

# KEMIJA OKOLJA

## UČNI NAČRT PREDMETA/COURSE SYLLABUS

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|-----------------------------------|------------------------------|
| <b>Predmet:</b>                   | Kemija okolja                |
| <b>Course title:</b>              | Chemistry of the environment |
| <b>Članica nosilka/UL Member:</b> | UL FKKT                      |

| Študijski programi in stopnja       | Študijska smer                  | Letnik                  | Semestri | Izbirnost |
|-------------------------------------|---------------------------------|-------------------------|----------|-----------|
| Kemija, prva stopnja, univerzitetni | Ni členitve (študijski program) | 2. letnik,<br>3. letnik |          | izbirni   |

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| <b>Univerzitetna koda predmeta/University course code:</b> | 0086919 |
| <b>Koda učne enote na članici/UL Member course code:</b>   | KESI3   |

| Predavanja<br>/Lectures | Seminar<br>/Seminar | Vaje<br>/Tutorials | Klinične vaje<br>/Clinical<br>tutorials | Druge oblike<br>študija<br>/Other forms<br>of study | Samostojno<br>delo<br>/Individual<br>student work | ECTS |
|-------------------------|---------------------|--------------------|---|---|---|------|
| 30                      | 20                  | 25 LV              |   |   | 75  | 5    |

**Nosilec predmeta/Lecturer:** prof. dr. Helena Prosen

**Vrsta predmeta/Course type:** izbirni/elective

|                          |                      |                         |
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| <b>Jeziki/Languages:</b> | Predavanja/Lectures: | Angleščina, Slovenščina |
|                          | Vaje/Tutorial:       | Angleščina, Slovenščina |

### 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:

- Splošni pojmi, lastnosti troposfere, stratosfere.
- Nastanek, pretvorbe in transport atmosferskih onesnaževal (trdni delci, CO, CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub>, ogljikovodiki). Pojav ozonskih lukenj in tople grede. Posledice onesnaževanja atmosfere (kisel dež, pojav mračenja). Ukrepi za zmanjšanje onesnaževanja.
- Površinske in podtalne vode. Kemija in biokemija onesnaževal v hidrosferi. Razgradljiva in nerazgradljiva onesnaževala voda in njihov vpliv na zdravje ljudi. Ukrepi za zmanjševanje onesnaženja voda.
- Zemlja in glavna onesnaževala. Problem nitratov in fosfatov v površinskih vodah in nitratov v podtalnici. Obstojna kemijska onesnaževala (klorirane spojine, policiklični aromati, fitofarmacevtska sredstva, kovine) in njihova usoda v okolju.

### Content (Syllabus outline):

- General concepts, properties of troposphere and stratosphere.
- Sources, transformations and transport of atmospheric pollutants (particulate matter, CO, CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub>, hydrocarbons). Ozone hole and greenhouse phenomena. Atmospheric pollution consequences (acid rain, dimming). Measures to decrease pollution.
- Surface and ground water. Chemistry and biochemistry of pollutants in hydrosphere. Degradable and non-degradable pollutants of waters, their influence on public health. Measures to decrease water pollution.
- Soil and its principal pollutants. Role of nitrates and phosphates in surface waters and nitrates in ground waters. Stable chemical pollutants

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| <p>5. Trdni odpadki - viri. Problemi z odlagališči in sežiganjem odpadkov.</p> <p>6. Energija in okolje. Jedrska energija in radioaktivni odpadki.</p> <p>7. Določanje splošnih in specifičnih onesnaževal. Vzorčenje in tehnike priprave okoljskih vzorcev. Hitri testi in senzorji za spremljanje onesnaženja okolja. Analitske tehnike za določanje organskih in anorganskih onesnaževal v atmosferi, v vodah in v zemlji.</p> <p>8. Ukrepi za zmanjševanje onesnaženja okolja.</p> <p>Laboratorijske vaje: določanje onesnaževal v vzorcih zraka, vode in tal z različnimi analiznimi tehnikami.</p> | <p>(chlorinated compounds, polycyclic aromatics, phytopharmaceuticals, metals) and their environmental fate.</p> <p>5. Solid waste - sources. Problematic issues of landfills and waste incinerators.</p> <p>6. Energy and environment. Nuclear energy and radioactive waste.</p> <p>7. Determination of general and specific pollutants. Sampling and sample preparation techniques for environmental samples. Rapid tests and sensors for pollution monitoring. Analytical techniques for organic and inorganic pollutant determination in atmosphere, water and soil.</p> <p>8. Measures to decrease environmental pollution. Laboratory work: pollutant determination in atmospheric, aqueous and soil samples with different analytical techniques.</p> |
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### Temeljna literatura in viri/Readings:

#### Temeljna literatura:

- G.W. vanLoon, S.J. Duffy: Environmental Chemistry, 3rd ed., Oxford Univ. Press, Oxford UK, 2011, 545 str.
- G. Fellenberg: The Chemistry of Pollution, Wiley 2000, 192 str. (20%)
- B.B. Kebbekus, S.Mitra: Environmental Chemical analysis, Blackie Academic&Professional, London 1998, 330 str. (30%)

#### Dopolnilna literatura:

- F.W. Fifield, P.J. Haines (eds.): Environmental Analytical Chemistry, 2nd ed., Blackwell Science, Oxford UK, 2000
- J.E. Girard: Principles of Environmental Chemistry, 2nd ed., Jones and Bartlett Publ., Sudbury, MA, USA, 2010
- znanstveni in strokovni članki (scientific and professional articles)

### Cilji in kompetence:

**Cilji:** Predstaviti študentom glavna onesnaževala atmosfere, vod in zemlje, njihove vplive na okolje in njihovo analitiko v okoljskih vzorcih

**Kompetence:** Sposobnost razumevanja osnovnih okoljskih dejstev; sposobnost opazovanja različnih pojavov; sposobnost predstavitve določenih okoljskih problemov ustno in v pisni obliki; sposobnost razreševanja konkretnih okoljskih problemov, sposobnost izbire ustrezne tehnike priprave vzorca in analize za različna onesnaževala.

### Objectives and competences:

**Objectives:** To inform the students about the principal pollutants in atmosphere, water and soil; their influence on the environment; analytical determination in environmental samples.

**Competences:** Ability to understand basic environmental facts; ability to observe diverse phenomena; ability to present selected environmental problems in oral and written form; ability to solve particular environmental problems; ability to select an appropriate sample preparation and analytical technique for different pollutants.

### Predvideni študijski rezultati:

Znanje in razumevanje  
Študent bo spoznal osnovna okoljska onesnaževala. Iz lastnosti okoljskih onesnaževal, ki jih je že delno spoznal pri drugih predmetih, lahko oceni njihov vpliv na kvaliteto okolja. Iz predstavljenih procesov za zmanjševanje emisij bo znal oceniti mejne vrednosti posameznih onesnaževal v okolju in jih pravilno določiti s primerno analizno tehniko. Uporaba

### Intended learning outcomes:

Knowledge and Comprehension  
Student will be informed about principal environmental pollutants. They can evaluate their influence on environment quality from their properties, which were in part introduced in other courses. Limit values of certain pollutants in the environment will be evaluated from the presented processes for emission lowering and accurately determined by an appropriate analytical technique.

Application

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| <p>Študent je sposoben kritično ovrednotiti vpliv posameznega onesnaževala na okolje in oceniti nevarnost, ki jo predstavlja za ljudi.</p> <p>Refleksija</p> <p>Študent bo pridobil tudi določen občutek za kritično oceno kvalitete okolja.</p> <p>Prenosljive spretnosti</p> <p>Študent bo znal uporabljati osnovne analizne metode za hitro določanje onesnaževal. Na osnovi teh meritev in njihove kritične ocene bo lahko sklepal o onesnaženosti okolja.</p> | <p>Student is able to critically evaluate the influence of particular pollutant on the environment and assess the risk for the population.</p> <p>Analysis</p> <p>Student will gain a certain ability to critically evaluate the environmental quality.</p> <p>Skill-transference Ability</p> <p>Student will be able to apply basic analytical methods for rapid pollutant determination. They will be able to assess the environmental pollution, based on these measurements and their critical evaluation.</p> |
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**Metode poučevanja in učenja:**

Predavanja, seminarji, laboratorijske vaje, delo na terenu.

**Learning and teaching methods:**

Lectures, seminars, laboratory work, field work

**Načini ocenjevanja:**

**Delež/Weight**

**Assessment:**

|                                  |         |                                   |
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| - pisni izpit (poz. ocena 6-10), | 60,00 % | - written exam (pass grade 6-10), |
| - seminarska naloga              | 30,00 % | - seminar coursework,             |
| - laboratorijske vaje            | 10,00 % | - laboratory work                 |

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

1. PROSEN, Helena, ZUPANČIČ-KRALJ, Lucija. Evaluation of photolysis and hydrolysis of atrazine and its first degradation products in the presence of humic acids. *Environ. pollut.* (1987) 2005, vol. 133, no. 3, 517-529.
2. PROSEN, Helena, FINGLER, Sanja, ZUPANČIČ-KRALJ, Lucija, DREVENKAR, Vlasta. Partitioning of selected environmental pollutants into organic matter as determined by solid-phase microextraction. *Chemosphere* (Oxford). 2007, vol. 66, no. 8, 1580-1589.
3. KRALJ CIGIĆ, Irena, PROSEN, Helena. An overview of conventional and emerging analytical methods for the determination of mycotoxins. *Int. J. Mol. Sci.* 2009, vol. 10, no. 1, 62-115.