

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	BIOTEHNOLOGIJA
<b>COURSE TITLE:</b>	BIOTECHNOLOGY

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

**Vrsta predmeta / Course type**

Izbirni predmet / Optional subject

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

BIO

Predavanja Lectures	Seminar Seminar	Sem. Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30	/	15	/	15	100	6

**Nosilec predmeta / Lecturer:**

doc. dr. Martin Batič / Martin Batič, Ph.D., Assist. Prof.

**Jeziki /****Predavanja / Lectures:** Slovenski / Slovenian**Languages:****Vaje / Tutorial:** Slovenski / Slovenian**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Potrebna znanja povezana s predmeti kemija in okolje in biologija z ekologijo, ki se dopolnjujejo z znanji predmetov ravnanje z odpadki, onesnaževanje in zaščita zraka, vode in tal, naravovarstvo, vplivi industrije na okolje, čiščenje odpadnih vod in metodami monitoringa ter vplivi kmetijstva na okolje. Potrebna pa so tudi osnovna znanja matematike, fizike in biologije.

**Prerequisites:**

Required knowledge related to the subjects of chemistry and the environment and biology with ecology complemented by knowledge of subjects' waste management, pollution and protection of air, water and soil; nature conservation; environmental impacts of the industry; waste water treatment and monitoring methods and the impact of agriculture on the environment. Basic knowledge of mathematics, physics and biology is also needed.

**Vsebina:**

- Uvod v biotehnologijo z definicijami, vlogo in cilji njene uporabe tudi na področju varstva okolja.
- Organizmi (mikroorganizmi) in metabolizmi pomembni za eko-tehnologije varstva okolja.
- Osnove biotehnološkega posredovanja z uporabo bioloških sistemov.
- Okoljska biotehnologija in okoljska trajnost - onesnaženja in nadzor onesnaženja (npr. bio/fito-remediacija; obdelava odpadnih snovi, itd.; primeri »čistih« tehnologij).
- Uporaba genskega inženirstva in gensko spremenjenih organizmov ter potencialna tveganja za okolje.
- Previdnostno načelo – biotehnologije in varstvo okolja ter izkušnje upoštevanja/neupoštevanja

**Content (Syllabus outline):**

- Introduction to biotechnology with definitions, role and objectives of its use also in the field of environmental protection.
- Organisms (microorganisms) and microbial metabolisms important for eco-technologies in environmental protection.
- Fundamentals of biotechnological intervention using biological systems.
- Environmental biotechnology and environmental sustainability - pollution and pollution control (eg. bio/phyto-remediation, treatment of waste materials, examples of "clean" technologies).

načela iz preteklosti s praktičnimi primeri (npr. antibiotiki, hormoni, BSE).

- Integrirana uporaba biotehnologije za varstvo okolja s proizvodnjo bioenergije, biogoriva in integrirane uporabe v kmetijstvu.
- Biotehnologija v povezavi z varstvom okolja in ekotehnologijami v prihodnosti ob razvoju na področju bioprosesov (bioreaktorji, nove separacijske tehnike), biosenzorji, proizvodnja, ravnanje z odpadki, nadzor onesnaženja in gensko spremenjeni organizmi).

- The use of genetic engineering and genetically modified organisms and potential risks to the environment.

- Precautionary principle - biotechnology and environmental protection, and taking into account / disregarding the principle of the past experience with practical examples (eg antibiotics, hormones, BSE).

- Integrated use of biotechnology for the protection of the environment with the production of bioenergy, biofuels and in agriculture.

- Biotechnology in the context of environmental protection and eco-technologies in the future in the development of bioprocesses (bioreactors, new separation techniques), biosensors, production, waste management, pollution control and genetically modified organisms).

