

**UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION**

<b>Predmet:</b>	Okoljske tehnologije
<b>Subject Title:</b>	Environmental Technologies

<b>Študijski program</b> Study programme	<b>Letnik</b> Year	<b>Semester</b> Semester
Varstvo okolja in ekotehnologije	1	1

<b>Predavanja</b> Lectures	<b>Sem. vaje</b> Tutorial	<b>Lab. vaje</b> Lab. work	<b>Teren. vaje</b> Field work	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
50	10	20	20	170	9

**Nosilec predmeta / Lecturer:** dr. Tanja Tajnik / Tanja Tajnik, Ph.D.

**Jeziki / Languages:** Predavanja / Lectures: 50  
**SL** Vaje / Tutorial: 50

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

Opravljen izpit pri predmetih Biologija z ekologijo (Ekosistemska biologija), Kemija in okolje.

**Prerequisites:**

Passed exams of Biology with Ecology (Ecosystem biology) and Chemistry and the Environment.

**Vsebina:**

- Razumevanje okoljskih sprememb in posledic (Spremembe okolja v času in prostoru / Vplivi na okolje zaradi človekove rabe virov energije, tal, vode in atmosfere / Trajnostna prihodnost okolja: možnosti in omejitve)
- Definicija okoljskih tehnologij in osnova za njihovo uporabo (Čistilne tehnologije / Čiste (integrirane) tehnologije / Nove tehnologije in procesi temelječi na novih materialih energetski učinkovitosti in alternativnih energetskih virih / Okoljska zakonodaja)
- Ekološke aplikacije za doseganje okoljske vzdržnosti na nivoju individuuma, populacije in združbe (Ecoremediacije / Obnova habitatov / Ohranjanje ogroženih vrst / Ravnanje s škodljivci / Upravljanje z odvzemi obnovljivih virov / Ekosistemske usluge in zdravje ekosistema)
- Tehnologije čiščenja onesnaženih virov, ki temeljijo na bioloških sistemih (Okoljska biotehnologija / Fitoremediacija – fitotehnologije: karakterizacija onesnaženja in ocena tveganja, biološki procesi, predstavitev tehnoloških rešitev, izbira in uporaba primernih tehnologij, izvedba programa nadzornih meritev, ključni principi načrtovanja, omejitve tehnoloških rešitev)
- Energija in okolje (Svetovne zaloge energije in poraba / Okoljski vplivi odvzema, dobave in uporabe fosilnih goriv / Alternative fosilnim gorivom – sončna, vetrna, vodna, biomasna, geotermalna in nuklearna energija – in njihov okoljski vpliv / Vodik kot energetski vir / Trajnostna nizko ogljična prihodnost).

**Content (Syllabus outline):**

- Understanding environmental issues (Environmental change in time and space / The effects on the environment arising from human use of the resources of energy, land, water and the atmosphere / Sustainable environmental future: opportunities and constraints)
- Definition of environmental technologies and rationale for its use (Treatment technologies / Clean (integrated) technologies / New technologies and processes based on new materials, energy efficiency and alternative energies / Environmental legislation)
- Ecological applications for managing environmental sustainability at individual, populations and community levels (Ecoremediation / Restoration of habitats / Conservation of endangered species / Pest management / Harvest management / Ecosystem services and ecosystem health)
- Technologies basing on biological systems for reclaiming contaminated resources (Environmental biotechnology / Phytoremediation - phytotechnologies: contamination characterization and risk assessment, biological processes, presentation of technological solutions, appropriate technology selection and application, monitoring programme design, key design principles, limitations of technological solutions)
- Energy and environment (World energy supply and

