION

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 1. stopnja	/	1.	2.
Environmental Protection and Eco-technologies, 1 <sup>st</sup> level	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course type** Obvezni predmet / Obligatory course

**Univerzitetna koda predmeta / University course code:** TZOO

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30	/	20	/	10	100	6

**Nosilec predmeta / Lecturer:** izr. prof. dr. Viktor Grilc, asist. dr. Matjaž Ravnjak / Viktor Grilc  
Viktor, Ph.D., Associate Prof., Matjaž Ravnjak, Ph.D.

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

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

Pogojev ni.

**Prerequisites:**

No formal prerequisites.

**Vsebina predmeta:**

**Content (Syllabus outline):**

**Uvod:** antropogeni izvori onesnažil in tveganj ter vplivi na sestavine okolja; urejanje varstva okolja, okoljske tehnologije in obvladovanje tveganj na raznih nivojih; faze industrijskega razvoja; merila za trajnostnost proizvodnje, storitev, potrošnje in navad; krožno gospodarstvo; civilno-družbeni in korporativni instrumenti za implementacijo in spremljanje učinkovitosti okoljskih ukrepov in konceptov

**Preprečevanje oz. izogibanje onesnaževanja:**

- družbeni pristopi k varstvu okolja: strateški, zakonodajni, organizacijski in tehnološki ukrepi; sodobni koncepti preprečevanja onesnaževanja; pristop 'Reduce-Reuse-Recycle' (»3R«)
- celostni pristop k preprečevanje emisij v proizvodnih procesih – sistemski pristopi k varstvu okolja: zmanjševanje onesnaževanja okolja in upravljanje tveganj; standardizirani sistemi varstva okolja; standardi ISO 14000; analiza življenjskega cikla izdelka; nestandardizirani (interni) sistemski pristopi: čistejša proizvodnja, učinkovita raba virov, »zelena industrija«, odgovorna raba, eko-dizajn, eko-profit; načrtovanje izvajanja sistematičnega preprečevanja onesnaževanja; nadzor nad onesnaževanjem; masna bilanca procesov (makro in mikro skali); energijska bilanca
- najboljše proizvodne prakse, IPPC/IED in Seveso direktiva; NRT/BREF dokumenti; pristop 'treh ničel'; ocena vplivov in tveganj; okolju prijazno načrtovanje procesov, storitev in izdelkov; zmanjšanje onesnaževanja iz razpršenih virov emisij; okoljski indikatorji; krožno gospodarstvo v industriji in storitvah; pametni sistemi energetske oskrbe
- zmanjševanje presežnih koncentracij onesnažil v odpadnih tokovih (čistilni postopki – 'end of pipe')

**Introduction:** anthropogenic sources of pollutants and risks and their impacts on environmental compartments; environmental sciences and technologies for pollution prevention – general approach; phases of industrial development; indicators of sustainable production, services, consumption, and behaviour; circular economy; public and corporate instruments to implement and measure the effectiveness of environmental measures and concepts

**Pollution prevention tactics and concepts:**

- public and social approach to environmental protection: strategic, legislative, organisational and technological measures; modern concepts for preventing pollution; Reduce-Reuse-Recycle (»3R«) approach
- integrated approach to pollution prevention – systemic approach to environmental protection: pollution prevention and risk management planning; standardized system of environmental protection; environmental standards ISO 14000; life cycle analysis and assessment; alternative (internally audited) systems: cleaner production, resource efficiency, "green industry", responsible care, eco-design, eco-profit; planning of systematic measures for preventing pollution; controlling over pollution; mass balance of processes (macro and micro scale); energy balance
- good manufacturing practices; IPPC/IED and Seveso directives and related documents (BAT/BREFs); "three-0" approach; impact and risk assessment; environmental-friendly design of processes, services and products; abatement of dispersed pollution sources; environmental indicators; circular production/distribution networks; smart energy supply
- end-of-pipe approach for abatement of exceeded pollutants' concentrations