#### Temeljni literatura in viri / Textbooks:

1. Biotehnologija - Osnovna znanja, 1996, Ur. Raspor, P., BIA d.o.o. – izbrana poglavja
2. Doelle H.W., 2007. Microbial metabolism and biotechnology, IOBB Publications – Biotechnology e-book.
3. Smith, J.E, 2009. Biotechnology, SaoPolo, Cambridge University Press
4. Wang, I.K., Ivanov, V., Tay, JH, Hung, YT, 2010. Environmental Biotechnology London, Springer Science + Business Media.
5. OECD. (1994). Biotechnology for Clean Environment – Prevention, detection, remediation. OECD.

#### Cilji in kompetence:

##### Predmetno specifični cilji in kompetence:

- seznaniti z vlogo in pojmi biotehnologije;
- usposobiti, da razume interdisciplinarnost biotehnologije ter razume integralno uporabo različnih znanosti (npr. mikrobiologije, biokemije, molekularne biologije, bioprosesnega inženirstva, itd.);
- seznaniti z vlogo organizmov (mikroorganizmov) in mikrobnegega metabolnega procesa ter zakonitosti njihovega vključevanja v procese na področju varstva okolja;
- seznaniti z možnostmi ter tveganji, ki jih nudi uporaba tehnik genskega spreminjanja za varstvo okolja;
- seznaniti s potenciali biotehnologije za nadzor in monitoring onesnaževanja ter odstranjevanje odpadnih snovi;

##### Splošne kompetence

- sposobnost kritičnega vrednotenja možnosti, ki jih lahko prispeva uporaba biotehnologije k ekotehnologijam in varstvu okolja

#### Objectives and competences:

##### Specific competences:

- the student gets acquainted with the concepts of biotechnology;
- qualify the student to understand the interdisciplinary nature of biotechnology and the integral use of different sciences (eg microbiology, biochemistry, molecular biology, bioprocess engineering, etc.);
- to be aware of the role of organisms (microorganisms) and the microbial metabolic processes, and their involvement in processes in the field of environmental protection;
- to be knowledgeable of the opportunities and risks posed by the use of techniques of genetic modification in the environment protection;
- to be aware and knowledgeable of the potential of biotechnology for the control and monitoring of pollution and the removal of waste materials;

##### General competences:

- ability to critically assess the possibilities offered by biotechnology can contribute to eco-technologies and environmental protection

**Predvideni študijski rezultati:**

- študent pozna vlogo in razume pojme biotehnologije;
- pozna in razume interdisciplinarnost biotehnologije ter razume integralno uporabo različnih znanosti (npr. mikrobiologije, biokemije, molekularne biologije, bioprocenega inženirstva, itd.);
- razume vlogo organizmov (mikroorganizmov) in mikrobne metabolnega procesa ter zakonitosti njihovega vključevanja v procese na področju varstva okolja;
- razume in pozna možnosti ter tveganja, ki jih nudi uporaba tehnik genskega spreminjanja za varstvo okolja;
- razume in pozna potencial biotehnologije za nadzor in monitoring onesnaževanja ter odstranjevanje odpadnih snovi;

**Intended learning outcomes:**

- The student comprehends the concepts of biotechnology;
- understand the interdisciplinary nature of biotechnology and the integral use of different sciences (e.g. microbiology, biochemistry, molecular biology, bioprocess engineering, etc.);
- comprehend the role of organisms (microorganisms) and the microbial metabolic processes, and their involvement in processes in the field of environmental protection;
- knows the opportunities and risks posed by the use of techniques of genetic modification in the environment protection;
- understands and knows the potential of biotechnology for the control and monitoring of pollution and the removal of waste materials;

**Metode poučevanja in učenja:****Oblike dela:**

- predavanja
- seminarske vaje
- samostojno delo študentov/tk

**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
- Tutorial
- Individual work of students

**Teaching methods:**

- Explanation
- Discussion, debate
- Practical demonstration
- Teamwork
- Preparation, presentation of a seminar paper

**Načini ocenjevanja:**

- pisni izpit
- priprava, predstavitev in zagovor seminarske naloge

Študent mora pripraviti, predstaviti in opraviti zagovor seminarske naloge, ki je predpogoj za pristop h pisnemu izpitu

**Ocenjevalna lestvica:**

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

Delež (v %) /

Weight (in %) /

**Assessment:****100**

- written exam
- preparation, presentation and perform the defence of seminar paper

The student should prepare, present and perform the defence of the seminar paper which is a prerequisite for the entrance to the written examination.