- Obravnavanje različnih vidikov vzdržnosti/trajnosti tehnologij iz različnih industrijskih sektorjev na primerih iz prakse (obravnavanje celotnega življenjskega cikla za predstavitev okoljskih, ekonomskih in socialnih vplivov).
- Tehnologije čiščenja onesnaženih virov, ki temeljijo na fizikalnih, kemijskih in fizikalno-kemijskih procesih (karakterizacija onesnaženja, snovne in energijske bilance, principi načrtovanja tehnoloških rešitev, nadzorne meritve, primeri iz prakse). **Problematika vodnih virov:** parametri kakovosti vode (organoleptični, fizikalni, kemijski, biološki); postopki čiščenja voda (sedimentacija, flotacija, koagulacija, filtracija, kemijski in biološki postopki); priprava tehnološke in pitne vode (groba in fina filtracija, dekarbonizacija, ionska izmenjava, mehčanje, membranski postopki). **Problematika varovanja zraka:** vrste onesnaženja zraka (trdni delci, aerosoli, organski plini, neorganski plini); glavni onesnaževalci zraka (ogljikov monoksid, ogljikov dioksid, žveplove spojine, dušikove spojine, fotokemijski oksidanti, organske spojine); postopki čiščenja zraka (usedalniki, cikloni, vlažni kolektorji, filtri, elektrostatični izločevalniki, absorpcijski stolpi, adsorpcijske naprave, kondenzacijsko čiščenje, zgorevalni postopki). **Problematika trdnih odpadkov:** vrste trdnih odpadkov (komunalni, industrijski, nevarni); tretja trdnih odpadkov (reciklaža, kompaktiranje, kompostiranje, uplinjanje, sežig, deponiranje).

use / Environmental effects of extracting, delivering and using fossil fuels / Alternatives to fossil fuels - solar, biomass, geothermal, and nuclear energy, wind power and water power – and their environmental impact / Hydrogen as an energy source / A sustainable low carbon future).

- Case studies from different industrial sectors covering various sustainability issues of technologies (life cycle approach to address environmental, economic and social issues).
- Pollution control approaches based on physical, chemical and physico-chemical processes (pollution determination, mass and energy balances, design principles of pollution control systems, measurements, practical examples). **Water sources issues:** water quality characteristics (organoleptic, physical, chemical, biological); water treatment operations (sedimentation, flotation, coagulation, filtration, chemical and biological operations); industrial and drinking water preparation (raw and fine filtration, decarbonization, ion exchange, softening, membrane operations). **Air pollution control:** air pollution species (solid particles, aerosol, organic gases, inorganic gases); air pollution compounds (carbon dioxide, carbon monoxide, sulfur compounds, nitrogen compounds, photochemical oxidants, organic compounds); air treatment operations (gravitational collectors, cyclones, wet collectors, filters, electrostatic precipitators, absorption columns, adsorption devices, condensation treatment, combustion based operations). **Solid waste treatment:** solid waste types (municipal, industrial, hazardous); solid waste treatment (recycling, size reduction, composting, gasification, combustion, waste disposal).

#### Temeljna literatura in viri / Textbooks:

Townsend, C.R. (2007). Ecological Applications: Toward a Sustainable World. Wiley-Blackwell.  
 Nathanail C. P., Bardos R.P. (2004). Reclamation of Contaminated Land. John Wiley & Sons.  
 Coley D. (2008). Energy and Climate Change: Creating a Sustainable Future. John Wiley & Sons.  
 Evans G.M., Furlong J.C. (2002). Environmental Biotechnology: Theory and Application. John Wiley & Sons.  
 Vrhovšek D., Vovk Korže A. (2007) Ekoremediacije. Filozofska fakulteta Maribor, Mednarodni center za ekoremediacije, Limnos d.o.o.

#### Cilji:

Vsebina predmeta bo spodbujala študente k raziskovanju kompleksnih medsebojnih vplivov tehnologije in okolja ter poglobila razumevanje vloge in prepletenosti ekosistemov. Cilj je usposobiti študente za koncipiranje in izbiro prave tehnologije za odstranitev onesnaženja, seznanitev z najnovejšo tehnologijo na področju obnovljivih virov z ozadji in principi pri izbiri ustreznih tehnologij za trajnostni tehnološki razvoj.