**Temeljna literatura in viri / Textbooks:**

**Obvezna:**

1. Bishop P., 2004. Pollution Prevention: Fundamentals and Practice. Waveland Press, Illinois
2. Cheremisinoff N.P., 2016. Pollution Control Handbook. Wiley
3. Mulholland K.L., Dyer J.A., 2010. Pollution Prevention: Methodology, Technologies and Practices. Wiley
4. Grilc V., 2019. Zbirka predavanj iz predmeta »Tehnologije za preprečevanje onesnaževanja«. e-učilnica VŠVO

**Cilji in kompetence:**

**Objectives and competences:**

**Predmetno specifični cilji in kompetence:**

- seznaniti študente z najpomembnejšimi pristopi za sistematično zmanjševanje onesnaževanja iz točkovnih in razpršenih virov ter z načini zaščite sestavin okolja za normalni razvoj živih bitij
- seznaniti študente z osnovnimi preventivnimi merami/postopki za preprečevanje/zmanjševanje onesnaževanja oz. s tehnologijami za odstranjevanje prekomernega onesnaževanja
- usposobljenost študentov za izbiro učinkovitih metod in tehnik za odstranitev/zmanjšanje onesnaženja

**Splošne kompetence:**

- sposobnost samostojne analize problemov, sinteze in oblikovanja rešitev za najbolj pogoste probleme

**Specific competences:**

- students get acquainted with systematic pollution prevention approach for point and dispersed sources, and with measures for air, water and soil prevention techniques
- students get acquainted with basic preventive measures/processes for preventing/reducing pollution, and with technologies for abatement exceeded pollution
- students get qualified to select efficient methods and techniques for pollution abatement and reduction

**General competences:**

- ability to analyse, synthesize, select and propose effective solutions to typically encountered problems

**Predvideni študijski rezultati:****Znanje in razumevanje:**

Študent bo ob zaključku tega predmeta:

- imel znanje o izvori in delovanju ključnih antropogenih onesnažil na osnovne sestavine okolja
- poznal in razumel principe načrtovanja trajnostnih proizvodnih postopkov
- poznal pristop k sistemskemu varstvu okolja, najboljše razpoložljive tehnologije (preventivne in kurativne)
- razumel osnovne inženirske/tehnične pristope za preprečevanje onesnaževanja oz. zmanjševanje emisijskih ali imisijskih vrednosti na sprejemljiv nivo
- razumel principe okoljskih tehnologij
- usposobljen za izbor optimalnih preventivnih pristopov za preprečevanje nastanka onesnaževanja
- poznal inženirske pristope za zmanjšanje onesnaženja na sprejemljivo mero
- sposoben predvidevanja izpolnjevanja zahtev okoljskih standardov z uporabo izbranih omilitvenih metod/tehnologij

**Intended learning outcomes:****Knowledge and Understanding:**

At the end of this course, student will:

- understand sources and impacts of the most common pollutants on different environmental compartments
- know and understand principles of planning of sustainable production processes
- demonstrate knowledge about systematic approach to environmental protection, and about best available technologies (both preventive and curative)
- demonstrate knowledge about the emerging techniques for pollution prevention and abatement of pollutant concentration to admissible levels
- understand principles of abatement technologies
- be able to select environmentally optimal preventive methods/technologies for preventing pollution
- have knowledge on engineering approaches for reducing environmental pollution at accessible level
- be able to predict the fulfilment of the required environmental standards by the selected mitigation methods/techniques

**Prenesljive/ključne spretnosti in drugi atributi:**

- sposobnost zbiranja, uporabe in interpretiranja domačih in tujih virov ekoloških in tehnoloških podatkov ter znanj
- zmožnost analize in izbora optimalne rešitve za posamezen obravnavan okoljski problem v praksi
- sposobnost pisnega in ustnega poročanja o zaznanih okoljskih problemih in tehnoloških rešitvah