**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
- računalniška učilnica

**Material conditions for subject realization:**

- classroom with the multimedia equipment
- computer classroom

**Obveznosti študentov:**

- pisni izpit
- opravljene seminarske vaje - izdelana seminarska naloga

**Student's commitments:**

- written examination
- finished tutorial - seminar paper

**Reference nosilca predmeta:**

1. Pedagoško delo
  - Predavatelj predmetov biotehnologija, okoljski management, bioterorizem in okoljski terorizem na visoki šoli in univerzitetnem študijskem programu;
  - Mentor, somentor, recenzent diplomantom, magistrantom in doktorantom;
2. Strokovno delo
  - Član in predsedujoči – AdHoc Technical Expert Group on Synthetic Biology;
  - Ekspert Slovenije pri EFSA - področje ocene tveganja za okolje;
  - Generalni tajnik slovenskega Znanstvenega odbora za namerno sproščanje GSO v okolje in dajanje izdelkov na trg;
  - Vodja ali sodelujoči v več nacionalnih in mednarodnih projektih s področja biotehnologije.
3. Priznanja
  - bronasto priznanje Madžarskega društva za mikrobiologijo (Hungarian Society for Microbiology) (2001).

**Lecturer's references:**

1. Teaching
  - Lecturer of subjects biotechnology, environmental management, bioterorism and environmental terrorism, at college(university) and in university study programme;
  - Mentor, co-mentor, reviewer to graduate, post-graduate and PHD students;
2. Professional work
  - Member and former Chair of AdHoc Technical Expert Group on Synthetic Biology;
  - Slovenian Expert in EFSA for environmental risk assessment;
  - Secretary general of Slovenian Scientific Committee for deliberate release and placing GMOs on the market;
  - Head or member in national and international projects in the field of biotechnology.
3. Awards
  - bronze award of Hungarian Society of Microbiology (2001).

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

- Batič, M. (2018). Okolje kot izziv za GSO, ali je to že prežvečena zgodba?, V: *Hrana , prehrana, zdravje: Naša dela so naša prihodnost* P. Raspor (ur.). s. 59 – 66.
- Fujs, Š., Gazdag, Z., Poljšak, B., Stibilj, V., Milačič, R., Pesti, M., Rasšpor, P., Batič, M., (2005). The oxidative stress response of the yeast *Candida intermedia* to copper, zinc, and selenium exposure. *J. basic microbiology*, ISSN 0233-111X, 2005, vol. 45, no. 2, str. 125-135.
- Strel, B., Batič, M., (2002). Biološke snovi : ocenjevanje tveganja pri delu z biološkimi dejavniki. V: BATIČ, Martin, et al. *Priročnik za varno in zdravo delo*. Ljubljana: Tehniška založba Slovenije. str. 98-116. [COBISS.SI-ID [15656409](#)]
- Batič, M., Oset, M., (2000) Biotehnologija v živilstvu. V: Raspor, P. (ur.), Strel, B. (ur.), Komac, M. (ur.). *Stanje in razvojne možnosti biotehnologije v slovenskem prostoru*, (Biotehnologija in mikrobiologija za prihodnost, 01). Ljubljana: Biotehniška fakulteta. 2000, str. 71-86. [COBISS.SI-ID [2376824](#)]
- Batič, M., Bayer, K., (1996). Merjenje bioloških parametrov v bioreaktorjih. V: Raspor, P. (ur.). *Biotehnologija, Osnovna znanja*. Ljubljana: Bia., str. 689-702, ilustr. [COBISS.SI-ID [250488](#)]