

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	EKOTOKSIKOLOGIJA
<b>COURSE TITLE:</b>	ECOTOXICOLOGY

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 1. stopnja	Modul: Okolje in zdravje	2. in 3.	/
Environmental Protection and Eco-technologies, 1 <sup>st</sup> level	Module: Environment and health	2 <sup>nd</sup> and 3 <sup>rd</sup>	/

**Vrsta predmeta / Course type** Modularni predmet / Modular subject

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

Predavanja Lectures	Seminar Seminar	Sem. Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
25	/	20	10	/	90	5

**Nosilec predmeta / Lecturer:** prof. dr. Bojan Sedmak / pred. dr. Anja Bubik

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

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

Opravljen izpit iz predmeta Kemija in okolje

**Prerequisites:**

Passed exam Chemistry and the Environment

**Vsebina:**

Osnovni načela v toksikologiji.

- Znaki zastrupitve.
- Izpostavljenost opredeljuje toksičnost.
- Doza naredi strup.

Toksikologija in ekotoksikologija.

Glavne skupine onesnaževal.

Anorganski ioni.

- Kovine.
- Anioni.

Organska onesnažila.

- Oglikovodiki.
- Poliklorirani bifenili.
- Insekticidi.
- Herbicidi.
- Detergenti.
- Zdravila.

Radioaktivni izotopi.

Plini.

Nanodelci.

**Content (Syllabus outline):**

- The basic principles of Toxicology
- Toxic syndrome recognition
- Route of exposure as determinant of toxicity
- The dose makes the poison

- Toxicology and Ecotoxicology
- Major classes of pollutants
- 

Inorganic ions

- Metals
- Anions

Organic pollutants

- Hydrocarbons
- Polychlorinated biphenyls
- Insecticides
- Herbicides
- Detergents
- Pharmaceuticals
- 

Radioactive isotopes

Gaseous pollutants

Nanoparticles

<p>Onesnažila v ekosistemih.  Onesnaževanje prsti.  Onesnažila v sedimentih,  Onesnažila v vodnih ekosistemih.  Prenos po prehranjevalnih verigah.</p> <p>Onesnažila in organizmi.  Prezem.  Distribucija.  Shranjevanje.  Metabolizem.  Izločanje.</p> <p>Učinki onesnažil na posamezne organizme.  Biokemični učinki.  Genotoksičnost.  Nevrotoksičnost.  Strupi, ki učinkujejo na mitohondrije.  Inhibicija ATP-az.  Motilci endokrinega sistema.  Inhibitorji fotosinteze.  Inhibitorji rasti.</p> <p>Učinki onesnažil na nivoju populacij in združb.  Številčnost populacij.  Rast populacij.  Biodiverziteta.  Odpornost na onesnaženje.  Evolucijski odgovori na okoljske spremembe.</p> <p>Naravna onesnaževala in naravni cikli  Eutrofikacija.  Kisel dež.  Sevanje in radioizotopi.  Onesnaženja z nafto.  Globalno segrevanje in toplogredni plini.  Ozonski plašč in UV sevanje.</p> <p>Globalni problemi onesnaževanja okolja.  Potovanja onesnaževal na velike razdalje in globalni transport.  Plastične mase.  Nanodelci.  Uporaba pesticidov iz zraka.  Škodljiva cvetenja alg in cianobakterij.</p> <p>Praktično usposabljanje v računalniški učilnici</p> <p>(Q)SAR – Ugotavljanje odnosa med strukturo učinkovine (toksina) in njenim delovanjem.</p>	<p>- Pollutants in ecosystems  Fate in soils  Pollutants in sediments  Pollutants in aquatic ecosystems  Transfer along food chains</p> <p>- Pollutants in organisms  Uptake  Distribution  Storage  Metabolism  Excretion</p> <p>Effects of pollutants on individual organisms  Biochemical effects  Genotoxicity  Neurotoxicity  Mitochondrial poisons  Inhibition of ATPases  Endocrine disruptors  Photosystem inhibitors  Plant growth inhibitors</p> <p>Effects of pollutants on populations and communities  Population abundance  Population growth rate  Biodiversity  Resistance to pollution  Evolutionary responses to environmental changes</p> <p>Natural pollutants and natural cycles  Eutrophication  Acid rain  Radiation and radioisotopes  Oil pollutions  Global warming and greenhouse gasses  Ozone layer and UV radiation</p> <p>Pollution problems worldwide  Long range movements and global transport of pollutants  Plastics  Nanoparticles  Aerial application of pesticides  Harmful algal and cyanobacterial blooms</p> <p>Practical training in a computer classroom</p> <p>(Q)SAR – Determination of Quantitative Structure Activity Relationship</p>
--	--

## Temeljni literatura in viri / Textbooks:

### Osnovna literatura:

- C.H. Walker, S.P. Hopkin, R.M. Sibly, D.B. Peakall: Principles of Ecotoxicology. 4th Edition, Taylor & Francis, London 2012.
- J.A. Timbrell: Introduction to Toxicology. Informa Healthcare, New York 2009.