**Transferable/key skills and other attributes:**

- ability to collect, use and interpret domestic and international databases of ecological and technical data, and knowledge
- ability to analyse and select an optimal solution for the relevant environmental issue in the practice
- ability to reporting in written and oral form about the recognized environmental problems and the selected technological solutions

**Metode poučevanja in učenja:**

- predavanja, interaktivno poučevanje
- individualna seminarska naloga s konzultacijami
- predstavitve in diskusije
- terenske vaje in ekskurzije v industrijska območja

**Learning and teaching methods:**

- interactive lectures, supported by intermedia equip
- individual seminar work with consultations
- presentations and discussions
- fieldwork and excursions to industrial sites

Delež (v %) /

Weight (in %) /

**Načini ocenjevanja:**

Končna ocena pri predmetu je sestavljena iz:

- pisnega izpita
- priprave, predstavitve in zagovora seminarske naloge

**70 %****30 %**

Ocenjevalna lestvica:

- zadostno 6: 60–67 %
- dobro 7: 68–75 %
- prav dobro 8: 76–83 %
- prav dobro 9: 84–90 %
- odlično 10: 91–100 %

**Assessment:**

Final evaluation consists of the mark for:

- written exam
- preparation, presentation and open discussion of seminar work

Grading scale:

- Sufficient D (6): 60–67%
- Good C (7): 68–75%
- Very good B (8): 76–83%
- Very good B+ (9): 84–90%
- Excellent A (10): 91–100%

**Materialni pogoji za izvedbo predmeta :**

- predavalnica z multimedijsko opremo

**Material conditions for subject realization:**

- lecturing room with intermedia support

**Obveznosti študentov:**

- izbor teme, izdelava, predstavitev in zagovor seminarske naloge
- aktivna udeležba na ekskurzijah in terenskih vajah
- opravljen izpit

**Student's commitments:**

- selection of an individual theme, preparation of seminar work, presentation and confrontation
- active attendance on plant visits and field exercises
- positive exam

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

**Pedagoško delo:**

- 1996–2000: Varstvo okolja II (na FKKT, UL)
- od 1999 dalje: Gospodarjenje z odpadnimi snovmi (FAGG-VKI, UL)
- 2001–2012: Gospodarjenje z odpadki (Interdisciplinarni študij varstva okolja, UL)
- 2002–2014: Ravnanje z odpadki (podiplomski program komunalne smeri FAGG UL)
- od 2014 dalje: Tehnologije za zmanjševanje onesnaževanja zraka, vode in tal (VŠVO)
- od 2017 dalje: Ravnanje z odpadki (VŠVO)

**Svetovalno delo:**

- 1995–2004: priprava in izvajanje projekta »Čista proizvodnja« (metodologija UNIDO) za >50 slovenskih podjetij

**Pedagogic activities:**

- 1996–2000: Environmental protection techniques (FKKT, UL)
- since 1999: Waste and resource management (FAGG-VKI, UL)
- 2001–2012: Waste management (interdisciplinary studies of environmental protection, UL)
- 2002–2014: Waste management (postgraduate studies at FAGG UL)
- since 2014: Technologies for pollution prevention (VŠVO)
- since 2017: Waste management (VŠVO)

**Consulting:**

- 1995–2004: leading of the consultant team on 'Cleaner production' programmes – UNIDO method (over 50 companies attended)

**Izbrani znanstveni članki / Selected scientific papers:**

Ninčević A., **Grilc V.**, 2012. Problems with the management of medical waste (in Slovene). *Environmental management*, 21:2-10.

Cukjati N., Zupančič G., Roš M., **Grilc V.**, 2012. Composting of anaerobic sludge: an economically feasible element of a sustainable sewage sludge management. *Journal of environmental management*, 106:48-55.

Zupančič G.D., **Grilc V.**, 2012. Anaerobic treatment and biogas production from organic waste. V: Kumar S. (ur.). *Management of organic waste*. Rijeka: InTech, str. 3-28.