#### Objectives:

The course will encourage students to explore the complex interplay between technology and the environment and deepen the understanding of the role and interrelations of ecosystems. The goal is to qualify students for planning and to select appropriate technologies for cleanup of contaminated sites, to acquaint them with latest technologies and use of renewable resources, and to acquaint them with underpinnings and rationale behind appropriate technology for sustainable technological development.

#### Predvideni študijski rezultati:

#### Intended learning outcomes:

**Znanje in razumevanje:**

Študenti bodo ob zaključku tega predmeta sposobni izkazati znanje in razumevanje na področju medsebojnih vplivov tehnologij in okolja ter prednosti in pomanjkljivosti posameznih okoljskih tehnologij. Sposobni bodo prepoznati in oceniti okoljski problem ter na podlagi analize izbrati ustrezno tehnološko rešitev.

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

Ob pridobivanju podatkov za izdelavo domačih nalog bodo študenti nadgradili spretnosti uporabe zahtevnejše strokovne literature, pridobil sposobnosti samostojne interpretacije ter strnjene ustnega in pisnega poročanja. S seminarsko nalogo, v kateri bodo reševali določen problem, bodo pridobili spretnosti identifikacije, analitičnega vrednotenja in reševanja problemov ter nadgradili pisalne veščine.

**Knowledge and Understanding:**

The students will be at the completion of this course capable to demonstrate knowledge and understanding on the field of complex interplay between technology and the environment and advantages and disadvantages of individual environmental technologies. They will be capable to recognise and assess the environmental problem and select on the basis of the analysis the appropriate technological solution.

**Transferable/Key Skills and other attributes:**

The students will upgrade their skills in the use of professional literature by the literature search for the preparation of homework assignments, where they will acquire capabilities in independent interpretation and concise oral and written reporting. With the seminar work, where they will solve given problem, they will acquire skills in identification, analytical evaluation and problem solving and upgrade their writing skills.

**Metode poučevanja in učenja:**

Predavanja, seminarji in seminarske naloge z njihovo ustno predstavitvijo, seminarske vaje (multimedijske predstavitve primerov iz prakse), terensko delo z demonstracijami in ekskurzijami, domače naloge (vaje iz zgoščenega pisanja, kratkih esejev na temo predavanj in dodeljenega materiala za branje).

**Learning and teaching methods:**

Lectures, seminars with seminar works and their oral presentations, tutorial (multimedia presentations on case studies), field work with demonstrations and excursions, homework assignments (exercises in concise writing, short essays on lecture topics and reading material).

**Načini ocenjevanja:****Način (pisni izpit, ustno izpraševanje, naloge, projekt)**

- aktivno sodelovanje na predavanjih
- opravljene domače naloge
- seminarska naloga – pisni izdelek
- seminarska naloga – ustna prezentacija
- pisni izpit (ali več vmesnih izpitov)

Delež (v %) /  
Weight (in %)

5  
20  
20  
5  
50

**Assessment:****Type (examination, oral, coursework, project):**

- active in-class discussion
- homework assignments
- seminar work – written presentation
- seminar work – oral presentation
- written examination (or several midterms)

**Materialni pogoji za izvedbo predmeta :**

Predavalnica z multimedijsko opremo

**Material conditions for subject realization:**

Classroom with the multimedia equipment

**Obveznosti študentov:**

(pisni, ustni izpit, naloge, projekti)

Študentje se morajo seznaniti s predhodno objavljenim študijskim gradivom, opraviti domače naloge in seminarsko nalogo. Prisotnost na seminarjih in terenskih vajah je obvezna. Priporočljiv je reden obisk predavanj na katerih se spodbuja diskusija in komunikacija. Na koncu predavanj sledi pisni izpit, ki ga je mogoče opraviti tudi z vmesnimi izpiti.

**Student's commitments:**

(written, oral examination, coursework, projects):

The students must read the texts which are given before the lectures, complete homework assignments and seminar work. Attendance of tutorials and field work is required. Regular attendance of lectures is recommended and active in-class discussions and communication encouraged. Written examination will be given at the end of the course, which can be passed also by midterms.