### Dodatna literatura:

- A.W. Hayes: Principles and Methods of Toxicology. 4<sup>th</sup> Edition, Taylor & Francis, London 2014.
- J.A. Timbrell: Principles of Biochemical Toxicology. Informa Healthcare, New York 2009.
- B. Sedmak: Cianobakterije in njihovi toksini, Vse živo, NIB, Ljubljana, 2011.

## Cilji in kompetence:

### Predmetno specifični cilji in kompetence:

- študente seznaniti z osnovami o strupenih snoveh in o učinkih njihove prisotnosti v okolju
- študenta usposobiti za samostojno delo in uporabo ustreznih metod in tehnik

### Splošne kompetence:

Študenti bodo pridobili teoretična in praktična znanja ter razumevanje s področja ekotoksikologije.

Študenti bodo pridobili osnovna znanja o toksičnih učinkih onesnaževal na organizme, populacije, biocenoze in ekosisteme ter možne načine ocene toksičnosti. Naučili se bodo pridobiti ekotoksikološke podatke in jih jih bili sposobni tudi kritično interpretirati.

## Objectives and competences:

### Specific competences:

- students are acquainted with basic knowledge of various toxic substances and their influence on various environments.
- students are qualified for individual and team work in the usage of appropriate methods and techniques

### General competences:

Students will acquire the theoretical and practical knowledge and understanding in the field of ecotoxicology.

Students will gain basic knowledge about toxic effects of pollutants on organisms, populations, biocenosis and ecosystems and possible ways of toxicity assessment. They will learn how to obtain ecotoxicological data and acquire the ability to interpret them.

## Predvideni študijski rezultati:

### Znanje in razumevanje

Študent bo ob zaključku tega predmeta sposoben:

- Kritično ovrednotiti tveganja, ki jih strupene snovi predstavljajo v različnih okoljih
- Oblikovati strategije za oceno izpostavljenosti
- Analiza in interpretacija meritev izpostavljenosti z različnimi orodji za modeliranje (stohastični in deterministični)
- Cenijo prednosti in slabosti toksikoloških in epidemioloških študij za pridobitev razmerja med odmerkom in odzivom
- Oblikovati strategije za preučevanje razmerja med odmerkom in odzivom
- Oceniti pogosto uporabljene metode za meritve učinka na zdravje

### Prenesljive/ključne spretnosti in drugi atributi:

- uporaba ustreznih metod in tehnik pri reševanju konkretnih znanstvenih problemov na izbranem področju

## Intended learning outcomes:

### Knowledge and Understanding

The student will be at the completion of this course able to:

- • Critically evaluate the risks of the presence of toxic substances in various environments.
- • Design strategies for exposure assessment
- • Analyse and interpret exposure measurements applying different modelling tools (stochastic and deterministic)
- • • Appreciate the advantages and disadvantages of toxicological and epidemiological studies for deriving dose-response relationships
- • Design strategies for study of dose-response relations
- • Evaluate frequently used methods for health effect measurements
-

- zbiranje in interpretacija podatkov
- poročanje

spretnosti uporabe domače in tuje literature

**Transferable/Key Skills and other attributes:**  
 use of appropriate research methods and techniques concerning concrete scientific problems within the field of investigation

**Metode poučevanja in učenja:**

**Oblike dela:**

- predavanja
- seminarji

**Metode dela:**

- razlaga
- dialog, diskusija
- preučevanje praktičnih primerov
- aktivno skupinsko delo

priprava, predstavitev in zagovor seminarske naloge

**Learning and teaching methods:**

**Forms of teaching:**

- in-class lectures
- seminars

**Teaching methods:**

- explanation
- discussion, debate
- practical demonstration
- teamwork

preparation, presentation and defence of a seminar paper

Načini ocenjevanja:	Delež (v %) Weight (in %)	Assessment:
<ul style="list-style-type: none"> <li>- pisni izpit</li> <li>- priprava, predstavitev in zagovor seminarske naloge</li> </ul> <p>Ocenjevalna lestvica:</p> <p>Ocene 5 negativno, 6-10 pozitivno</p> <ul style="list-style-type: none"> <li>▪ zadostno 6: 51-60 %</li> <li>▪ dobro 7: 61-70 %</li> <li>▪ prav dobro 8: 71-80 %</li> <li>▪ prav dobro 9: 81-90 %</li> <li>▪ odlično 10: 91-100 %</li> </ul>	<p><b>50</b></p> <p><b>50</b></p>	<ul style="list-style-type: none"> <li>- written exam</li> <li>- preparation, presentation and defence of seminar paper</li> </ul> <p>Grading system:</p> <p>Garding: 5 fail 6-10 pass</p> <ul style="list-style-type: none"> <li>▪ Sufficient D (6): 51-60 %</li> <li>▪ Good C (7): 61-70 %</li> <li>▪ Very good B (8): 71-80 %</li> <li>▪ Very good B+ (9): 81-90 %</li> <li>▪ Excellent A (10): 91-100 %</li> </ul>

**Materialni pogoji za izvedbo predmeta :**

- predavalnica z multimedijско opremo

laboratorij s specifičirano laboratorijsko opremo

**Material conditions for subject realization:**

- classroom with the multimedia equipment

**Obveznosti študentov:**

- Izdelana seminarska naloga

**Student's commitments:**

- Seminar paper

**Reference nosilca predmeta:**

Bojan Sedmak Št raziskovalca 7736

Avtor številnih mednarodno citiranih znanstvenih člankov s področij, toksikologije, ekotoksikologije in biokemije. Najbolj citiran znanstveni članek je do leta 2018 dosegel preko 200 navedb.

**Journal of Environmental Sciences (Elsevier) - Član uredniškega odbora**

**Lecturer's references:**

Bojan Sedmak researcher No. 7736

Author of numerous articles from the fields of toxicology, ecotoxicology and biochemistry are cited internationally. The most frequently cited article until 2018 has over 200 entries.

**Journal of Environmental Sciences (Elsevier) – Member of the Editorial Board**

## Patenti

LEŠTAN, Domen, SEDMAK, Bojan, LAKOVIČ, Gorazd. *Preprečevanje masovnega pojavljanja škodljivih cianobakterij : patent št. 23987 (A), 2013-08-30.* Ljubljana: Urad RS za intelektualno lastnino, 2013. 5 str., [ilustr.]. [COBISS.SI-ID [2885199](#)] patentna družina: WO2013115732 (A2), 20130-08-08

LEŠTAN, Domen, SEDMAK, Bojan, LAKOVIČ, Gorazd. *Process and device to control harmful cyanobacterial blooms : pub. no.: WO/2013/115732 : international application no. PCT/SI2013/000006.* [Geneva]: World Intellectual Property Organization, 2013. [17] str., ilustr. [COBISS.SI-ID [4498255](#)]

SEDMAK, Bojan, LAKOVIČ, Gorazd, LEŠTAN, Domen, MEGLIČ, Andrej, GERL, Marko. *Method and system for simultaneous detection of micro-particle concentration in suspension and their morphological and physiological traits : pub. no.: WO/2016/156281 : international application no. PCT/EP2016/056753.* [Geneva]: World Intellectual Property Organization, 2016. [25] str., ilustr. [COBISS.SI-ID [4497487](#)]

### Nagrade:

2005 – Prometej znanosti 2005 za odličnost pri komuniciranju znanosti.

2012 - Why, When, Where and How - nagrada Rajske drevo za najboljši dokumentarec (1<sup>st</sup> International Nature Film Festival, G-Fest)

2012 - Why, When, Where and How - Najboljši film v kategoriji Narava in Ekologija (6<sup>th</sup> BOFF – 6<sup>th</sup> Bovec Outdoor Film Festival).

2015 – Miroslav Zei award for outstanding achievements

## Patents:

LEŠTAN, Domen, SEDMAK, Bojan, LAKOVIČ, Gorazd. *Preprečevanje masovnega pojavljanja škodljivih cianobakterij : patent št. 23987 (A), 2013-08-30.* Ljubljana: Urad RS za intelektualno lastnino, 2013. 5 str., [ilustr.]. [COBISS.SI-ID [2885199](#)] patentna družina: WO2013115732 (A2), 20130-08-08

LEŠTAN, Domen, SEDMAK, Bojan, LAKOVIČ, Gorazd. *Process and device to control harmful cyanobacterial blooms : pub. no.: WO/2013/115732 : international application no. PCT/SI2013/000006.* [Geneva]: World Intellectual Property Organization, 2013. [17] str., ilustr. [COBISS.SI-ID [4498255](#)]

SEDMAK, Bojan, LAKOVIČ, Gorazd, LEŠTAN, Domen, MEGLIČ, Andrej, GERL, Marko. *Method and system for simultaneous detection of micro-particle concentration in suspension and their morphological and physiological traits : pub. no.: WO/2016/156281 : international application no. PCT/EP2016/056753.* [Geneva]: World Intellectual Property Organization, 2016. [25] str., ilustr. [COBISS.SI-ID [4497487](#)]

### Awards

2005 – Award winner “Prometheus of Science 2005” for excellence in science communication.

2012 – Why, When, Where and How - Award Tree of Eden for the best Nature Documentary film (1<sup>st</sup> International Nature Film Festival, G-Fest).

2012 - Why, When, Where and How - Best film in the Nature and Ecology category (6<sup>th</sup> BOFF – 6<sup>th</sup> Bovec Outdoor Film Festival).

2015 – Miroslav Zei award for outstanding achievements